FEASIBILITY STUDY
NORTON COMPANY RESTORATION SITE
WATERVLIET, NEW YORK

OCTOBER 31, 1990
REVISED
JANUARY 18, 1991

PREPARED FOR:

NORTON COMPANY
COATED ABRASIVE DIVISION
2600 10TH AVENUE
WATERVLIET, NEW YORK 12189

NORTON

PREPARED BY:

ERM-NORTHEAST ENGINEERS, P.C.
SUITE 7
501 NEW KARNER ROAD
ALBANY, NEW YORK 12205

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LIST OF ABBREVIATIONS

ARARs:	Applicable or Relevant and Appropriate Requirements
BNA's:	Base/Neutral-Acid Extractables
CFR:	Code of Federal Regulations
CM/SEC:	Centimeters Per Second
CRQL:	Contract Required Quantitation Limit
EPA:	Environmental Protection Agency
EP Toxicity:	Extraction Procedure Toxicity
FR:	Federal Register
FS:	Feasibility Study
ISV:	In-Situ Vitrification
MCLs:	Maximum Contaminant Levels
MCLGs:	Maximum Contaminant Level Goals
MG/KG:	Milligrams per Kilogram
MG/L:	Milligrams per Liter
MW:	Monitoring Well
NCP:	National Contingency Plan
NYSDEC:	New York State Department of Environmental Conservation
O & M:	Operation and Maintenance
OVA:	Organic Vapor Analyzer
PAH:	Polynuclear Aromatic Hydrocarbons
PCB's:	Polychlorinated Biphenyls
POTW:	Publicly Owned Treatment Works
PPB:	Parts per Billion
PPM:	Parts per Million
PVC:	Polyvinyl Chloride
RCRA:	Resource Conservation and Recovery Act
RI:	Remedial Investigation
SB:	Soil Boring
SCGs:	Standards, Criteria and Guidelines
SDWA:	Safe Drinking Water Act
SED:	Sediment Samples
SMCLs:	Secondary Maximum Contaminant Levels
TAGM:	Technical Administrative Guidance Manual
TCL:	Target Compound List
TCLP:	Toxicity Characteristic Leaching Procedure
TIC's:	Tentatively Identified Compounds
TPH:	Total Petroleum Hydrocarbons
USEPA:	United States Environmental Protection Agency
VOC's:	Volatile Organic Compounds

EXECUTIVE SUMMARY

ERM-Northeast Engineers, P.C. (ERM-Northeast) conducted a Feasibility Study (FS) for the Norton Company restoration site in the town of Colonie, New York. The FS was a comprehensive and systematic evaluation of remedial alternatives that culminated in the selection of the most appropriate approach for addressing previously identified soil and ground water contamination at the site. The FS was conducted in strict conformance with NYSDEC guidelines.

The FS process resulted in the selection of a remedial approach (designated Alternative 4) that will isolate the hazardous material from the environment while soil and ground water restoration is accomplished. The alternative provided the best long term solution to current concerns while minimizing short term, construction-related impacts to the surrounding community.

Purpose, Objectives and Scope

The Remedial Investigation (RI) documented that contamination present in the soil and shallow groundwater within the industrial fill area consists of volatile and semi-volatile organic compounds and polynuclear aromatic hydrocarbons. Groundwater contamination does not extend beyond the limits of the industrial fill area and does not come within 150 feet of the property boundary. Therefore, the overall remedial objective is the mitigation of the

documented contamination in a manner which protects public health and the environment and balances performance, cost and implementability while subsequently permitting the return to productive use of the overall site.

The remedial objectives of the FS are further specified by statute and regulation to include:

- A strong preference for a permanent remedial action that reduces the volume, toxicity and/or mobility of the contamination;

- The requirement to comply to the extent practicable with applicable New York State and Federal Standards, Criteria and Guidelines (SCGs); and

- The requirement to protect human health, welfare and the environment.

The scope of the FS included the following tasks:

- define site-specific remedial objectives;
- investigate and screen potentially viable remedial technologies;
- formulate and screen these remedial alternatives; and
- perform a detailed evaluation of the selected approach for addressing site contamination.

A public health and environmental risk assessment was performed concurrent with the FS.

Site Information

The Norton Company Restoration Site is located north of the Norton Company's Coated Abrasive Division plant in the Town of Colonie, New York. The Restoration Site covers 22 acres, of which 4 acres is an industrial fill area. Material placement within the industrial fill area occurred between 1955 and 1966 and included disposal of waste tape, drummed liquid, sludges and fly ash.

Environmental studies conducted by several parties at the Restoration Site indicated that hazardous material was present in the soil and shallow groundwater within the industrial fill area. These findings resulted in the placement of the site on the New York State Department of Environmental Conservation Hazardous Waste Site Registry with a Class 2 designation. Norton Company entered into an Order on Consent (File Number R4-045A-87-05) with the New York State Department of Environmental Conservation which required the performance of a Remedial Investigation/Feasibility Study (RI/FS) of the site. Norton Company retained ERM-Northeast to design and implement the RI/FS.

ERM-Northeast performed the Remedial Investigation in 1989 with RI field work being conducted from June 12 to October 31, 1989. Investigative activities included a soil gas survey; the installation of overburden and bedrock monitoring wells; and sampling and analysis of surface water, sediment, soil, and groundwater. Field observations and analytical results were evaluated to characterize the hydrogeology and geochemistry of the site. This information was used to perform a Risk Assessment to determine potential effects of site conditions on human health and the environment.

The Remedial Investigation determined that there has been no significant degradation of surface water and sediment proximal to the site. Soils within the industrial fill area contain varying concentrations of volatile organic compounds and polynuclear aromatic compounds.

Shallow groundwater within the central portion of the industrial fill areas contains relatively high concentrations of volatile and semi-volatile organic compounds. The vertical and lateral extent of groundwater contamination is confined because of the subsurface geological conditions in the central portion of the industrial fill area. Hydrogeologic conditions at the site result in limited groundwater flow in this area; therefore, contaminant migration has not occurred beyond the industrial fill area. Groundwater contamination does not extend beyond the limits of the industrial fill area and does not come within 150 feet of the property boundary.

The Risk Assessment performed for the Remedial Investigation indicated that the site does not pose a significant imminent threat to human health or the environment in its present condition. Therefore, no immediate remedial measures were recommended.

Development and Screening of Remedial Alternatives

The primary function of the FS is the development of remedial alternatives in order to allow for selection of the most appropriate methods to protect public health and the environment and presents the best balance of effectiveness, implementability and cost. A three-phase process was used in this FS:

Phase I - Develop general remedial responses and select remedial technologies

Phase II - Develop and screen remedial alternatives

Phase III - Evaluate final alternatives in detail

Remedial technologies were screened by their effectiveness, implementability and relative costs.

General remedial responses and the final remedial technologies were assembled into a comprehensive list of potential viable remedial alternatives. The alternatives were then screened against the criteria of effectiveness and implementability to yield the set of final selected remedial alternatives, shown in Table ES-1. Detailed evaluation was then performed on these final alternatives.

Public Health Evaluation

The NYSDEC Technical and Administrative Guidance Memorandum for the Selection of Remedial Actions at Inactive Hazardous Waste Sites (NYSDEC, 1990) provides summary tables for each of the criteria to be evaluated in selection of a remedial alternative.

Impacts to human health and the environment during remedial actions are included in the table labelled Short-Term Effectiveness (see Table 6-2 of Appendix D). Scores can range from 0 to 4 for human impacts and 0 to 4 for environmental impacts, resulting in a total maximum score of 8 for impacts during remediation. In addition, the time required to

TABLE ES-1
ALTERNATIVE DESCRIPTION

Alternative #1 - No Action

- No treatment effort would take place under this alternative.
- Deed restrictions, access restrictions and monitoring would be included.

Alternative #2 - Containment

- No treatment effort would take place under this alternative.
- A slurry wall would be installed around the industrial fill to isolate it from the environment.
- A clay-soil cap to prevent infiltration would be placed over the industrial fill and keyed into the slurry wall.
- Deed restrictions, access restrictions and monitoring would be included.

Alternative #3 - Vitrification

- A permanent treatment effort would take place under this alternative.
- In-situ treatment via vitrification would be performed on the industrial fill. Deed restrictions, access restrictions and monitoring would be included.

TABLE ES-1 (cont'd)

Alternative #4 - Containment with Groundwater Treatment

- A permanent treatment effort would take place under this alternative.
- A slurry wall would be installed around the industrial fill to isolate it from the environment.
- A groundwater collection system would be installed inside the slurry wall and groundwater would be pumped to a treatment system for subsequent discharge.
- A soil venting system would be installed under a clay-soil cap on top of the industrial fill.
- A clay-soil cap would be installed to prevent infiltration and keyed into the slurry wall.
- Deed restrictions, access restrictions and monitoring would be included.

Alternative #5 - Source Removal

- A permanent treatment effort would take place under this alternative.
- The industrial fill would be excavated and dewatered.
- The dewatered material would be incinerated and residuals sent to a RCRA facility.
- The water would be collected and treated for subsequent discharge.
- Deed restrictions, access restrictions would not be included.
- Monitoring would be included.

implement the alternative and the duration of the mitigative effort are scored, making a score of 10 the maximum for the overall short-term effectiveness evaluation.

Impacts to human health and the environment following remediation are addressed in the table labelled Protection of Human Health and the Environment (see Table 6-3 of Appendix D). Scores can range from 0 to a maximum of 20, with 20 being the most protective score.

Each of the five remedial alternatives is scored based on the information presented in the following sections, as shown in Tables 6-1 through 6-9 of Appendix D and summarized below.

As discussed in Section 1.1 of Appendix D, the No Action Alternative was evaluated in the baseline risk assessment. That study indicated that none of the potential exposure routes represents a significant threat to human health. However, because during the Remedial Investigation the groundwater in the industrial fill area could not be sampled, it was conservatively assumed that exposures via groundwater and air could potentially be unacceptable. The risk to environmental resources is rated at slightly greater than acceptable resulting in a total score of 8 (out of 20) for long-term protection of human health and the environment.

All of the remaining remedial alternatives (#2 through #5) received the maximum score of 8 for protection of the community and the environment during remedial actions. Any waste streams generated as a result of remediation (i.e., air and water from the air stripper and air from the soil venting system) would be adequately treated prior to discharge.

Each of the remaining four remedial alternatives also received the maximum score of 20 for protection of human health and the environment following remediation. Each of these alternatives effectively eliminates all potential human or environmental exposure routes by either source control or removal.

Detailed Evaluation of Final Alternatives

The detailed evaluation involved a multi-media comparison with the following criteria:

- Compliance, to the extent practicable, with New York State and Federal Standards, Criteria and Guidelines;
- Overall protection of human health and the environment;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume through treatment;
- Short-term effectiveness;

- Implementability; and
- Cost.

Table ES-2 provides a Summary of the alternative evaluations based on the New York State evaluation guidelines as shown on the tables contained in Appendix B and C.

Preferred Alternative - Alternative #4 - Containment with Groundwater Treatment.

This Alternative has the highest point total of (94) and thus best meets the stated criteria. This alternative scored well with all the technical criteria. This alternative provides a long-term solution to identified concerns and provides active site remediation while minimizing short - term construction - related impacts.

Other Alternatives

Alternative #1 - No Action

This Alternative was not considered for a complete evaluation against all seven criteria due to the fact that it does not comply with the remedial objectives.

TABLE ES-2
SUMMARY OF ALTERNATIVE EVALUATIONS

CRITERIA

Alternative	SCG** Compliance (max. of 10)	Overall Protection (max. of 20)	Long-Term Effectiveness (max. of 15)	Reduction (max. of 15)	Short-Term Effectiveness (max. of 10)	Implementability (max. of 15)	Cost (max. of 15)	Point Totals (max. of 100)
1: No Action	0	8	N/A	N/A	N/A	N/A	N/A	N/A
2: Containment	6	20	4	1	10	14	15(2.260*)	70
3: Vitrification	10	20	14	15	10	8	2(61.160*)	79
4: Containment with Groundwater Treatment	10	20	13	13	9	15	14(7.360*)	94
5: Source Removal	7	20	15	12	8	11	1(71.685*)	74
Relative Weight	10	20	15	15	10	15	15	100

* Cost in millions of dollars
**SCG compliance is to the extent practicable
N/A: Not applicable

Alternative #3 - Vitrification

This Alternative had the second highest point total of (79). The main technical drawback of this alternative is that it is an innovative technology, and as such, may be difficult to implement and could have some uncertainties associated with it. Due to these uncertainties, technical delays are likely during implementation. Additionally, Alternative #3 is a patented process, which means there is only one vendor which can be considered, and it is very expensive to implement.

Alternative #5 - Source Removal

This Alternative had the third highest point total of (74). It does not comply with all three categories of SCGs and results in minor short-term threats to the community and environment. Construction of the remedial effort would be somewhat difficult and is dependent on off-site disposal of site debris and residuals. This alternative is by far the most expensive to implement.

Alternative #2 - Containment

This Alternative has the lowest point total of (70) because the alternative provides no treatment of the contamination. As a result, the alternative does not comply with

groundwater standards and scores poorly in terms of long-term effectiveness and permanence, as well as reduction of toxicity, mobility, or volume through treatment.

The only two alternatives which comply to the extent practicable with all three categories of SCGs and upon remediation results in a commercially usable site are Alternative #3 - Vitrification and Alternative #4 - Containment with Groundwater Treatment. Alternative #4 scores better than Alternative #3 in the evaluations, but both are viable remedial alternatives. A comparison of costs associated with the alternatives indicates that Alternative #3 would cost an order of magnitude more than Alternative #4. Given the uncertainties inherent in the innovative technology associated with Alternative #3, as well as its high cost, it was considered to be a less desirable approach than Alternative #4.

Consequently, based on consideration of the six technical criteria and the seventh criterion (cost), as well as providing upon remediation a commercially useable site, Alternative #4 - Containment with Groundwater Treatment is the recommended remedial method for remediation of the Norton Company Restoration Site.

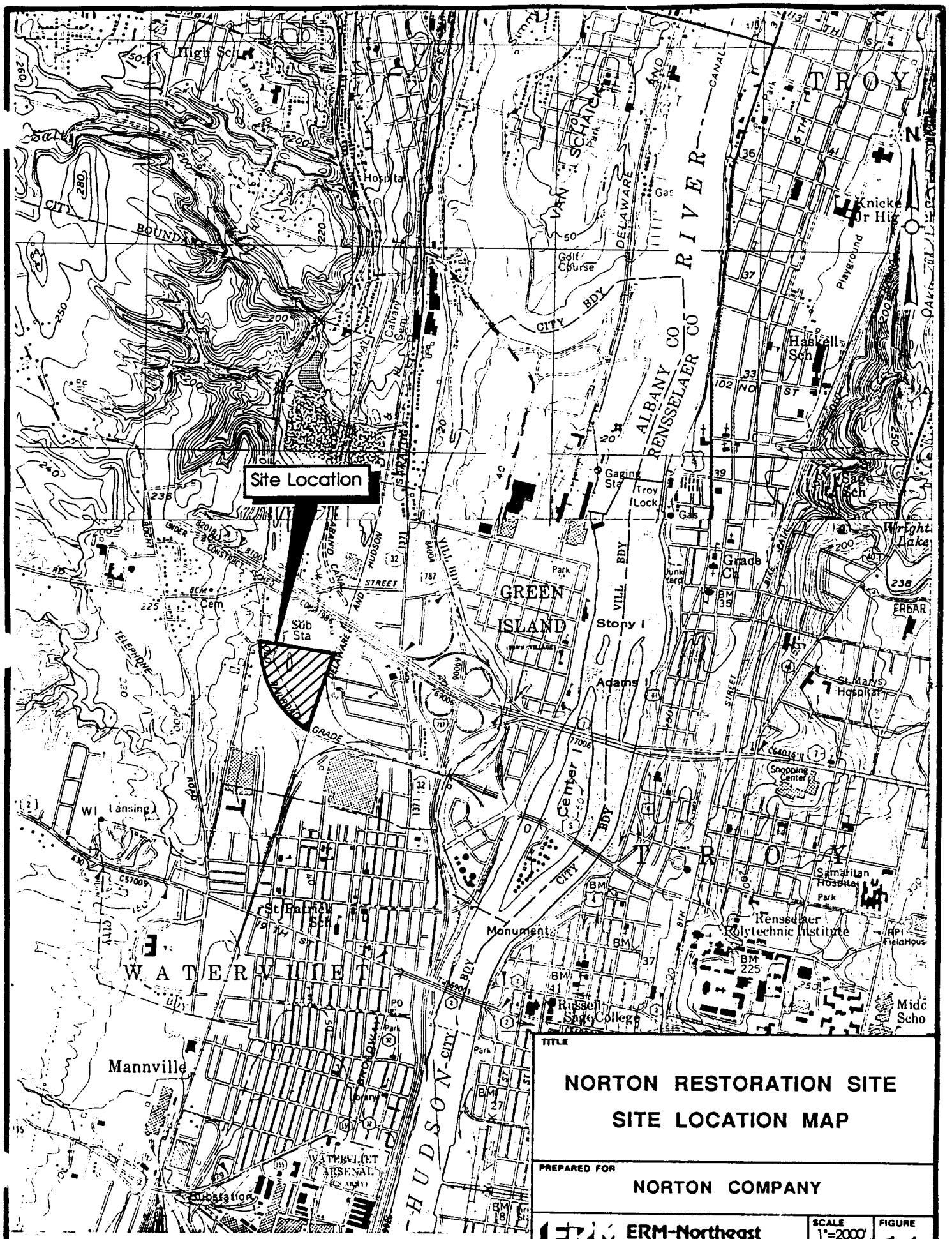
1.0 INTRODUCTION

1.1 General

The Norton Company Restoration Site Feasibility Study (FS) was conducted for the New York State Department of Environmental Conservation (NYSDEC), Albany, New York, by ERM-Northeast, Albany, New York. The FS consisted of an extensive literature search of remedial technologies at all stages of development, screening of these technologies, combining the remaining technologies into remedial action alternatives, and determining which alternatives were most appropriate for the Norton Company Restoration Site. This FS was preceded by a Remedial Investigation (RI). The results of the RI are summarized in this chapter.

1.2 Site Description

The Norton Company Restoration Site is located north of Norton's Coated Abrasive Division Plant in the City of Watervliet, Town of Colonie, Albany County, New York. The site location is depicted in Figure 1-1.



TITLE

NORTON RESTORATION SITE

SITE LOCATION MAP

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Environmental Resource Management

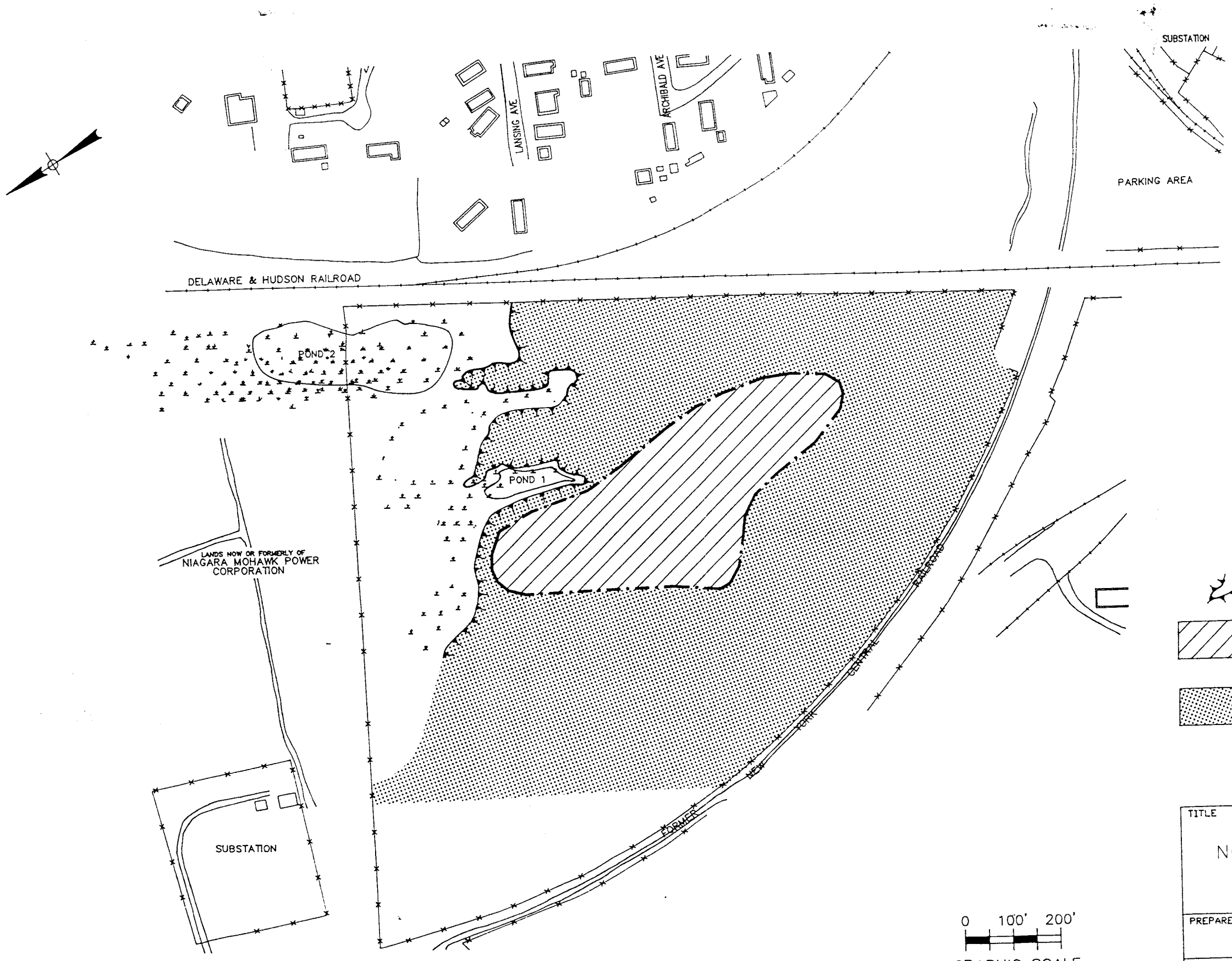
SCALE	FIGURE
1"=2000'	1-1
DATE Sept.90	

146621

The restoration site encompasses an area of 22 acres in the shape of a quarter of a circle. A site plan is presented in Figure 1-2. The two straight sides of the site are approximately 1,200 feet long and the curved southern boundary is 1,800 feet long. The northern portion of the site consists of a 3.2-acre marsh which contains two ponds. This part of the site lies at a lower elevation than the remainder of the site and most likely represents the undisturbed original grade. To the northwest of the marshy area is an elevated 2.2-acre heavily wooded parcel. Employee statements and in-depth visual inspection of the area indicate that the wooded area has probably never been used for disposal by the Norton Company.

South of the marsh are fill deposits covering a total of 17.8 acres and extending horizontally to within approximately 30 feet of the southern site boundary. Within the fill deposits is an oblong-shaped area approximately four acres in areal extent which represents the extent of industrial fill deposits. These deposits were originally mapped in 1965 and boundaries were confirmed during the 1988 Phase II site investigation.

A former railroad bed extends along the southern site boundary and forms a topographic high. This feature consists of iron slag deposited by the railroad in the past. Much of the area characterized by fill deposits and iron slag deposits is currently wooded.



LEGEND

TOE OF FILL EMBANKMENT

INDUSTRIAL FILL DEPOSITS

PERIMETER FILL DEPOSITS

TITLE

NORTON RESTORATION SITE
SITE PLAN

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SCALE	FIGURE
GRAPHIC	1-2
DATE 9/6/90	

Located to the north of the Restoration Site is an electrical substation owned by the Niagara Mohawk Power Company. To the East of the site is an active railroad track which is the property of the Delaware and Hudson Railroad Company. To the northwest of the Restoration Site lies an asphalt plant owned and operated by Callanan Industries.

The entire site boundary is fenced. Access to the site is obtained through locked gates located at the southeast and northwest corners of the property.

1.3 Site History

The Norton Company Restoration Site was used as a landfill between 1955 and 1966 for the purpose of filling the area to prepare it for possible future development. Filling activities included the placement of industrial waste in the central portion of the site. Much of this industrial waste was solid material, such as waste tape rolls and paper. Quantities of liquid waste in 55-gallon drums were also reported to have been deposited in the industrial landfill. The liquid waste reportedly consisted of solvents, settling basin sludge and waste phenol/formaldehyde type resins. The solvents included toluene, xylene, ethanol, methyl isobutyl ketone and methyl ethyl ketone. Test pit excavation performed during a Phase II study indicates that it is unlikely that any of the drums are still intact. Landfilling of these wastes ceased in 1966.

From 1966 to 1973, liquid latex was deposited in five surface holding lagoons on the landfill site. The latex sealed the lagoon bottoms and subsequently dried to form a hard rubbery material. Fly ash from the plant's boiler house was deposited in the landfill during the same time period. From 1973 to 1980, only construction waste and fly ash was disposed of at the site. The amount of waste deposited in the landfill cannot be accurately established.

The landfill has been inactive since 1980. However, a small portion of the southeast corner of the site was used for fire training exercises from the late 1960's to 1986.

1.4 Summary of Previous Investigative Activity

A chronology of response actions and initial remedial measures which have taken place at the site is as follows:

1. 1979 - Albany County Health Department inspects site.

2. September 1980 - United States Environmental Protection Agency (USEPA) inspects site.

3. October 1980 - USEPA conducts soil and water sampling of site.

4. 1984 - NYSDEC conducts a PHASE I site investigation.

5. April, 1987 - NYSDEC requests that Norton Company conduct a PHASE II site investigation.

6. October, 1987 - Norton Company enters into consent order to conduct the PHASE II investigation.

7. September, 1987 - January 1988 - Norton Company conducts a PHASE II site investigation.

8. March, 1988 - Norton Company presents the PHASE II report to the NYSDEC.

9. April, 1988 - NYSDEC conditionally accepts the PHASE II investigation document.

10. April, 1988 - NYSDEC reclassifies the site as a Class 2 site.

11. April, 1988 - The NYSDEC requests that Norton Company prepare a remedial study work plan.

12. September, 1988 - Norton Company submits Remedial Studies Work Plan.

13. May, 1989 - The NYSDEC issues oral approval of the Norton Company Remedial Investigation/Risk Assessment work plan during a meeting with Norton Company and ERM-Northeast. Approval to initiate statement of work in early June is granted orally at a meeting with the NYSDEC.

14. July, 1989 - Norton Company enters into an order on consent to conduct the Remedial Investigation/Risk Assessment and Feasibility Study.

15. June, 1989 - October, 1989 - Norton Company conducts a Remedial Investigation/Risk Assessment of the Restoration Site.

16. May, 1990 - The NYSDEC accepted the Remedial Investigation Report.

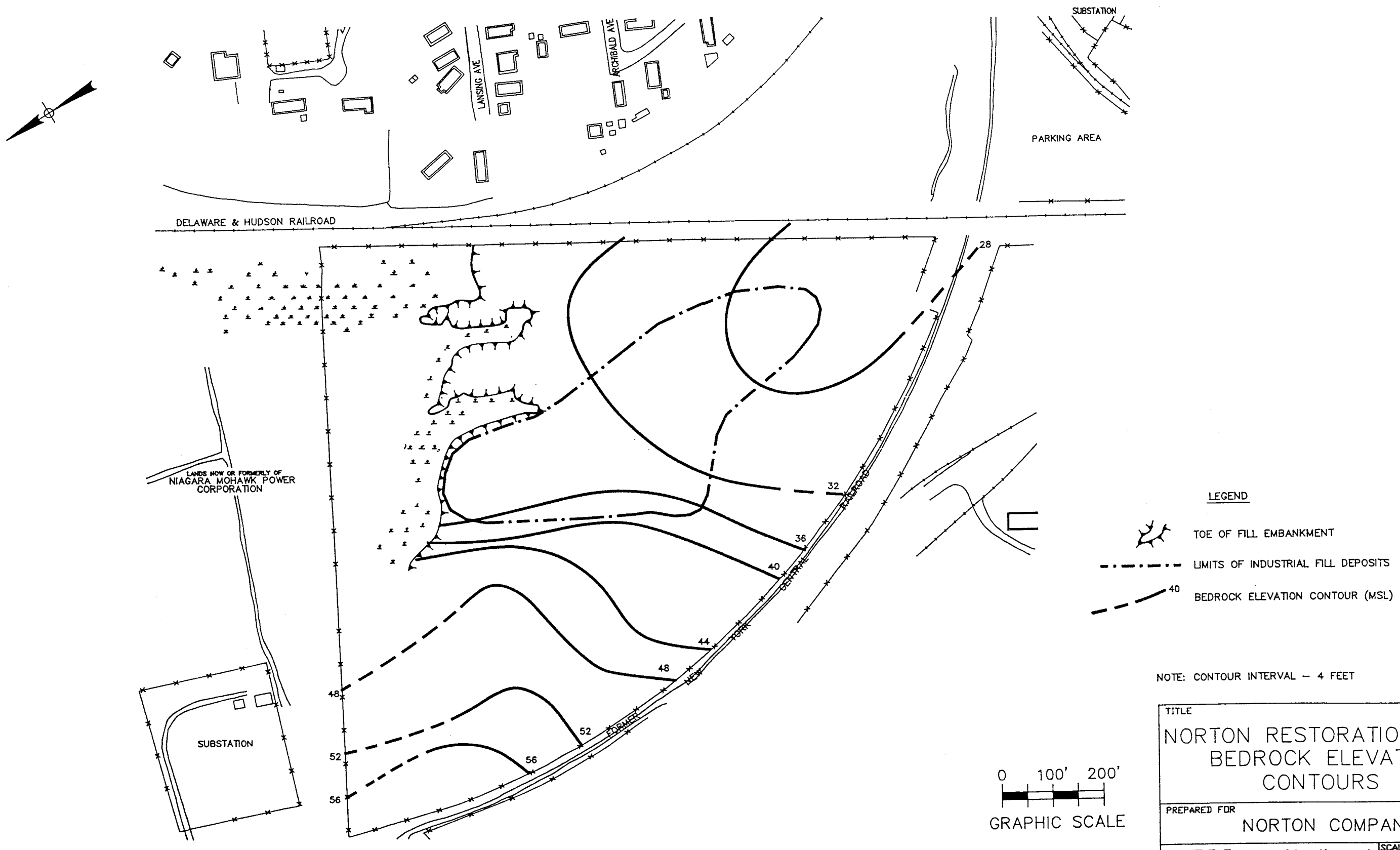
The PHASE II investigation established the type, approximate location and relative concentrations of contaminants. This investigation consisted of a magnetometer survey, excavation of test pits, construction of four monitoring wells within the landfill area, construction of four perimeter monitoring wells, and collection of surface water and sediment samples. The test pits were used to approximately define the extent of the industrial landfill. Based on these data, the potential public health/environmental hazards were evaluated and the immediate effect of site conditions on potential receptors identified. No adverse public health/environmental effects due to present site conditions were found.

The only initial remedial measure required was to limit site access. This involved inspection and repair of the existing perimeter fencing and routine surveillance. The Remedial Investigation Report confirmed the results of the Phase II investigation report and further defined the limits of the contamination. This investigation consisted of a soil gas survey; soil borings; installation of overburden and bedrock monitoring wells; and sampling and analysis of surface water, sediment, soil and groundwater. The soil borings were used to further define the limits of the industrial fill. Again no adverse public health/environmental effects due to present site conditions were found.

1.5 Results of Remedial Investigation

1.5.1 Site Geology

The bedrock underlying the site consists of dark gray to black, poorly fractured argillaceous shales of the Snake Hill formation. Depth to bedrock varies and bedrock outcrops do occur on-site. A bedrock contour map is shown in Figure 1-3. As shown, a bedrock high occurs in the northwestern corner of the site. Bedrock slopes to the southeast, where a shallow bedrock trough exists. A secondary bedrock high occurs in the north-central portion of the site. Total thickness of the Snake Hill formation below the site is unknown, but is at least 100 feet based on rock drilling



TITLE

NORTON RESTORATION SITE
BEDROCK ELEVATION
CONTOURS

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Environmental Resources Management

SCALE	FIGURE
GRAPHIC	1–3
DATE 9/6/90	

performed during the installation of monitoring wells. Drilling actions and activities indicate that only minor fractures are present in the bedrock below the site.

The overburden materials overlying the bedrock are residual soils, marsh deposits and fill deposits. Overburden thickness varies from non-existent at bedrock outcrops to 15 feet below grade. The natural marsh deposits and residual soils are found immediately overlying the bedrock and are limited in thickness. The residual soils are the result of bedrock shale weathering and are composed of silt and clays. The residual soil thickness ranges from six inches to two feet.

Immediately overlying, or in place of, the residual soils are discontinuous layers of marsh deposits consisting of dark gray to black clayey silts with significant organic content. These deposits were found frequently throughout the site during soil boring and test pit investigation work. The marsh deposits initially covered significant portions of the site. They have since been covered by the site fill materials.

The fill materials overlying the natural soils and/or bedrock have been characterized and classified into two different categories: industrial fill and perimeter (non-industrial) fill. The perimeter (non-industrial) fill consists of iron slag material mixed with coal ash, brick fragments, cinders, construction debris, and soils ranging from silts to gravels. In addition to the perimeter (non-industrial) fill materials, the

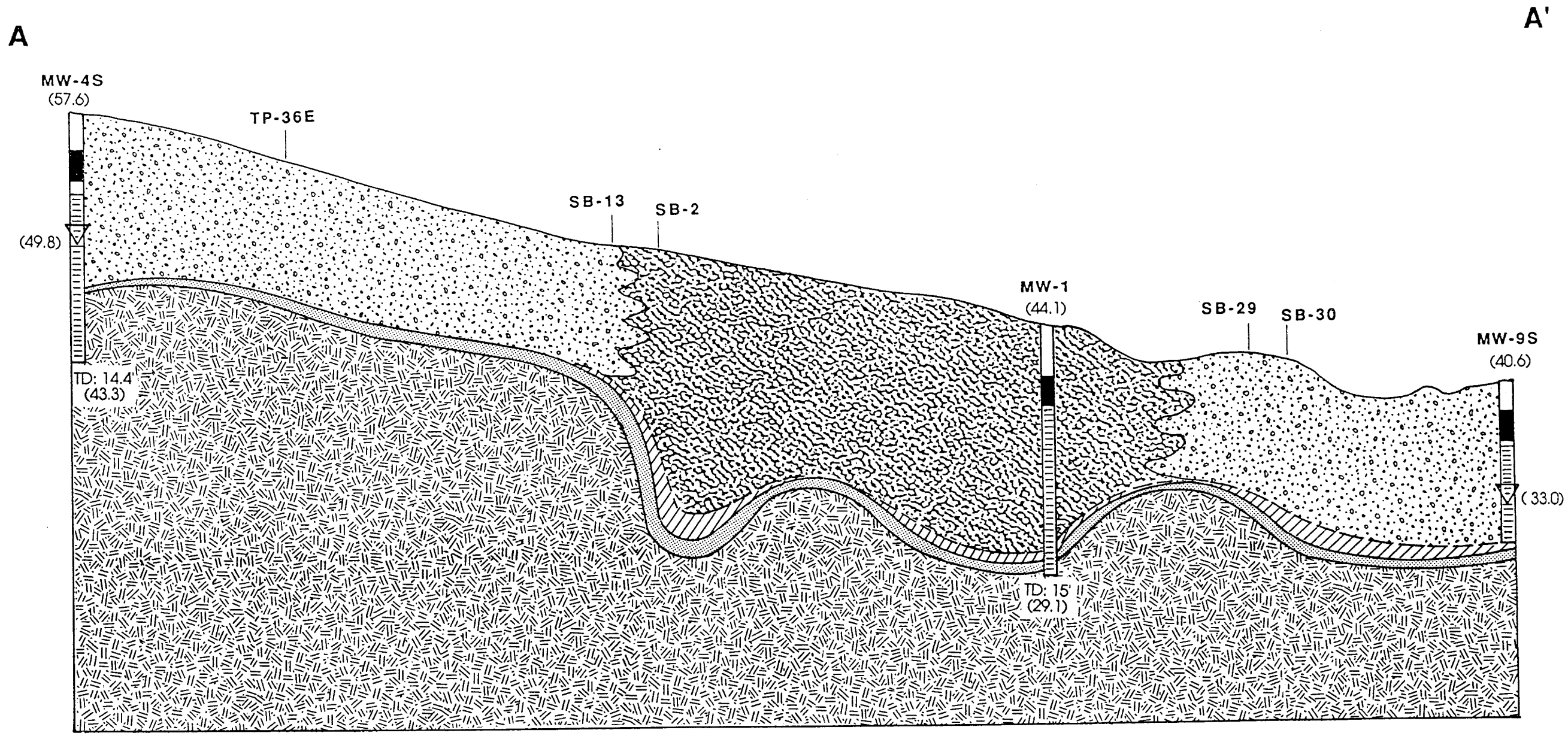
industrial fill contains materials such as pressure sensitive tape, rags, wire, drums, abrasive material and ceramics. Drums were observed in test pits within the industrial fill completed during the Phase II investigation. The drum's condition ranged from remnants to partially intact. Fluids were observed, but not characterized, in some of the partially intact drums. Soil staining was also observed in association with some of the drums.

The distribution of the fill types is shown in Figure 1-2. The fill boundaries are based on past investigative work. The thickness of the fill types varies but averages between ten and fifteen feet. Figure 1-4 shows the fill types, soils and bedrock in cross section.

1.5.2 Site Hydrology and Hydrogeology

Surface water exists in the northern portions of the site. The location and configuration of the surface water bodies are shown in Figure 1-2.

A small, unnamed stream enters the site along the north property line and flows through the marshy area. This stream originates approximately 500 feet north of the property line on the adjacent Niagara Mohawk property and subsequently discharges into the western pond (Pond 1). The western and eastern (Pond 2) ponds discharge



NOTE: For Location of Section A-A' see Fig. 1-6

LEGEND

- "Fill" - Predominantly Iron Slag and Cinders
- "Industrial Fill" - Containing Industrial Wastes
- Natural Swamp Deposits - Peat, Silt and Clay with Plant Debris
- Silt and Clay (Weathered Bedrock)
- Bedrock - Shale

MW-1 (44.1) — Well Identification and Ground Elevation
Bentonite Seal
(30.7) — Ground Water Elevation - as Measured 10/24/89
Screened Portion of Well
TD: 15' (29.1) — Total Depth of Well (Below Grade) Elevation of Bottom of Screen

SCALE: NONE

1"=100'
1"=7"
SCALE:

TITLE

NORTON RESTORATION SITE
CROSS SECTION
A-A'

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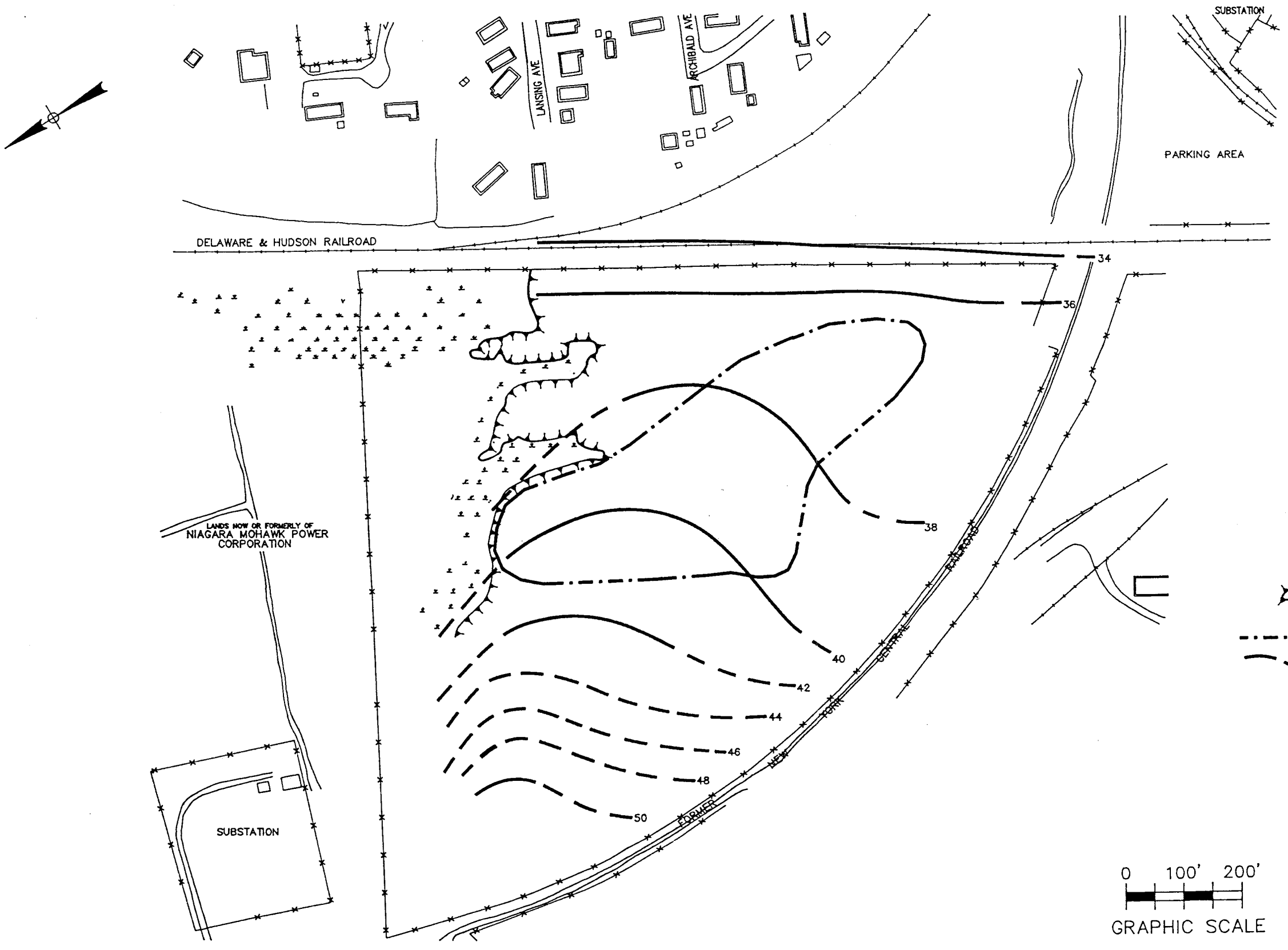
SCALE	FIGURE
Noted	1-4
DATE Sept.90	

149926

northward via a small outlet stream, eventually joining with a drainage culvert adjacent to the new Route 7 bypass, approximately 1000 feet northeast of the northeastern site boundary. This drainage gully runs under the Delaware & Hudson railroad tracks and the east-flowing water eventually discharges to the Hudson River. During times of particularly heavy rainfall, the marshy area and pond water levels may rise enough to cause overflow into a drainage gully running along the eastern site fenceline. This gully forms the mouth of a storm sewer line that directs overflow water south and eventually connects with a second storm sewer line at the southern corner of the site. These storm lines discharge under the Delaware & Hudson railroad tracks to a triangular parcel of land to the east.

The shallow unconfined groundwater table occurs in the overburden generally within six feet of grade. Groundwater elevation contours based on October 24, 1989 measurements are shown in Figure 1-5.

Overburden groundwater flow is to the southeast throughout most of the site. This southeasterly flow is consistent with the regional groundwater flow towards the Hudson River. Localized groundwater flow directions within the overburden materials do vary, however, as a result of irregularities in the underlying bedrock topography and permeability variations in the overburden deposits.



LEGEND

TOE OF FILL EMBANKMENT

LIMITS OF INDUSTRIAL FILL DEPOSITS

38 GROUNDWATER ELEVATION CONTOUR (MSL)

NOTE: CONTOUR INTERVAL – 2 FEET

TITLE

NORTON RESTORATION SITE
GROUNDWATER ELEVATION
CONTOURS

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SCALE	FIGURE
GRAPHIC	1–5
DATE 9/6/90	

A subtle bedrock topographic high exists in the north-central portion of the site. This high point causes groundwater flow in the northern portion of the site to be diverted as it flows southeast. Following a "path of least resistance", the groundwater flows around the bedrock high, diverting to the east and south.

One hydraulic gradient cannot be calculated for the site as a whole. The gradient in the northwestern portion of the site is different from the gradient throughout the area of fill deposits to the southeast. An average hydraulic gradient of 0.029 feet/foot exists in the northwestern portion of the site and along the north and southwest "flanks" of the site. However, in the southeastern portion of the site, an area that was initially a low-energy marsh environment prior to landfilling operations, the gradient is only 0.010 feet/foot. Therefore, groundwater flow velocity through the central portion of the site will be low in relation to other areas within the site.

Another factor influencing the movement of shallow groundwater is the permeability of the overburden deposits. Permeability tests were not performed at the Norton Restoration Site because of the heterogeneity of the site fill materials. However, the permeability of the overburden deposits, although variable, is estimated to be fairly low due to the high proportion of silts and clays in the fill. The low permeability of the site fill materials will further restrict the movement of water through the industrial fill deposits.

Bedrock groundwater is contained within fractures, bedding planes and joints within the bedrock. Production rates of wells installed at the Restoration Site are low, typical of wells installed in shale bedrock formations. The variable but low recharge rates of bedrock wells at the site indicate that bedrock fracture patterns are irregular and that groundwater movement through this system is fairly restricted. Results of bedrock groundwater level measurements however indicate the general flow direction in the bedrock is east towards the Hudson River.

Based on the site geology, the bedrock and overburden groundwater appears to be interconnected. Although some clay deposits exist on site, they are typically silty, thin and contain abundant shale fragments indicating derivation from the weathered bedrock surface as opposed to deposition of clays in a freshwater environment. Because of the physical character of the clay, it is not suitable as a confining layer. In addition, water level measurements do not indicate a significant difference between bedrock and overburden groundwater elevations. There is no clear trend for groundwater elevation differences at well pair locations. At some locations, bedrock groundwater elevations are higher than overburden groundwater elevations, suggesting an upward component of flow, while at other locations the reverse situation is true. Thus the vertical component of groundwater flow is uncertain.

Groundwater production rates are variable, but typically less than two gallons per minute. Although no clear patterns of groundwater rates have emerged, it appears that greater production rates exist at the southeastern corner of the site in both the overburden and bedrock wells.

1.5.3 Extent and Nature of Contamination

1.5.3.1 General

Waste products disposed of at the Norton Company Restoration Site are not migrating off-site and impacting the surrounding environment. The contaminated media of concern at the site are limited to shallow groundwater and soils within the industrial fill area. This section is a summary of the conclusions of the Remedial Investigation Report as accepted by NYSDEC. A more detailed discussion of the analytical data can be found in the Remedial Investigation Report.

1.5.3.2 Air

Air monitoring indicates that ambient air quality degradation is not a concern with respect to volatile organics in the vicinity of the Norton Company Restoration site

during non-disruptive on-site activities and that adverse health effects due to gaseous emissions from the site are not expected.

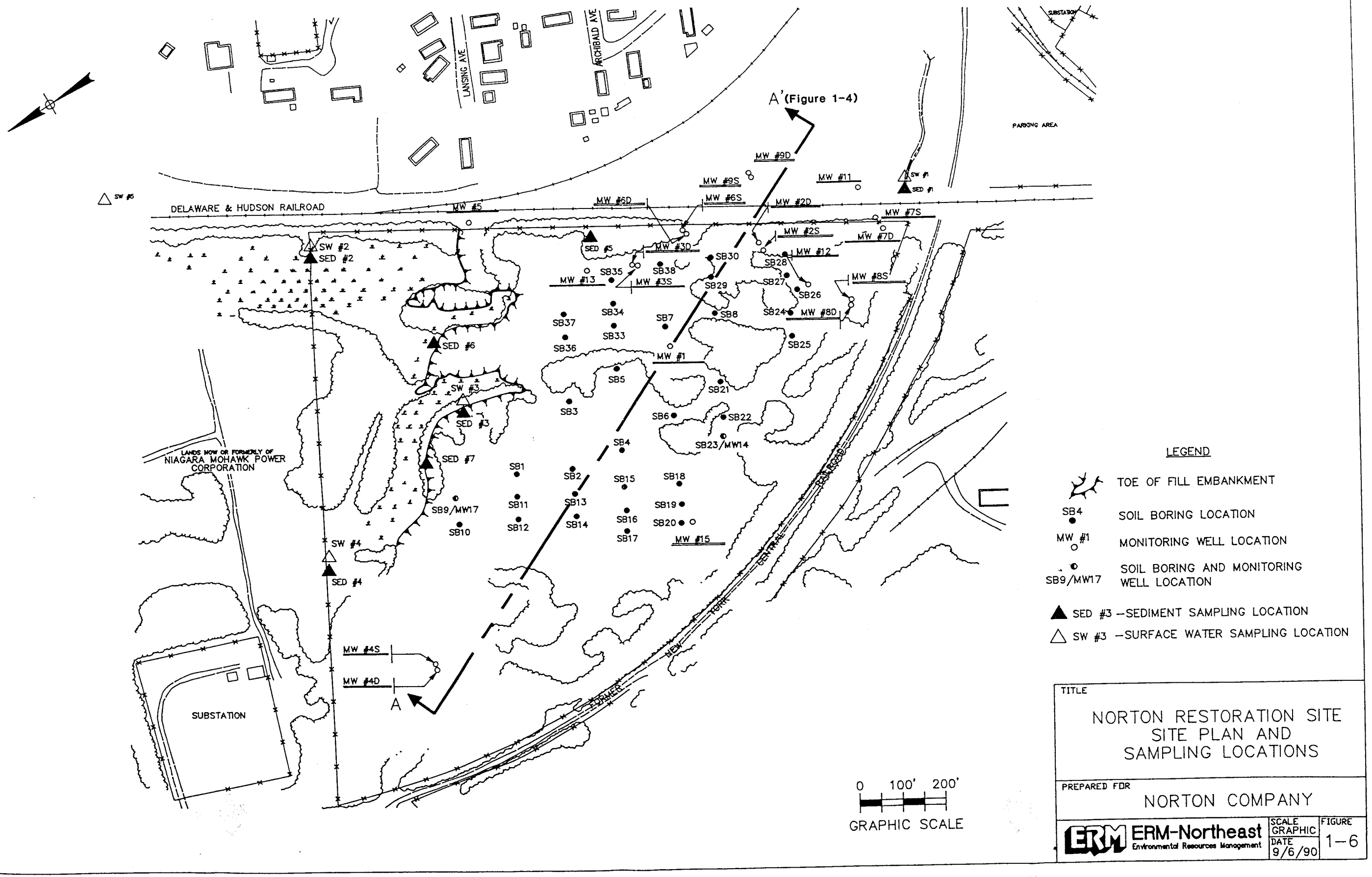
Higher total volatile organic concentrations were detected during drilling operations resulting from deeper soil or groundwater quality, not ambient air quality.

1.5.3.3 Soils

Soil sampling in and around the industrial fill area was performed in order to establish the lateral and vertical extent and composition of the fill materials; the occurrence, thickness and character of natural soils; the occurrence and extent of soil contamination; and the depth to the water table and bedrock surfaces. The program was specifically designed, utilizing previously obtained data including soil gas survey results, to more accurately define the extent of the industrial fill materials.

Soil borings were drilled at 36 locations within the industrial fill and surrounding area (Figure 1-6).

Unsaturated soil contamination is relatively minor; isolated Polynuclear Aromatic Hydrocarbons (PAH) contamination exist at the southern corner of the site and at the northern limits of the industrial fill area. PAH contamination is attributed to the


LANSING AVE.
ARCHIBALD AVE.
SUBSTATION
PARKING AREA
A' (Figure 1-4)
DELAWARE & HUDSON RAILROAD
SW #5
SW #1
SED #1
SW #2
SED #2
SED #5
SED #6
SW #3
SED #3
SED #7
SW #4
SED #4
MW #9D
MW #9S
MW #11
MW #6D
MW #6S
MW #2D
MW #5
MW #7S
MW #2S
MW #7D
MW #3D
MW #12
MW #13
MW #3S
MW #8S
MW #8D
MW #1
MW #15
MW #4S
MW #4D
SB1
SB2
SB3
SB4
SB5
SB6
SB7
SB8
SB9/MW17
SB10
SB11
SB12
SB13
SB14
SB15
SB16
SB17
SB18
SB19
SB20
SB21
SB22
SB23/MW14
SB24
SB25
SB26
SB27
SB28
SB29
SB30
SB33
SB34
SB35
SB36
SB37
SB38
LANDS NOW OR FORMERLY OF
NIAGARA MOHAWK POWER
CORPORATION
SUBSTATION
A
FORMER NEW YORK CENTRAL RAILROAD
LEGEND
TOE OF FILL EMBANKMENT
SB4 SOIL BORING LOCATION
MW #1 MONITORING WELL LOCATION
SB9/MW17 SOIL BORING AND MONITORING WELL LOCATION
SED #3 –SEDIMENT SAMPLING LOCATION
SW #3 –SURFACE WATER SAMPLING LOCATION
0 100' 200'
GRAPHIC SCALE
TITLE
NORTON RESTORATION SITE
SITE PLAN AND
SAMPLING LOCATIONS
PREPARED FOR
NORTON COMPANY
ERM-Northeast
Environmental Resources Management
SCALE GRAPHIC
DATE 9/6/90
FIGURE 1-6

coal ash mixed with the cinder and slag fill and bulldozed over portions of the site. PAH compounds are tightly bound to the soil matrix and are relatively immobile.

The concentrations of certain metals (notably iron and manganese) in the site fill are uniformly high due to the slag component of the fill material. As the E.P. Toxicity tests of the fill show, these metals are tightly bound to the matrix and are therefore immobile.

No PCB's were detected in soil samples obtained form the test pit 36 area, although the Phase II investigation results indicated the presence of PCB compounds at this location. The Phase II results appear to be valid. Therefore, the results of the present study indicate that the existence of PCB compounds is extremely limited in both concentration and extent.

Fire training activities in the southern corner of the property did not contribute to site contamination based on analysis of surficial soil samples

1.5.3.4 Surface Water and Sediment

Metals and PAH compounds exist in the stream and pond sediments. Metal concentrations are due to the slag component of the site fill materials; these metals

are quite immobile. The concentration of PAH compounds is variable across the site. The highest concentration in sediments occur in the eastern site drainage ditch at the inflow of the eastern storm sewer line. Rainwater run-off, carrying quantities of site fill in suspension, ponds in this location. The suspended fill sediments settle out of the water and accumulate. High sediment PAH concentrations were also recorded at sampling locations directly adjacent to the site fill materials. Thus, the PAH concentrations in the sediment are ultimately a results of the coal ash component of the fill.

Surface water quality has not been degraded by the site fill materials. Analyses indicate that surface water entering, crossing and leaving the site has approximately the same chemistry.

1.5.3.5 Groundwater

A total of 22 groundwater monitoring wells were installed around and downgradient of the Norton Restoration Site (Figure 1-6). The results of two episodes of sample collection and analysis of samples from these wells (excluding MW-1) during the RI indicate that groundwater contamination is limited to a small area within the industrial fill, does not extend beyond the boundaries of the fill area, and does not

approach the site boundaries. Results of all groundwater sampling performed at the site indicate that groundwater contamination at the Norton Restoration Site is limited to the industrial fill area based on the results of analysis from MW-1.

Previous site activities have negatively impacted the overburden groundwater in the industrial fill deposits. As evidenced by the soil gas survey, initial soil boring work, the secondary close-space boring program and the results of the previous Phase II investigation, the area of concern within the industrial fill centers around MW-1 and SB-7 with a radius of approximately 50 feet. A saturated soil sample obtained from this area contained high concentrations of organic solvents that have mixed with discarded tape products, potentially creating the viscous resin-like substance found in MW-1 and SB-7.

Groundwater flow at the site follows the regional flow to the east. Locally, site flow is diverted to the north and south around a bedrock topographic high situated in the north-central portion of the site. The overall shallow groundwater flow gradient of the site is considered average (0.029 feet/foot); however, an area of relatively low flow gradient (0.010 feet/foot) exists in the central portion of the site.

Groundwater flow through the industrial fill materials is extremely limited. Overburden groundwater flow follows the bedrock topography. A secondary bedrock

topographic high in the north-central portion of the site diverts groundwater flow to the south and east and away from the industrial fill materials. This diversion of upgradient groundwater causes the groundwater within the industrial fill materials to virtually stagnate. In addition, the original marsh deposits within the boundary of the industrial fill area further indicate that this is a low energy setting with limited shallow groundwater flow potential.

Because of the lack of groundwater flow through the contaminated industrial fill materials, transport of contaminants out of the industrial fill and into the perimeter fill and off-site materials has not occurred.

Perimeter and off-site downgradient overburden monitoring wells have not been affected by the industrial fill.

Overburden and bedrock aquifers are hydraulically connected, although no clear vertical flow component can be distinguished.

Bedrock aquifer quality has not been degraded by prior site activities. Downgradient bedrock monitoring wells are not contaminated. The bedrock aquifer directly below the industrial fill materials was not sampled to avoid potential cross contamination during drilling operations. However, contamination of the bedrock aquifer is not

expected due to the absence of contamination in the perimeter bedrock wells, the lack of a downward gradient, the relative impermeability of the bedrock formation and the density of the compounds detected in the shallow groundwater sample obtained from MW-1.

1.5.3.6 Risk Assessment

Data collected during the RI was utilized in the performance of an accurate Risk Assessment. Risk Assessment findings indicate that, under current site conditions, no significant risk to human health or the environment is present due to the Restoration Site.

1.5.3.7 Summary

In summary, based on the Remedial Investigation results the soil contamination at the site is localized and immobile and the area of volatile organic compounds in the groundwater is limited to a portion of the industrial fill area and has not moved significantly from the apparent source.

2.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

This section presents an identification of remedial technologies as well as the methodology and technical considerations used in the identification process.

2.1 Introduction

As outlined by the New York State Department of Environmental Conservation (NYSDEC) Technical and Administrative Guidance Memorandum (TAGM) for the Selection of Remedial Actions at Inactive Hazardous Waste Sites and the National Contingency Plan (NCP), alternatives for site-wide remediation are developed by assembling combinations of technologies, and the media to which they would be applied, into alternatives that address contamination on a site-wide basis or for an identified operable unit. This process consists of the following five general steps:

1. Develop remedial action objectives specifying the contaminants and media of interest, exposure pathways, and remediation goals that permit a range of treatment and containment alternatives to be developed. The objectives developed are based on contaminant-specific applicable or relevant and appropriate New York State and/or Federal Standards, Criteria and Guidelines (SCGs) and risk factors.

2. Develop general response actions for each medium of interest, defining containment, treatment, excavation, pumping or other actions, singly or in combination, that may be taken to satisfy the remedial action objectives for the site.

3. Identify volumes or areas of media to which general response actions might be applied, taking into account the requirements for protectiveness as identified in the remedial action objectives and the chemical and physical characterization of the site.

4. Identify and screen the technologies applicable to each general response action to eliminate those that cannot technically be implemented at the site. The general response actions are further defined to specify remedial technology types (e.g., the general response action of treatment can be further defined to include chemical or biological technology types). Subsequent to the identification and screening of technologies, process options are identified and evaluated on the basis of effectiveness, implementability, and cost.

5. Assemble the selected representative technologies into alternatives representing a range of treatment and containment combinations.

The NYSDEC TAGM and the NCP requires that, to the extent practicable, the following types of alternatives should be developed:

(a) A number of treatment alternatives ranging from one that would eliminate the need for long-term management (including monitoring) at a site to one that would use treatment as a principal element to address the principal threats at the site.

(b) Include at least one alternative that involves containment of waste with little or no treatment but provides protection of human health and the environment by preventing potential exposure and/or by reducing the mobility.

(c) Include a no-action alternative. The no-action alternative may include some minimal actions such as fencing, using institutional controls, or monitoring.

2.2 Develop Remedial Action Objectives

As outlined by the NYSDEC TAGM and the NCP, the development of remedial action objectives involves specifying the contaminants and media of interest, exposure pathways, and remediation goals that permit a range of treatment and containment alternatives to be developed. The objectives developed are based on contaminant specific SCGs and risk factors.

In the case of the Norton Company Restoration Site, the media of concern, in terms of treatment, are limited to the soils and groundwater within the industrial fill area. As described in Section 1.0, the site consists of the industrial fill area, surrounded by the perimeter fill which makes up the rest of the site. The semi-volatile and metal contaminants detected in both fill areas are not of concern.

The potential human exposure pathway for contaminated groundwater is ingestion. The groundwater aquifer at the restoration site is not utilized as a domestic water source for either the residential or industrial community. Additionally, it is not expected to become a water source at any time in the future, due to the fact that the surrounding community obtains water from a municipal water system. It is possible however, that sometime in the future after site remediation, the property may be sold to another party, who may attempt to install wells for some reason. Potential environmental exposure pathways for contaminated groundwater consist of ingestion and/or direct contact with flora and fauna.

Potential human and environmental exposure pathways for contaminated soil at the site consists of ingestion, direct contact, and inhalation (due to site disturbance during remediation).

The remedial action objectives developed for the site are outlined below.

2.2.1 Objectives for Groundwater Remediation

- Prevent ingestion of water having a detectable concentration of carcinogens (benzene is the only carcinogen present) and a total excess cancer risk of greater than 10^{-4} to 10^{-7}.
- Prevent ingestion of water having non-carcinogens in excess of the SCGs.
- Restore the groundwater within the industrial fill area to appropriate contaminant levels compared to the SCGs.

- Minimize the potential for contamination of surface waters and surface sediments at and adjacent to the site.

2.2.2 Objectives for Soil Remediation

- Prevent ingestion/direct contact/inhalation of soil having 10^{-4} to 10^{-7} excess cancer risk from carcinogens (benzene is the only carcinogen present).
- Prevent ingestion/direct contact/inhalation of soil having non-carcinogens in excess of their reference doses.
- Restore the soil within the industrial fill area to appropriate contaminant levels compared to the SCGs.
- Prevent migration of contaminants that would result in further groundwater contamination.

Applicable or relevant and appropriate SCGs on which remedial objectives and remedial goals are based are presented in Section 2.2.3.

2.2.3 Applicable Standards, Criteria and Guidelines (SCGs)

This section presents both applicable or relevant and appropriate New York State Federal Standards, Criteria and Guidelines (SCGs) and the analytical results of a background soil sample obtained during the Phase II Investigation. The following SCGs were reviewed:

- New York State Ambient Water Quality Standard and Guidance Values, Rev. Sept. 25, 1990, Table 2-1;
- Analytical results for a background soil sample taken in the vicinity of the site (Phase II Investigation), Table 2-2;
- EPA Proposed National Primary and Secondary Drinking Water Regulations (54 FR 22062; May 22, 1989), Table 2-3; and
- RCRA Toxicity Characteristics, Table 2-4.

2.3 Develop General Response Actions

General response actions describe those actions that would satisfy the remedial action objectives. These may include treatment, containment, excavation, extraction, disposal, institutional actions, or a combination of these. Like remedial action objectives, general response actions are medium-specific.

General response actions that might be taken at a site are initially defined during scoping and are refined throughout the RI/FS as a better understanding of site conditions is gained. In developing alternatives, combinations of general actions may be identified, particularly when disposal methods are strongly dependent on whether the medium has been previously treated.

TABLE 2-1
NEW YORK STATE AMBIENT WATER QUALITY STANDARDS AND GUIDANCE VALUES
DATE OF REVISIONS: SEPTEMBER 25, 1990
(All Concentrations in Parts per Million)

Chemical	
Volatile Organics	
Methylene Chloride	0.005
Acetone	0.05*
Carbon Disulfide	0.05*
2-Butanone	0.05*
1,2-Dichloropropane	0.005
Benzene	N.D.
4-Methyl-2-Pentanone	0.05*
2-Hexanone	0.05*
Toluene	0.005
Ethyl Benzene	0.005
Total Xylenes	0.005[1]
Chloroform	0.100
1,1-Dichloroethane	0.005
1,1,1-Trichloroethane	0.005

[1] Applies to each isomer (1,2-;1,3-;and 1,4-) individually.

Chemical	
Semi-Volatile Organics	
Phenols	0.001
2-Methylphenol	N.S.
4-Methylphenol	N.S.
2,4-Dimethylphenol	N.S.
Benzoic Acid	N.S.
Total Phenols	0.001
Bis(2-ethylhexyl) phthalate	0.050
Diethylphthalate	0.050*
Di-n-octylphthalate	0.050*
Fluoranthene	0.050*
2-Methylnaphthalene	N.S.
Naphthalene	0.010*
Phenanthrene	0.050*
Pyrene	0.050*

N.S. - No Standard
N.D. - Not Detected

* - Guidance Value

Chemical	
Inorganics	
Aluminum	N.S.
Arsenic	0.025
Barium	1.0
Beryllium	0.003*
Cadmium	0.01
Calcium	N.S.
Chromium	0.05
Chromium (Hexavalent)	0.05
Cobalt	N.S.
Copper	0.20
Iron	0.30[2]
Lead	0.025
Magnesium	35*
Manganese	0.30[2]
Mercury	0.002
Nickel	N.S.
Potassium	N.S.
Silver	0.05
Sodium	20.0
Vanadium	N.S.
Zinc	0.3

[2] Iron and Manganese Total 0.50

TABLE 2-2
ANALYTICAL RESULTS
BACKGROUND SOIL SAMPLE
(All Concentrations in Parts per Million)

INORGANICS

	BG
Aluminum	14,340
Arsenic	3.5
Barium	103
Beryllium	1.7
Cadmium	1.7 B
Calcium	2600 B
Chromium	21
Cobalt	19 B
Copper	17 B
Lead	25
Iron	29,200
Magnesium	4270
Manganese	763
Mercury	0.14
Nickel	17
Potassium	1032
Silver	0.47
Sodium	151 B
Vanadium	28
Zinc	64 B

ORGANICS

VOLATILES	BG
Carbon Disulfide	BD
Benzene	BD
Tetrachloroethane	BD
Toluene	BD
Ethyl Benzene	BD
Total Xylenes	BD
SEMI VOLATILES	
Naphthalene	BD
2-Methylnaphthalene	BD
Phenanthrene	BD
Anthracene	BD
Fluoranthene	BD
Pyrene	BD
Benzo (a) Anthracene	BD
Bis(2-Ethylhexyl) Phthalate	BD
Chrysene	2.350 B
Benzo (b) Fluroanthene	BD
Benzo (k) Fluroanthene	BD
Benzo (a) Pyrene	BD
Total Phenols	BD
PESTICIDES/PCBS	
Arochlor 1248	BD
Arochlor 1254	BD

B = This result is of questionable qualitative significance since this compound was detected in a blank at a similar concentration.

BD = Below detection level.

TABLE 2-3
EPA PROPOSED NATIONAL PRIMARY AND SECONDARY DRINKING WATER REGULATIONS

Proposed MCLGs for inorganic chemicals:

Asbestos	7 million fibers/liter (longer than 10 u)
Barium	5 mg/l
Cadmium	0.005 mg/l
Chromium	0.1 mg/l
Mercury	0.002 mg/l
Nitrate[1]	10 mg/l (as N)
Nitrite[1]	1 mg/l (as N)
Selenium	0.05 mg/l

Proposed MCLGs for synthetic organic chemicals:

Acrylamide	Zero
Alachlor	Zero
Aldicarb	0.01 mg/l
Aldicarb sulfoxide	0.01 mg/l
Aldicarb sulfone	0.04 mg/l
Atrazine	0.003 mg/l
Carbofuran	0.04 mg/l
Chlordane	Zero
o-Dibromochloropropane (DBCP)	Zero
o-Dichlorobenzene	0.8 mg/l
cis-1,2-Dichloroethylene	0.07 mg/l
trans-1,2-Dichloroethylene	0.1 mg/l
1,2-Dichloropropane	Zero
2,4-D	0.07 mg/l
Epichlorohydrin	Zero
Ethylbenzene	0.7 mg/l
Ethylene dibromide (EDB)	Zero
Heptachlor	Zero
Heptachlor epoxide	Zero
Lindane	0.0002 mg/l
Methoxychlor	0.4 mg/l
Monochlorobenzene	0.1 mg/l
Polychlorinated biphenyls (PCBs) (as decachlorobiphenyl)	Zero
Pentachlorophenol	0.2 mg/l
Styrene	Zero/0.1 mg/l[2]
Tetrachloroethylene	Zero
Toluene	2 mg/l
Toxaphene	Zero
2,4,5-TP (Silvex)	0.05 mg/l
Xylenes (total)	10 mg/l

[1] In addition, MCLG for total nitrate and nitrite = 10 mg/1 (as N).
[2] EPA proposes MCLGs of 0.1 mg/l based on a Group C carcinogen classification and zero based on B_2 classification.

Proposed SMCLs:

Aluminum	0.05 mg/l
o-Dichlorobenzene	0.01 mg/l
p-Dichlorobenzene	0.005 mg/l
Ethylbenzene	0.03 mg/l
Pentachlorophenol	0.03 mg/l
Silver	0.09 mg/l
Styrene	0.01 mg/l
Toluene	0.04 mg/l
Xylene	0.02 mg/l

Proposed MCLs for inorganic chemicals:

Asbestos	7 million fibers/liter (longer than 10 um)
Barium	5 mg/l
Cadmium	0.005 mg/l
Chromium	0.1 mg/l
Mercury	0.002 mg/l
Nitrate[1]	10 mg/l (as N)
Nitrite[1]	1 mg/l (as N)
Selenium	0.05 mg/l

Proposed MCLs for synthetic organic chemicals:

Acrylamide	Treatment technique
Alachlor	0.002 mg/l
Aldicarb	0.01 mg/l
Aldicarb sulfoxide	0.01 mg/l
Aldicarbsulfone	0.04 mg/l
Atrazine	0.003 mg/l
Carbofuran	0.04 mg/l
Chlordane	0.002 mg/l
Dibromochloropropane (DBCP)	0.0002 mg/l
o-Dichlorobenzene	0.6 mg/l
cis-1,2-Dichloroethylene	0.07 mg/l
trans-1,2-Dichloroethylene	0.1 mg/l
1,2-Dichloropropane	0.005 mg/l
2,3-D	0.07 mg/l
Epichlorohydrin	Treatment technique
Ethylbenzene	0.7 mg/l
Ethylene dibromide (EDB)	0.00005 mg/l
Heptachlor	0.0004 mg/l
Heptachlor epoxide	0.0002 mg/l
Lindane	0.0002 mg/l
Methoxychlor	0.4 mg/l
Monochlorobenzene	0.1 mg/l
Polychlorinated biphenyls (PCBs) (as decachlorobiphenyl)	0.0005 mg/l
Pentachlorophenol	0.2 mg/l
Styrene	0.005 mg/l/0.1 mg/l[2]
Tetrachloroethylene	0.0005 mg/l
Toluene	2 mg/l
Toxaphene	0.005 mg/l
2,4,5-TP (Silvex)	0.05 mg/l
Xylenes (total)	10 mg/l

[1] In addition, MCL for total nitrate and nitrite = 10.0 mg/l (as N).
[2] EPA proposes MCLs of 0.1 mg/l based on a Group C carcinogen classification and .005 mg/l based on a B_2 classification.

TABLE 2-4
RCRA TOXICITY CHARACTERISTICS
MAXIMUM CONCENTRATION OF CONTAMINANTS
FOR TOXICITY CHARACTERISTIC LEACHING PROCEDURE
(All Concentrations in Parts Per Million)

Arsenic	5.0
Barium	100.0
Benzene	0.5
Cadmium	1.0
Carbon tetrachloride	0.5
Chlordane	0.03
Chlorobenzene	100.0
Chloroform	6.0
Chromium	5.0
o-Cresol	200.0
m-Cresol	200.0
p-Cresol	200.0
Cresol	200.0
2,4-D	10.0
1,4-Diochlorobenzene	7.5
1,2-Dichlorethane	0.5
1.1-Dichloroethylene	0.7
2.4-Dinitrotoluene	0.13
Endrin	0.02
Heptachlor (and its hydroxide)	0.008
Hexachlorobenzene	0.13
Hexachlorobutadiene	0.5
Hexachloroethane	3.0
Lead	5.0
Lindane	0.4
Mercury	0.2
Methoxychlor	10.0
Methyl ethyl ketone	200.0
Nitrobenzene	2.0
Pentachloropheneol	100.0
Pyridine	5.0
Selenium	1.0
Silver	5.0
Tetrachloroethylene	0.7
Toxaphene	0.5
Trichloroethylene	0.5
2,4,5-Trichlorophenol	400.0
2,4,6-Trichlorophenol	2.0
2,4,5-TP Silvex	1.0
Vinyl Chloride	0.2

General response actions which have been developed for the Norton Company Restoration Site are shown in Table 2-5.

2.4 Identify Volumes of Media

The first step in identifying potential remedial technologies is to make an initial determination of areas or volumes of media to which general response actions might be applied. This initial determination is made for each medium of interest on a site. Response actions for areas or volumes of media are often refined after sitewide alternatives have been assembled to take interactions between media into account.

Defining the areas or volumes of media requires judgement and includes consideration of not only acceptable contaminant levels and exposure routes, but also, site conditions and the nature and extent of contamination.

TABLE 2-5
GENERAL RESPONSE ACTIONS

Media	Action
Soil	No Action Institutional Actions Containment Ex-Situ Treatment In-Situ Treatment Off-Site Treatment
Groundwater	No Action Institutional Actions Containment Collection Ex-Situ Treatment In-Situ Treatment Off-Site Treatment

Two media, soil and groundwater, are of concern at the Norton Company Restoration site. The industrial fill area constitutes the volume which must be remediated. The industrial fill has an average depth of 15 feet and a surface area of approximately 190,000 square feet. Therefore the total volume of concern is approximately 2.9 million cubic feet and includes both the soil and interstitial groundwater.

Assuming an average depth to water of five feet and a soil porosity of 25%, an estimate of the groundwater of concern is approximately 3.6 million gallons. The dry soil volume (assuming 25% porosity) is still approximately 2.9 million cubic feet (106,000 cubic yards) which represents approximately 160,000 tons of dry soil. It should be noted that these numbers are just estimates and the actual figures may vary.

2.5 Identify and Screen Remedial Technologies and Process Options

Based upon the general response actions developed and site characteristics, the remedial technologies shown on Table 2-6 have been developed.

As outlined by the NYSDEC TAGM and the NCP, once remedial technologies have been identified, the next step is to identify and evaluate technology process options to select a representative process for each technology type retained for consideration. At this stage in

TABLE 2-6

REMEDIAL TECHNOLOGY DEVELOPMENT

Media	General Response Action	Remedial Technology
Soil	No Action	None
	Institutional Actions	Access Restrictions Monitoring
	Containment	Cap Surface Controls Landfill Barriers
	Ex-Situ Treatment	Physical/Chemical Treatment Solidification/Stabilization Dewatering Biological Treatment
	In-Situ Treatment	Physical/Chemical Treatment Biological Treatment
	Off-Site Treatment	Physical/Chemical Treatment
Groundwater	No Action	None
	Institutional Action	Access Restrictions Monitoring
	Containment	Cap Barriers
	Collection	Extraction Subsurface Drains
	Ex-Situ Treatment	Physical Treatment/Chemical Treatment Biological Treatment On-Site Discharge
	In-Situ Treatment	Physical/Chemical Treatment Biological Treatment
	Off-Site Treatment	Physical/Chemical Treatment Off-Site Discharge

the development of remedial alternatives, the selected processes are intended to represent the broad range of process options within a general technology type.

After the universe of potentially applicable technology types and process options are identified, the options are evaluated with respect to short-term technical implementability. This is accomplished by using readily available information from the RI site characterization on contaminant types and concentrations and on-site characteristics to screen out technologies and/or processes that could not be effectively implemented.

Process options which have been identified, and the initial screening of technologies and process options are summarized for Soil General Response Actions and Groundwater General Response Actions in Table 2-7 and Table 2-8, respectively. Technologies or process options which were screened out on the basis of the screening comments are shaded in the tables.

The remedial technologies surviving this initial screening for each environmental medium are discussed in Appendix A. Several technologies apply to remediation of both soils and groundwater, in which case, the discussion is not repeated.

TABLE 2-7

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS

Soil General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
A No Action	None	Not Applicable	No action.	Required for consideration by NCP.
B Institutional Actions	Access Restrictions	Deed Restriction	Property deeds in area of influence would include restrictions on wells.	Potentially applicable.
		Fencing	Fencing would limit receptor access to the site.	Potentially applicable.
	Monitoring	Soil Monitoring	Ongoing monitoring of soils.	Potentially applicable.
C Containment	Cap	Clay+Soil	Compacted clay covered with soil over areas of contamination.	Potentially applicable.
		Asphalt	Application of a layer of asphalt over areas of contamination.	Most organics can weaken and permeate this cover type.
		Soil Cement	Installation of a concrete slab over areas of contamination.	Potentially applicable.
		Multi-Media	Clay and synthetic membrane covered by soil over contaminated areas.	Potentially applicable.
		Synthetic Membrane	Placement of a synthetic membrane and soil over contaminated areas.	Potentially applicable.
	Surface Controls	Diversion Ditch	Excavated channels used to intercept and divert runoff.	Potentially applicable.
		Grading	Used to reshape surface to minimize infiltration, erosion and ponding.	Potentially applicable.
	Landfill	Onsite Vault	On-site containment of material using an impermeable barrier.	Potentially applicable.
		Onsite Underground	On-site storage of material after treatment.	Potentially applicable.
		Offsite Landfill	Transport contaminated soils to appropriate landfill.	Potentially applicable.
	Barriers	Grout Curtain	Pressure injection of grout in a regular pattern of drilled holes.	Objects such as concrete blocks will pose problems.
		Slurry Wall	Trench around contaminated areas filled with a soil bentonite slurry.	Potentially applicable.
		Vibrating Beam	Advance beams into the soil and inject slurry as beam is withdrawn.	Objects such as concrete blocks will pose problems.
		Horizontal Barriers	Involves variations of grouting or other construction support methods.	Not applicable. Shallow bedrock exists at site.

Technologies that are screened out

TABLE 2-7 (cont'd)

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS

Soil General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
D Ex-situ Treatment	Physical/Chemical Treatment	Incineration	Combustion in an appropriate incinerator.	Potentially applicable.
		Aeration	Expose soil to air. Results in volatilization and oxidation.	Potentially applicable.
		Immobilization	Methods designed to render contaminants insoluble.	Reliability and effectiveness not demonstrated.
	Solidification/ Stabilization	Pozzolanic Agent	Waste is mixed with portland cement.	Organics interfere with cement's set.
		Encapsulation	Large particles are encapsulated using a secure barrier.	Potentially applicable.
	Dewatering	Belt Filter Press	Waste is placed on a fabric filter belt and compressed.	Site debris would make implementation difficult.
		Drying Beds	Waste is spread out and moisture is allowed to runoff and/or evaporate.	Potentially applicable.
	Biological Treatment	Composting	Degradation of organics using micro-organisms in an aerobic environment.	High concentrations of inorganics pose problems.
		Activated Sludge	Degradation of organics in an anaerobic environment.	High concentrations of inorganics pose problems.
E In-situ Treatment	Physical/Chemical Treatment	Water/Solvent Leaching	Sorbed contaminants mobilized into solution by use of an extractant.	Not feasible. Too many organic compounds.
		Soil Venting	Collection of organic vapors.	Potentially applicable.
		Hydrolysis	Cleavage of organic molecules by pH adjustment.	Not feasible due to high inorganic levels.
		Oxidation	Redox reactions are used to alter oxidation state of compounds.	Largely conceptual for in-situ treatment.
		Vitrification	Pass an electric current between electrodes sunk into the ground.	Potentially applicable.
	Biological Treatment	Cultured Microbes	Degradation of organics using microorganisms.	High concentrations of inorganics pose problems.
F Offsite Treatment	Physical/Chemical Treatment	Incineration	Combustion in an appropriate incinerator.	Potentially applicable.
		Disposal	Transportation of waste to either a landfill or TSDF.	Potentially applicable.

TABLE 2-8

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS

Groundwater General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
A No Action	None	Not Applicable	No action.	Required for consideration by NCP.
B Institutional Actions	Access Restrictions	Deed Restriction	Deeds in the area of influence would include restrictions on wells.	Potentially applicable.
		Fencing	Fencing would limit receptor access to the site.	Potentially applicable.
	Monitoring	Groundwater Monitoring	Ongoing monitoring of wells.	Potentially applicable.
C Containment	Cap	Clay+Soil	Compacted clay covered with soil over areas of contamination.	Potentially applicable.
		Asphalt	Application of a layer of asphalt over areas of contamination.	Most organics can weaken and permeate this cover type.
		Soil Cement	Installation of a soil cement slab over areas of contamination.	Potentially applicable.
		Multi-Media	Clay and synthetic membrane covered by soil over contaminated areas.	Potentially applicable.
		Synthetic Membrane	Synthetic membrane covered by soil over contaminated areas.	Potentially applicable.
	Barriers	Slurry Wall	Trench around areas of contamination is filled with soil bentonite slurry.	Potentially applicable.
		Grout Curtain	Pressure injection of grout in a regular pattern of drilled holes.	Objects such as concrete blocks will pose problems.
		Vibrating Beam	Advance beams into the soil and inject slurry as beam is withdrawn.	Objects such as concrete blocks will pose problems.
		Horizontal Barriers	Variations of grouting or other construction support techniques.	Not applicable. Shallow bedrock exists at site.
D Collection	Extraction	Extraction Wells	Series of wells to extract contaminated groundwater.	Potentially applicable.
		Extraction/ Injection Wells	Injection wells inject water to increase flow to extraction wells.	Potentially applicable.
	Subsurface Drains	Interceptor Trenches	Trenches filled with porous media to collect contaminated water.	Potentially applicable.

Technologies that are screened out

TABLE 2-8 (cont'd)

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS

Groundwater General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
E Ex-situ Treatment	Physical/Chemical Treatment	Air Stripping	Mix large volumes of air with water to promote transfer of VOCs to air.	Potentially applicable.
		Steam Stripping	Mix large volumes of steam with water to promote transfer of VOCs to steam.	Potentially applicable.
		Carbon Adsorption	Adsorption of contaminants onto activated carbon.	Potentially applicable.
		Solvent Extraction	Separate liquids by mixing water with an extractant solvent.	Not feasible. Too many organic compounds.
		Oxidation	Oxidation reactions are used to decompose, or solubilize organics.	Potentially applicable.
		Reverse Osmosis	Use of high pressure to force water through a resin membrane.	Contaminant concentrations too low for this treatment.
		Ion Exchange	Contaminated water is passed through a resin bed and ions are exchanged.	Not feasible due to high levels of inorganics.
		Filtration	Used to remove suspended solids. Provides no treatment of waste.	Not applicable.
		Gravity Separation	Use of gravity for density stratification of liquids.	Not effective for removal of organics.
		Incineration	Combustion in an appropriate incinerator type.	Potentially applicable.
	Biological Treatment	Aerobic	Degradation of organics using micro-organisms in an aerobic environment.	Not feasible due to high levels of inorganics.
		Anaerobic	Degradation of organics in an anaerobic environment.	Not feasible due to high levels of inorganics.
	Onsite Discharge	Spray Irrigation	Aerated water sprayed over site to enhance biodegradation.	Potentially applicable.
		Overland Flow	Extracted water aerated and discharged onto the ground.	Potentially applicable.
F In-situ Treatment	Physical/Chemical Treatment	Immobilization	Methods designed to render contaminants insoluble.	Reliability and effectiveness not demonstrated.
		Oxidation	Redox reactions are used to alter oxidation state of compounds.	Largely conceptual for in-situ treatment.
		Solvent Flushing	Separate liquids by mixing groundwater with an extractant.	Not feasible. Too many organic compounds.
	Biological Treatment	Aerobic	Degradation of organics using micro-organisms in an aerobic environment.	Not feasible due to high levels of inorganics.
		Anaerobic	Degradation of organics in an anaerobic environment.	Not feasible due to high levels of inorganics.

TABLE 2-8 (cont'd)

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS

Groundwater General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
G Offsite Treatment	Physical/Chemical Treatment	RCRA Facility	Extracted groundwater discharged to licensed facility for treatment.	Potentially applicable.
	Offsite Discharge	Deep Well Injection	Extracted water discharged to deep well injection system.	Deep aquifer not suitable for injection of contaminants.
		POTW	Extracted water discharged to POTW.	Potentially applicable.

2.5.1 Evaluate Process Options

In the next step of alternative development, the technology processes considered to be implementable are evaluated in greater detail before selecting one process to represent each technology type. One representative process is selected if possible, for each technology type to simplify the subsequent development and evaluation of alternatives without limiting flexibility during remedial design. In some cases more than one process option may be selected for a technology type. This is done if two or more processes are sufficiently different in their performance or impact that one would not adequately represent the other.

Process options are evaluated using the same criteria that will be applied to alternatives during screening and detailed analysis: effectiveness, implementability, and cost.

2.5.1.1 Effectiveness Evaluation of Process Options

Specific technology processes that have been identified are evaluated further on their effectiveness in protecting human health and the environment and in satisfying one or more of the general response actions defined for each medium or operable unit. Each process option is evaluated relative to other processes within the same

technology types to preserve the variety of technologies needed to develop a range of alternatives. The following considerations are included in this evaluation:

- Consider the potential effectiveness of process options in handling the estimated areas or volumes of media and meeting the contaminant reduction goals identified in the general response actions, relative to other processes within the same technology type. This evaluation applies primarily to the ability of treatment technologies to reduce contaminant levels in media and of containment technologies to reduce exposure levels.
- Determine the effectiveness of the process options in protecting human health and the environment during the construction phase. Factors to be considered include dust or emissions during construction, excavation, or on-site treatment and the potential for the release of materials during construction.
- Determine how proven and reliable the process is with respect to the contaminants and conditions at the site.

2.5.1.2 Implementability Evaluation of Process Options

Implementability encompasses both the technical and institutional feasibility of implementing a technology process. Technical implementability is used as an initial screen of technology types and process options to eliminate those that are clearly ineffective or unworkable at a site. Therefore, this subsequent, more detailed evaluation of process options places greater emphasis on the institutional aspects of implementability. This evaluation includes the following:

- The ability to obtain necessary approval from government agencies.
- Compliance to the extent practicable with location - specific and action - specific SCGs.
- Availability of treatment, storage, and disposal services and capacity.
- Availability of necessary equipment and skilled workers to implement the technology.

2.5.1.3 Cost Evaluation of Process Options

Cost plays a relatively minor role in the screening of process options. Relative Capital and Operation & Maintenance Costs are used rather than detailed estimates. At this stage in the process the cost analysis is based on engineering judgement, and each process is evaluated as to whether costs are high, low, or medium relative to other process options in the same technology type. The greatest cost consequences in site remediation are usually associated with the degree to which different general technology types are used. The effect on cost of using different process options within a technology type is usually smaller.

2.5.1.4 Process Option Evaluation Results

The evaluation of process options for soil remediation and groundwater remediation is presented in Tables 2-9 and 2-10, respectively. Process options which were determined to be ineffective or difficult to implement were not considered in alternative development.

TABLE 2-9
TECHNOLOGY SCREENING FOR SOILS REMEDIATION

Technology	Effectiveness	Implementability	Cost
A. No Action	Must be fully evaluated under 40 CFR 300.68. Provides no treatment and does not achieve remedial action goals.	Not acceptable to public or government.	None
B. Institutional Actions			
• Access Restrictions			
- Deed Restrictions	Effectiveness depends on continued future implementation. Does not reduce contamination.	Legal requirements.	Negligible
- Fencing	Effectiveness depends on continued future maintenance. Does not reduce contamination.	Site presently fenced.	Negligible
• Monitoring			
- Soil Monitoring	Useful for documenting conditions. Does not reduce risk by itself.	Alone, not acceptable to public or government.	Low capital Low O & M
C. Containment			
• Cap			
- Clay & Soil	Effective, susceptible to cracking, but has self-healing properties.	Easily implemented. Restrictions on future land use.	Low capital Low maintenance

TABLE 2-9 (cont'd)
TECHNOLOGY SCREENING FOR SOILS REMEDIATION

Technology	Effectiveness	Implementability	Cost
- Soil Cement	Effective, but susceptible to weathering and cracking.	Easily implemented. Restrictions on future land use.	Moderate capital High maintenance
- Multi-Media	Effective, least susceptible to cracking.	Easily implemented. Restrictions on future land use.	Moderate capital Moderate maintenance
- Synthetic Membrane	Effective as long as integrity is maintained. Susceptible to tearing.	Easily implemented. Restrictions on future land use.	Moderate capital Moderate maintenance
• Surface Controls			
- Diversion Ditches	Effective at controlling runoff, but by itself does nothing to reduce contamination.	Easily implemented using conventional technology.	Low capital Low O & M
- Grading	Effective at minimizing infiltration.	Easily implemented using conventional technology.	Low capital Low O & M
• Landfill			
- On-Site Vault	Would require a large excavation. Requires groundwater containment. Air quality during excavation would be a problem.	Difficult to implement. Zoning may be a problem.	High capital Moderate O & M
- On-Site Underground	Requires effective containment system around landfill. Air quality during excavation would be a problem.	Difficult to implement. Requires containment barrier and land ban considerations.	High capital Moderate O & M
- Off-Site Landfill	Effective at remediating site but does not treat soil contamination. Air quality during excavation would be a problem.	Would have to consider land ban implications and Federal, State, and Local transportation regulations.	High capital Low O & M

TABLE 2-9 (cont'd)
TECHNOLOGY SCREENING FOR SOILS REMEDIATION

Technology	Effectiveness	Implementability	Cost
• Barriers			
- Slurry Wall	Effective containment strategy.	Readily implementable using conventional techniques.	Moderate capital Low O & M
D. Ex-Situ Treatment			
• Physical/Chemical Treatment			
- Incineration	Effective destruction process. A variety of process options exist. Ash disposal may be hazardous waste.	Mobile units would require permitting. Transportation to off-site facilities requires compliance with transportation regulations.	High capital Low O & M
- Aeration	Effective. Results in volatilization of VOCs and oxidation of some organics.	Readily implementable. Vapor collection must be considered.	Moderate capital Moderate O & M
• Solidification/ Stabilization			
- Encapsulation	Effectively isolates wastes from leaching solutions.	May be difficult to implement due to nature of site materials.	High capital Moderate O & M
• Dewatering			
- Drying Beds	Effectively dewaters soils but provides no treatment. Used in conjunction with other technologies.	Readily implementable. Leachate collection would be necessary.	Moderate capital Moderate O & M

TABLE 2-9 (cont'd)
TECHNOLOGY SCREENING FOR SOILS REMEDIATION

Technology	Effectiveness	Implementability	Cost
E. In-Situ Treatment			
• Physical/Chemical Treatment			
- Soil Venting	Effective for volatile organics.	Readily implementable.	Moderate capital Low O & M
- Vitrification	Effective but costly and so has been restricted to radioactive or very highly toxic wastes.	Difficult to implement due to material, power and equipment required.	High capital High O & M
F. Off-Site Treatment			
• Physical/Chemical Treatment			
- Incineration	Effective. A variety of process options exist. Air quality during excavation and incineration would be a problem.	Would require compliance with transportation regulations and ash disposal considerations.	High capital Low O & M
- Disposal	Effective at remediating site but provides no treatment by itself. Air quality during excavation would be a problem.	Would have to consider land ban implications and Federal, State, and Local transportation regulations.	Moderate capital Low O & M

TABLE 2-10
TECHNOLOGY SCREENING FOR GROUNDWATER REMEDIATION

Technology	Effectiveness	Implementability	Cost
A. No Action	Must be fully evaluated under 40 CFR 300.68. Provides no treatment and does not achieve remedial action goals.	Not acceptable to public or government.	None
B. Institutional Actions			
• Access Restrictions			
- Deed Restriction	Effectiveness depends on continued future implementation. Does not reduce contamination.	Legal requirements.	Negligible
- Fencing	Effectiveness depends on continued future maintenance. Does not reduce contamination.	Site presently fenced.	Negligible
• Monitoring			
- Groundwater Monitoring	Useful for documenting conditions. Does not reduce risk by itself.	Alone, not acceptable to public or government.	Low capital Low O & M
C. Containment			
• Cap			
- Clay & Soil	Effective, susceptible to cracking, but has self-healing properties.	Easily implemented. Restrictions on future land use.	Low capital Low maintenance

TABLE 2-10 (cont'd)
TECHNOLOGY SCREENING FOR GROUNDWATER REMEDIATION

Technology	Effectiveness	Implementability	Cost
- Soil Cement	Effective, but susceptible to weathering and cracking.	Easily implemented. Restrictions on future land use.	Moderate capital High maintenance
- Multi-Media	Effective, least susceptible to cracking.	Easily implemented. Restrictions on future land use.	Moderate capital Moderate maintenance
- Synthetic Membrane	Effective as long as integrity is maintained. Susceptible to tearing.	Easily implemented. Restrictions on future land use.	Moderate capital Moderate maintenance
• Barriers			
- Slurry Wall	Effective containment strategy.	Readily implementable using conventional techniques.	Moderate capital Low O & M
D. Collection			
• Extraction			
- Extraction Wells	Effective in removing contaminants from the aquifer. Treatment or disposal of groundwater is required.	Overburden relatively thin. Suction lift pumps would be required.	Moderate capital Moderate O & M
- Extraction/Injection Wells	Effective in removing contaminants from the aquifer. Treatment or disposal of groundwater is required.	Overburden relatively thin. Suction lift pumps would be required.	Moderate capital Moderate O & M
• Subsurface Drains			
- Interceptor Trenches	Effective for downgradient flow interception.	Readily implementable.	High capital Low O & M

TABLE 2-10 (cont'd)
TECHNOLOGY SCREENING FOR GROUNDWATER REMEDIATION

Technology	Effectiveness	Implementability	Cost
E. Ex-Situ Treatment			
• Physical/Chemical Treatment			
- Air Stripping	Effective for removing volatiles from the groundwater. Can remove up to 80% of the organics present. Off-gas may require treatment.	Well developed technology for groundwater treatment. Packaged units available. Little operator attention required.	Moderate capital High O & M
- Steam Stripping	Considered only when air stripping is inadequate. Will not significantly out-perform air stripping.	Readily implementable.	Moderate capital Moderate O & M
- Carbon Adsorption	Useful as a polishing process after air stripping. Can produce effluent meeting drinking water standards.	Readily implementable. Packaged units available. Carbon usage can be high and costly.	High capital Low O & M
- Oxidation	Used to detoxify organic pollutants. A variety of oxidation schemes exist.	Readily implementable. Some risks associated with chemical handling.	Low capital Low O & M
- Incineration	Effective means of destroying organic compounds. Ash disposal may be hazardous waste. A variety of incineration options exist.	Readily implementable. Permits required for on-site mobile units. Must comply with transportation regulations when transporting to off-site facilities.	High capital Low O & M

TABLE 2-10 (cont'd)
TECHNOLOGY SCREENING FOR GROUNDWATER REMEDIATION

Technology	Effectiveness	Implementability	Cost
• On-Site Discharge			
- Spray Irrigation	An effective means of aerating and discharging water.	Readily implementable. Capture of vapors must be considered.	Low capital Low O & M
- Overland Flow	Effective for volatile organics.	Readily implementable. Capture of vapors must be considered.	Low capital Low O & M
G. Off-Site Treatment			
• Physical/Chemical Treatment			
- RCRA Facility	Effective and reliable treatment. Transportation required.	Would have to transport to the nearest available facility that would accept the groundwater.	High transportation cost
• Off-Site Discharge			
- POTW	Effective and reliable treatment. POTW can accept low levels of contaminants.	Permits required.	Low capital Low O & M

3.0 SCREENING OF REMEDIAL ALTERNATIVES

3.1 Assemble Alternatives

In assembling alternatives, general response actions and the process options chosen to represent the various technology types for each medium are combined to form alternatives for the site as a whole. As discussed in Section 2.1, alternatives are developed that will represent a range of treatment and containment options as follows:

(a) A number of treatment alternatives ranging from one that would eliminate the need for long-term management (including monitoring) at a site to one that would use treatment as a principal element to address the principal threats at the site.

(b) One or more alternatives that involve containment of waste with little or no treatment but provide protection of human health and the environment by preventing potential exposure and/or by reducing the mobility.

(c) A no-action alternative. The no-action alternative may include some minimal actions such as fencing, using institutional controls, or monitoring.

Descriptions are developed for each alternative in Section 3-2. These descriptions are largely qualitative, but are in sufficient depth that the overall concept and fundamental criteria are clear. Some alternatives that are clearly infeasible or inappropriate may be eliminated in the initial screening stage of the FS. Those alternatives that successfully pass this screening process will be evaluated in detail in Section 4.0.

3.2 Description of Alternatives

In this section, technologies that have passed the technology screening process are combined and assembled into alternatives. In accordance with USEPA guidelines, at least one alternative is developed for each of the categories listed in Section 3.1 These alternatives are grouped by category for ease of analysis and are listed below.

3.2.1 Outline of Alternatives

Alternatives that Require No Action.

Alternative 1: No Action

- No action (includes deed restrictions, fencing, and monitoring)

Alternatives that Involve Containment with Little or No Treatment but Protect Public Health and the Environment Primarily by Preventing Potential Exposure or Reducing the Mobility of the Waste.

Alternative 2: Containment

- Slurry wall around contaminated area
- Clay and soil cap over site
- Deed restrictions
- Site restrictions (fencing)
- Monitoring

Treatment Alternatives that Would Eliminate the Need for Long-Term Management of the Site.

Alternative 3: Vitrification (Innovative)

- In-Situ treatment with vitrification
- Deed restrictions
- Site restrictions (fencing)

A Range of Alternatives that Use Treatment as a Primary Element to Address the Principal Threats at the Site.

Alternative 4: Containment with Groundwater Treatment

- Slurry wall around contaminated area
- Clay and soil cap over site
- Soil venting
- Groundwater collection inside slurry wall
- Groundwater treatment
- Deed restrictions
- Site restrictions (fencing)
- Monitoring

Alternative 5: Source Removal

- Complete waste removal
- Waste dewatering
- Incineration (off-site or on-site)
- Disposal of residuals in a RCRA landfill (off-site or on-site)
- Groundwater collection

- Groundwater treatment
- Deed restrictions
- Site restrictions (fencing)
- Monitoring

3.2.2 Detailed Description of Alternatives

Alternative 1: No Action

In the no action alternative, no remedial action would be undertaken. This alternative is included as a baseline against which potential alternatives can be measured. The no action alternative applies to the site as a whole.

This alternative would include deed restrictions which would eliminate the exposure pathways to surface soils and groundwater on-site by precluding development; and fencing would be used to prevent unauthorized site access. Contamination would remain in the soil and there would be no barriers to potential migration of contaminated groundwater.

The site perimeter is currently fenced with a 6-foot high fence. There are two lockable gates which provide access to the area by authorized personnel to inspect and maintain the site. Monitoring of groundwater would be conducted periodically for documentation purposes.

Alternative 2: Containment

A soil/bentonite slurry wall would be constructed around the perimeter of the industrial fill area. The slurry wall would be keyed into the underlying bedrock to ensure that a low permeability barrier is attained. Permeabilities of $1x10^{-7}$cm/sec have been achieved with soil/bentonite slurry walls. The barrier wall would prevent the inflow of groundwater to the fill material; isolate what groundwater is trapped in the fill within the slurry wall, thus preventing migration off-site; and contain any potential leachate which may be generated once the cap is installed.

Prior to installation of the clay and soil cap, fill material would be brought on-site to provide a pre-graded base to receive the clay cap. This is preferable to regrading the site and disturbing the fill material thereby increasing potential exposure. A geofabric material would be set over the fill material, and two feet of low permeability clay ($1x10^{-7}$cm/sec) would be installed. Following proper compaction

of the clay, two feet of soil material suitable for sustaining vegetative growth would be placed over the clay.

Additionally, deed and site restrictions would be undertaken at the site as described in Alternative 1. Site monitoring would consist of periodic groundwater sampling and analysis.

Alternative 3: Vitrification

The in-situ vitrification (ISV) process is a patented process which uses an electric current which is passed between electrodes placed in the ground and converts soil and contaminated materials to a stable glass material. The electric current heats the soil and rocks to approximately 3,000 degrees fahrenheit, which decomposes all organic materials. During the process, metallic and inorganic materials are dissolved into or are encapsulated in the vitrified mass. Gases evolve from the melt or go into solution. Evolved gases, which reach the surface, are collected in a hood and processed in the offgas adsorption system.

A hood 30 feet square provides a cover over the target area of soil. Four molybdenum -carbon electrodes on a 20 foot square pass down through seals in the

hood to contact and penetrate the soil to a depth as desired. When the electric current ceases, the molten volume cools and solidifies. After melting in one location, the offgas system and power supply (but not the electrodes) are moved to the next 20 foot square area, and the process is repeated from the beginning. A number of field tests have been completed including four large-scale tests where up to 500 tons have been vitrified in a single test. This is equivalent to a block 15 by 15 feet and 30 feet deep. Such a block would take approximately 80 hours to vitrify, depending on soil moisture, and electrode spacing.

As a result, it is claimed that in-situ vitrification can be used on most soils, including those saturated with water. The effect of water is to increase the cost of processing by virtue of its heat of vaporization.

In addition to vitrification, Alternative 3 also includes deed restrictions and site restrictions and monitoring, as described in Alternative 1.

Alternative 4: Containment with Groundwater Treatment

Alternative 4 is Alternative 2 with the addition of groundwater collection and treatment and soil venting.

Groundwater inside the slurry wall would be collected using interceptor trenches and subsequently treated. The extracted water would either be conveyed to the Albany County POTW for treatment or treated on-site.

Soil venting would be accomplished by placing a 12 inch layer of coarse gravel on top of the emplaced fill material, prior to installation of the cap. A system of perforated piping, usually PVC, would be used to collect any organic vapors which would either be vented to the atmosphere or to an offgas treatment system. Alternatively the piping system may be connected to several exhaust blowers which would enhance vapor recovery by imposing a negative pressure on the collection layer (i.e., vacuum extraction).

Alternative 5: Source Removal

This alternative is designed to mitigate chemical release by the excavation and subsequent incineration of the industrial fill material.

Dewatering facilities or procedures would be utilized prior to, and during the excavation because of the high groundwater levels in the water table aquifer.

Vacuum extraction of VOCs may be implemented prior to excavation if warranted by potential emission considerations. Borrow material will be needed to backfill the site on completion of all industrial fill material excavation activities. Incineration residuals would be disposed of in a RCRA landfill. Careful consideration of land disposal prohibitions under 40 CFR 268 would be required.

Groundwater in the water table aquifer would need to be pumped and treated. This treatment could consist of air stripping utilizing a package plant. Carbon adsorption would be used as a polishing step for the groundwater. Alternatively, it may be possible to convey the groundwater to the Albany County POTW through the sewer system and have it treated by the POTW.

Deed and site restrictions, as well as site monitoring would be undertaken as described in Alternative 1.

On-site incineration could be carried out instead of off-site incineration utilizing a mobile incinerator. In New York State, the mobile incinerator could be subject to a siting and permitting process similar to that encountered when attempting to site and permit a permanent incineration facility. Due to this process, lengthy delays of the site remediation would be encountered and due to the residential area east of the site the use of a mobile incinerator on-site may not be approved.

On-site disposal of residuals would require the construction of a RCRA landfill. To construct a RCRA landfill, fill material would be excavated from a predetermined perimeter starting point and extend down to bedrock. A two foot layer of clay having a permeability of not greater than $1x10^{-7}$cm/sec would be installed followed by a double synthetic liner conforming to RCRA standards which is then covered with a one foot layer of porous material to comprise the leachate collection system. Fill material previously excavated would be placed back into the portion of the landfill ready to receive soil and backfilled in six inch lifts.

The process of constructing the landfill would then proceed in sequence, extending across the industrial fill area. Side slopes of the portion of the landfill both above and below grade would be 3:1. Once all material is landfilled, a two foot clay layer with a permeability of not greater than $1x10^{-7}$cm/sec would be installed followed by a synthetic membrane, a one foot drainage layer, and a two foot layer of soil to support vegetation.

The permitting process could have to be followed for an on-site landfill approval just as the permitting process would have to be followed for on-site incineration. Disposal at an existing landfill is preferable to constructing an on-site landfill due to permitting and financial considerations. Transportation costs of hazard however, and transportation regulations would have to be adhered to.

3.3 Preliminary Screening Evaluation

3.3.1 Effectiveness Evaluation

In the initial screening process each alternative is evaluated against two categories; environmental effectiveness, and implementability. In the first category, a general assessment is given of the effectiveness of each alternative in protecting human health and the environment. Each alternative is evaluated as to the extent to which it will eliminate significant threats to public health and the environment through reductions in toxicity, mobility and volume of the hazardous wastes at the site. Both the short-term and long-term effectiveness is evaluated; short-term referring to the construction and implementation period, and long-term referring to the period after the remedial action is in place and effective. Tables 1-1, 2-1, 3-1, 4-1 and 5-1 of Appendix B are used in evaluating the effectiveness of each alternative in protecting human health and the environment.

3.3.2 Implementability Evaluation

In the second category, implementability, both the technical and administrative feasibility of constructing, operating, and maintaining a remedial action alternative

is evaluated. Technical feasibility refers to the ability to construct, reliably operate and meet technical specifications or criteria, and the availability of specific equipment and technical specialists to operate necessary process units. It also includes operation, maintenance, replacement, and monitoring of technical components of an alternative, if required, into the future after the remedial action is complete. Administrative feasibility refers to compliance with applicable rules, regulations and statutes and the ability to obtain approvals from other offices and agencies, the availability of treatment, storage, and disposal services and capacity.

Implementability of each remedial alternative is evaluated using Tables 1-2, 2-2, 3-2, 4-2 and 5-2 of Appendix B.

3.4 Summary of Screening

Results of the effectiveness and implementability screening of remedial alternatives are summarized in Table 3-1. As can be seen from the screening results, all five remedial alternatives passed the initial screening effort. Therefore, all the remedial alternatives will be subjected to a detailed analysis in Section 4.0.

TABLE 3-1

RESULTS OF THE EFFECTIVENESS AND IMPLEMENTABILITY SCREENING

Alternative	Short-Term/Long-Term Effectiveness* Score (Maximum Score = 25)	Implementability** Score (Maximum Score = 15)
1: No Action	14	12
2: Containment	15	14
3: Vitrification	25	8
4: Containment with Groundwater Treatment	22	15
5: Source Removal	18	11

* A score of ≥ 10 is acceptable
** A score of ≥ 8 is acceptable

4.0 DETAILED ANALYSIS OF ALTERNATIVES

4.1 Introduction

As outlined in the NYSDEC Technical and Administrative Guidance Memorandum (TAGM) for the Selection of Remedial Actions at Inactive Hazardous Waste Sites, the detailed analysis of alternatives is the analysis and presentation of the relevant information needed to allow decision-makers to select a site remedy. During the detailed analysis, each alternative is assessed against seven evaluation criteria which are described in Section 4.3.

The specific requirements of remedial alternatives that must be addressed in the Feasibility Study (FS) report are listed below:

- Be protective of human health and the environment;
- Attain to the extent practicable the SCGs or explain why compliance with SCGs was not needed to protect public health and the environment;
- Satisfy the preference for treatment that significantly and permanently reduces toxicity, mobility, or volume of hazardous wastes as a principal element; and
- Be cost-effective.

4.2 Description of Alternatives

The five remedial alternatives which are subjected to a detailed analysis are summarized in Table 4-1. These alternatives are discussed below.

4.2.1 Alternative #1: No Action

Alternative #1 is the No Action alternative. While no treatment effort would be made under this alternative, deed restrictions, access restrictions, and monitoring would take place. Deed restrictions would include clauses which would prevent the installation of domestic or industrial groundwater wells on the site for any other reason than groundwater monitoring. Additionally, no soil excavation or other surface disturbances would be allowed in the future.

Site restrictions include an existing six foot high fence which surrounds the site. This fence has two locked gates. Unauthorized personnel would not be allowed on-site for any reason. The integrity of the site fencing would be maintained indefinitely.

Monitoring of groundwater wells would consist of periodic (twice a year) CLP monitoring of a maximum of 21 monitoring wells. Every five years this monitoring

TABLE 4-1
REMEDIAL ALTERNATIVES

Alternative #	Alternative Name	Description
1	No Action	No remedial action. Deed and site restrictions, monitoring.
2	Containment	Slurry wall, clay and soil cap, deed and site restrictions, monitoring.
3	Vitrification	In-situ vitrification, deed and site restrictions.
4	Containment with Groundwater Treatment	Slurry wall, clay and soil cap, soil venting, groundwater collection and treatment, deed and site restrictions, monitoring.
5	Source Removal	Source removal, dewatering, incineration, landfill disposal of residuals, groundwater collection and treatment, deed and site restrictions, monitoring.

schedule would be re-evaluated to determine if sampling frequencies are adequate.

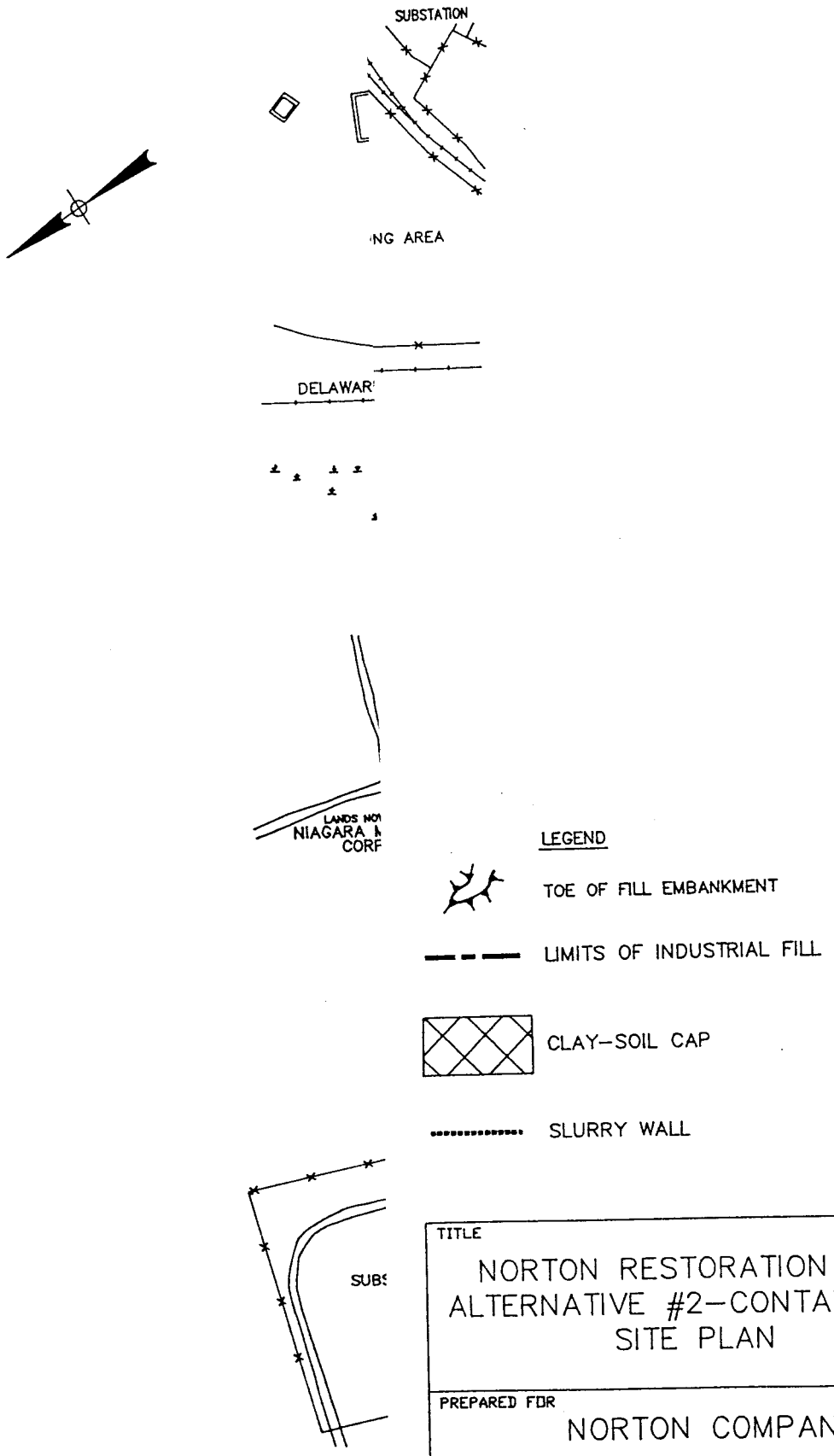
4.2.2 Alternative #2 - Containment

Alternative #2 consists of the following:

- Slurry Wall
- Clay and soil cap
- Deed restrictions
- Site restrictions (fencing)
- Monitoring

Installation of a slurry wall would consist of a soil-bentonite slurry wall which totally encircles the industrial fill area. This slurry wall would be keyed into the bedrock, having an average depth of 15 feet, a width of 3 feet, and total length of approximately 2,000 feet. A site plan which depicts the location of the slurry wall is presented in Figure 4-1.

The area within the confines of the slurry wall would be capped with a clay and



TITLE

NORTON RESTORATION SITE
ALTERNATIVE #2–CONTAINMENT
SITE PLAN

PREPARED FOR

NORTON COMPANY

ERM-Northeast
Environmental Resources Management

SCALE	FIGURE
GRAPHIC	4–1
DATE 9/19/90	

soil cap. The surface area capped would be approximately 190,000 square feet (4.4 acres). Construction of the cap would entail placing a layer of gravel fill on the surface to be capped, rather than grading and disturbance of the existing surface. A geofabric material would be set over the fill material, and two feet of low permeability clay ($1x10^{-7}$cm/sec) would be installed. The clay would be keyed into the slurry wall. Following compaction of the clay, two feet of soil material suitable for sustaining vegetative growth would be placed over the clay.

Deed restrictions would be imposed to prevent any future domestic or industrial groundwater well installation or other overall site disturbance from occurring. Additionally, site restrictions would be achieved through the use of the existing site perimeter fencing. This fencing has two locked gates and is six feet in height.

Site monitoring would consist of groundwater sampling and analysis carried out twice a year. This sampling scheme and the chosen alternative would be re-evaluated based on a time frame set by the NYSDEC to determine if these were adequate.

4.2.3 Alternative #3: Vitrification

Alternative #3 entails:

- In-situ treatment with vitrification
- Deed restrictions
- Site restrictions (fencing)
- Monitoring

In-Situ Vitrification (ISV) would be applied to the entire industrial fill area. This area consists of 190,000 square feet (4.36 acres) and is illustrated in Figure 4-2. The entire thickness of overburden (average of 15 feet) would be vitrified. The ISV process itself is described in detail in Section 3.2.2, where an initial description of Alternative #3 is presented.

A discussion on Deed and Site restrictions, as well as monitoring can be found in Section 4.2.1.

4.2.4 Alternative #4: Containment with Groundwater Treatment

Alternative #4 consists of the following:

LEGEND

TOE OF FILL EMBANKMENT

LIMITS OF INDUSTRIAL FILL

AREA OF IN-SITU VITRIFICATION

TITLE

NORTON RESTORATION SITE
ALTERNATIVE #3-VITRIFICATION
SITE PLAN

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Environmental Resources Management

SCALE	DATE	FIGURE
GRAPHIC	9/19/90	4-2

- Soil-bentonite slurry wall encircling the industrial fill
- Soil venting system under the clay and soil cap
- Groundwater collection system inside slurry wall
- Clay and soil cap over the industrial fill
- Groundwater handling and/or treatment system
- Deed restrictions
- Site restrictions (fencing)
- Monitoring

In Alternative #4, a soil - bentonite slurry wall would be installed encircling the industrial fill. This slurry wall would have a width of approximately 3 feet and a total length of approximately 2,000 feet. The slurry wall would be keyed into bedrock at an average depth of 15 feet.

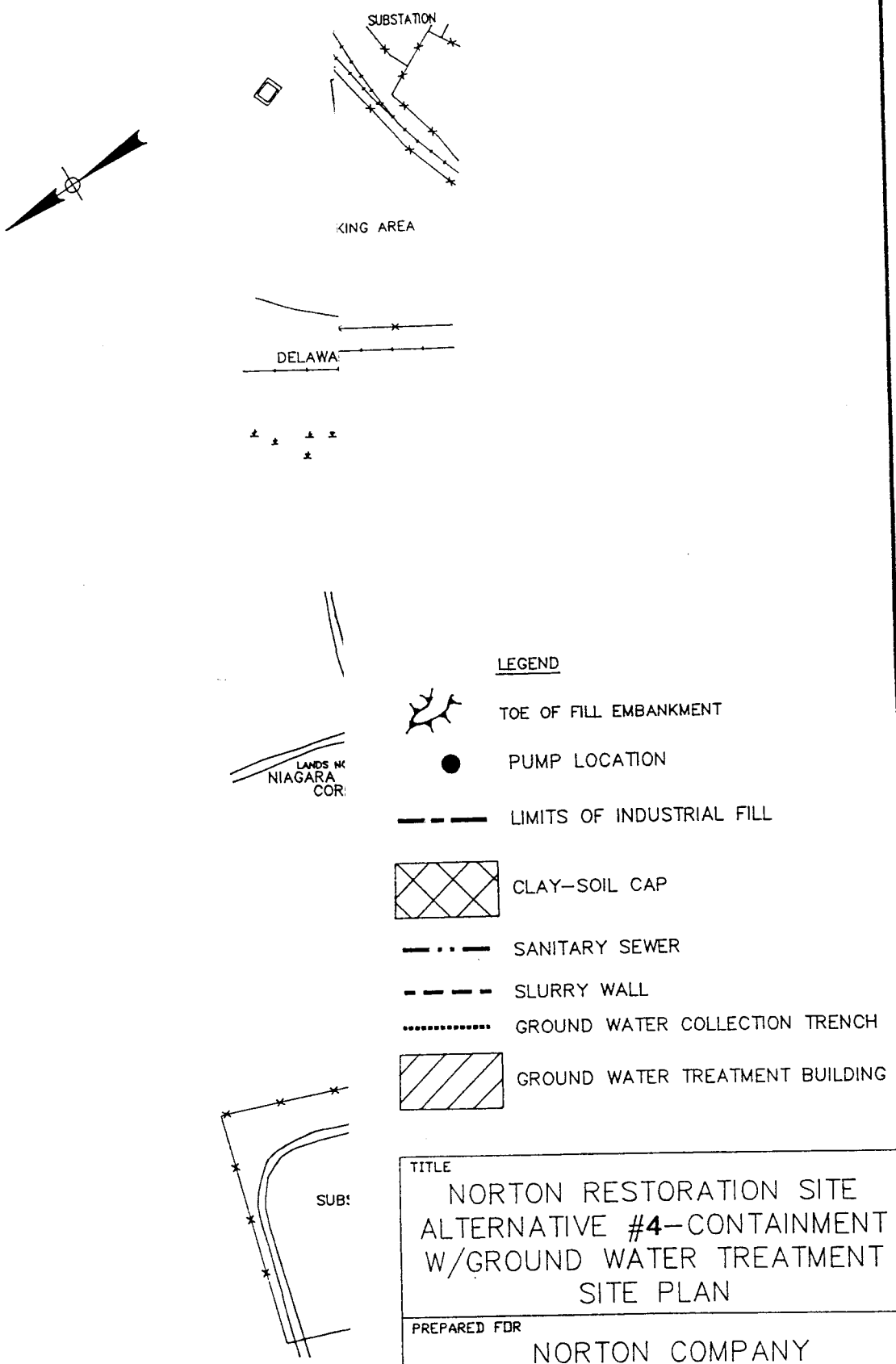
A groundwater collection system and soil venting system would be installed. Groundwater within the confines of the slurry wall would be collected through the use of a subsurface drain system. Installation of the subsurface drain would consist of 700 linear feet of a bio-polymer slurry trench and 700 linear feet of piping. Bio-polymer slurry trenches are a relatively new method for installation of subsurface drains. Fill material excavated during installation of the subsurface drain would be placed on the industrial fill area during construction. Minimal to no air emissions

would be expected during construction. The bio-polymer slurry trench would penetrate the entire overburden thickness, being an average of 15 feet in depth. The resultant subsurface drain would trend through the central portion of the industrial fill.

The venting system would consist of 2,000 feet of PVC piping installed at the ground surface and overlain by a gravel layer which will serve as a pre-graded base for the cap. The soil venting piping would be connected to centrifugal blowers, which would maintain a negative pressure within the gravel layer. Collected off-gases would be scrubbed to remove VOCs.

Once the soil venting system and groundwater collection system are in place the area within the confines of the slurry wall would be capped with a clay and soil cap. The surface area capped would be 190,000 square feet (4.4 acres). A geofabric material would be placed over the gravel fill and two feet of low permeability clay ($1x10^{-7}$cm/sec) would be installed. Following compaction of the clay, two feet of soil material suitable for sustaining vegetative growth would be placed over the clay.

The subsurface drain location, slurry wall, and the clay and soil cap are depicted in Figure 4-3.



TITLE

NORTON RESTORATION SITE
ALTERNATIVE #4-CONTAINMENT
W/GROUND WATER TREATMENT
SITE PLAN

PREPARED FOR

NORTON COMPANY

ERM-Northeast
Environmental Resources Management

SCALE	FIGURE
GRAPHIC	4-3
DATE 9/19/90	

Collected groundwater would be treated by an on-site treatment plant. The plant may consist of a air stripping unit for removal of VOCs. The stripping tower effluent would be passed through a carbon adsorption column for polishing. Design of the treatment plant will be based on full scale pilot tests during final design activities. The final effluent would be either discharged into the sewer system depending on approval or disapproval of discharge permits by the Albany County POTW or discharged based on appropriate permits to on-site existing drainage features. It is possible that the Albany County POTW will accept partially treated or untreated groundwater. Cost estimates of Alternative #4 assume worst conditions (i.e., complete groundwater treatment).

A discussion on Deed and Site restrictions, as well as monitoring can be found in 4.2.1.

4.2.5 Alternative #5: Source Removal

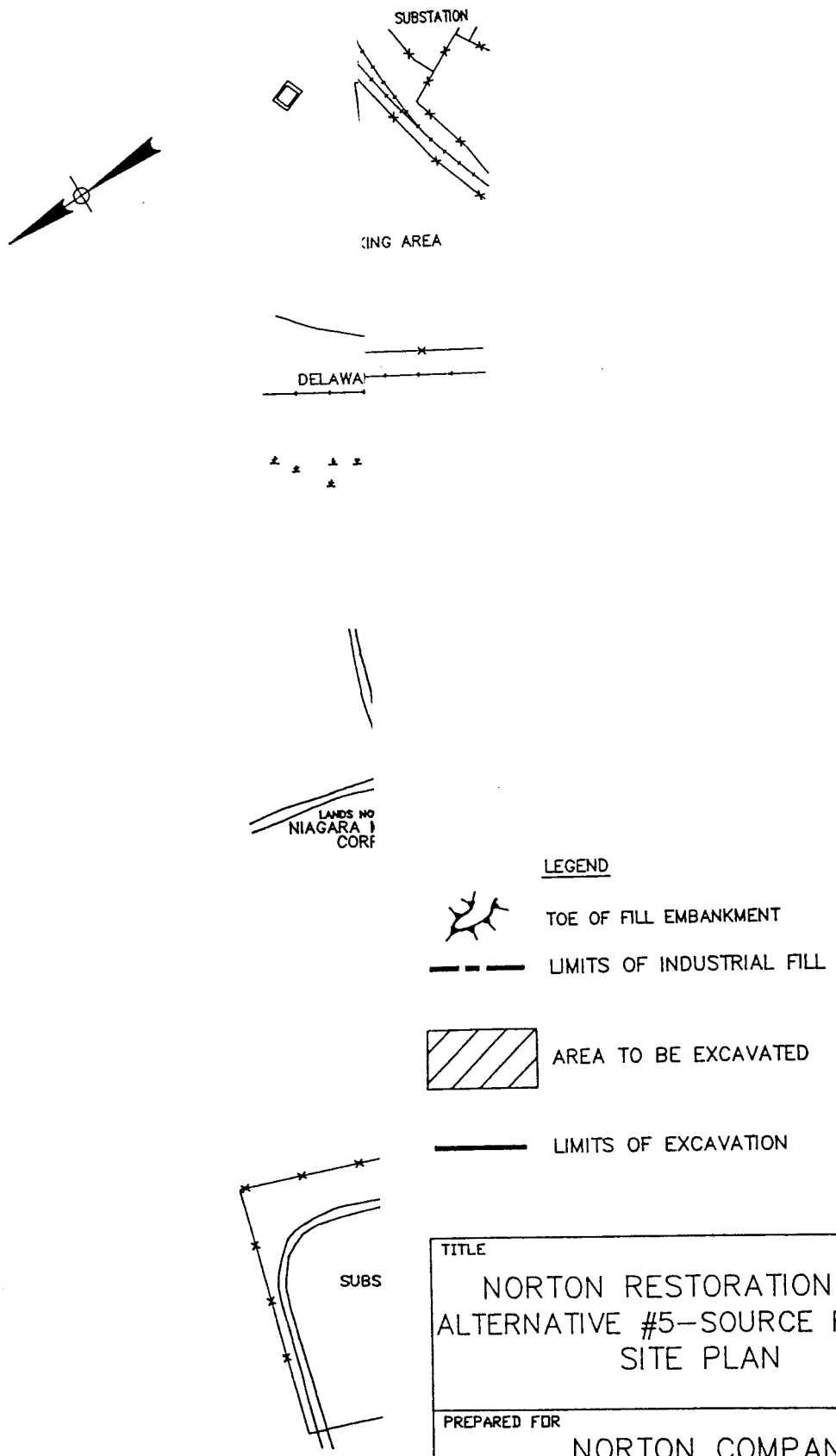
Alternative #5 consists of the following:

- Complete waste removal
- Waste dewatering

- Incineration (off-site)
- Disposal at a RCRA Facility (off-site)
- Groundwater Collection
- Groundwater Treatment
- Deed Restrictions
- Site Restrictions (fencing)
- Monitoring

In Alternative #5, the soils of the industrial fill area would be totally excavated (i.e., excavated to bedrock). The volume of industrial fill is 110,000 cubic yards. Subsequent to excavation, the soils would be dewatered. The area to be excavated, as well as the limits of excavation are depicted in Figure 4-4.

Dewatering facilities would be provided prior to, and during the excavation because of the high groundwater levels in the water table aquifer. Vacuum extraction of VOCs may be implemented prior to excavation if warranted by potential emission considerations. Groundwater in the excavated soils would be allowed to drain off by gravity and would then be collected for treatment. The excavated area would then be backfilled with 51,000 cubic yards of clean fill.



TITLE

NORTON RESTORATION SITE
ALTERNATIVE #5–SOURCE REMOVAL
SITE PLAN

PREPARED FOR

NORTON COMPANY

ERM-Northeast
Environmental Resources Management

SCALE	FIGURE
GRAPHIC	4-4
DATE 9/19/90	

Debris would be screened out of the soils prior to transportation to an incineration facility. This debris is estimated to consist of 22,000 cubic yards, which would be disposed of in an industrial landfill. Subsequent to screening of the soils, the soils would be transported to an incinerator for treatment.

Groundwater collected from the excavated soils would be treated using an air stripper package plant for removal of VOCs. The resultant effluent would then be passed through a carbon adsorption column for polishing. As discussed in Section 4.2.4, it may be possible to discharge partially treated water to the sewer system for final treatment at the Albany County POTW.

A discussion on Deed and Site restrictions, as well as monitoring can be found in Section 4.2.1.

4.3 Evaluation Criteria

Seven evaluation criteria have been developed to address the requirements and considerations listed in Section 4.1. These evaluation criteria serve as the basis for conducting the detailed analysis during the FS and for subsequently selecting an appropriate remedial action. The evaluation criteria are:

- Compliance to the extent practicable with SCGs;
- Overall Protection of Human Health and the Environment;
- Long-term Effectiveness and Permanence;
- Reduction of Toxicity, Mobility, or Volume;
- Short-term Effectiveness;
- Implementability; and
- Cost.

The detailed analysis of alternatives follows the development and preliminary screening of alternatives and precedes the actual selection of a remedy. The results of the detailed analysis serve to document the evaluations of alternatives and provide the basis for selecting a remedy. Evaluation results are summarized in Table 5.1.

The nature and importance of the seven evaluation criteria is discussed below.

4.3.1 Compliance to the extent practicable with SCGs

This evaluation criterion is used to determine how each alternative to the extent practicable complies with applicable or relevant and appropriate New York State and Federal Standards, Criteria and Guidelines (SCGs). There are three general categories of SCGs: chemical, location, and action - specific. With reference to the

remedial alternatives, relevant standards include the Standards and Guidance Values for Groundwater (NYSDEC Water Quality Regulations) and RCRA standards. Many of the RCRA requirements address operating landfill activities and are therefore not applicable to the Norton Company Restoration Site. However, one potentially applicable closure requirement is that the final cover at a hazardous waste landfill must achieve a permeability of less than or equal to the permeability of any bottom liner system or natural subsoils present. The Norton Company Restoration Site does not have a bottom liner and the permeability of the natural subsoils is unknown.

The RCRA groundwater protection standards include maximum concentrations for certain organic and inorganic constituents which are identical to the Maximum Contaminant Levels (MCLs) established for these chemicals under the Safe Drinking Water Act (SDWA). These levels are applied at the specified point of compliance (i.e., edge of the landfill) unless background levels for the particular chemical already exceed the maximum level. For those hazardous constituents detected in the groundwater for which MCLs have not been established, the concentration must not exceed background levels.

Evaluation of compliance to the extent practicable with SCGs is conducted utilizing Tables 1-1, 2-1, 3-1, 4-1 and 5-1 of Appendix C.

According to the NYSDEC TAGM, if an alternative does not meet to the extent practicable the SCGs and waiver of the SCGs is not appropriate or justifiable, such an alternative should not be further considered.

4.3.2 Overall Protection of Human Health and the Environment

This evaluation criterion provides a final check to assess whether each alternative meets the requirements that it is protective of human health and the environment. The overall assessment of protection is based on a composite of factors assessed under other evaluation criteria, especially long-term effectiveness and performance, short-term effectiveness, and compliance to the extent practicable with SCGs.

Evaluation of the overall protectiveness of an alternative is carried out utilizing Tables 1-2, 2-2, 3-2, 4-2 and 5-2 of Appendix C.

4.3.3 Long-Term Effectiveness and Permanence

This evaluation criterion addresses the results of a remedial action in terms of its permanence and quantity/nature of waste or residual remaining at the site after response objectives have been met. The primary focus of this evaluation is the extent

and effectiveness of the controls that may be required to manage the waste or residual remaining at the site and operating system necessary for the remedy to remain effective. The following components of the criterion are addressed:

- Permanence of the remedial alternative;
- Magnitude of remaining risk;
- Adequacy of controls; and
- Reliability of controls.

Evaluation of this criterion is carried out utilizing Tables 1-3, 2-3, 3-3, 4-3 and 5-3 of Appendix C.

4.3.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

This evaluation criterion assesses the remedial alternative's use of treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of the hazardous wastes as their main element. As a matter of NYSDEC policy, it is preferred to use treatment to eliminate any significant threats at a site through destruction of toxic contaminants, reduction of the total mass of contaminants,

irreversible reduction in contaminants mobility, or reduction of the total volume of contaminated media.

Evaluation of this criterion is performed utilizing Tables 1-4, 2-4, 3-4, 4-4 and 5-4 of Appendix C.

4.3.5 Short-Term Effectiveness

This evaluation criterion assesses the effects of the alternative during the construction and implementation phase until remedial response objectives are met. Under this criterion, alternatives should be evaluated with respect to their effects on human health and the environment during implementation of the remedial action. The following factors are addressed for the alternative:

- Protection of the community during remedial actions;
- Environmental impacts;
- Time until remedial response objective are achieved; and
- Protection of workers during remedial actions.

Evaluation of this criterion is conducted using Tables 1-5, 2-5, 3-5, 4-5 and 5-5 of

Appendix C.

4.3.6 Implementability

This evaluation criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation. This criterion involves analysis of the following factors:

- Technical feasibility;
- Administrative feasibility; and
- Availability of services and materials.

Evaluation of implementability is carried out using Tables 1-6, 2-6, 3-6, 4-6 and 5-6 of Appendix C.

4.3.7 Cost

The application of cost estimates to the evaluation of alternatives is discussed in this section. Detailed capital cost estimates for each alternative are contained in Appendix E.

Capital Costs

Capital costs consist of direct (construction) and indirect (non-construction and overhead) costs. Direct costs include expenditures for the equipment, labor and materials necessary to install remedial actions. Indirect costs include expenditures for engineering and other services that are not part of actual installation activities but are required to complete the installation of remedial alternatives.

Operation and Maintenance Costs

Annual costs are post-construction costs necessary to ensure the continued effectiveness of a remedial action. This includes occasional re-evaluation of the site during and after remedial efforts have been taken. While the schedule for re-evaluation of a site during and after remediation is determined on a case by case basis, for the purposes of this study it has been assumed that the site will be re-evaluated every five years (worst case scenario) until completion of the remediation.

Present Worth Analysis

A present worth analysis is used to evaluate expenditures that occur over different time periods by discounting all future costs to a common base year, usually the current year. This allows the cost of remedial action alternatives to be compared on the basis of a single figure representing the amount of money that, if invested in the base year and disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life. For this evaluation a discount interest rate of 10% has been assumed.

Relative weights based on cost are assigned to the alternatives by designating the lowest present worth alternative as a high score of 15. Other alternatives are assigned a cost score which is inversely proportional to their present worth.

4.4 Analysis of Remedial Alternatives

The remedial alternatives were evaluated against the seven criteria described in Section 4.3. These criteria are as follows:

1) Compliance to the extent practicable with SCGs;

2) Overall Protection of Human Health and the Environment;

3) Long-term Effectiveness and Permanence;

4) Reduction of Toxicity, Mobility, or Volume through Treatment;

5) Short-term Effectiveness;

6) Implementability; and

7) Cost.

The alternatives were evaluated against each criterion using the evaluation forms presented in Appendix C. For details of the evaluations against criteria 1 through 6, refer to Appendix C. The details for criterion 7, Costs, are presented in Tables 4-2 through 4-5 in the cost discussions in this section.

In the discussions which follow, each alternative is assessed in reference to the evaluation criteria.

Alternative #1: No Action

Alternative #1 does not meet to the extent practicable any of the appropriate SCGs. In addition, this alternative provides minimal protection of human health and the environment. The unrestricted use of land and water would not be achieved with Alternative 1, and

potential contaminant exposures via groundwater and soils would be unacceptable. Because of this, significant risks would still exist at the site subsequent to implementation of the alternative.

Due to the failure of Alternative #1 to comply with the SCGs and the lack of protection of human health and the environment, Alternative #1 is not acceptable and will not be further evaluated.

Alternative #2: Containment

Alternative #2 complies with two out of three categories of SCGs and scores a 6 (Relative Weight = 10) on the SCG compliance evaluation. This alternative consists of containment only and as such to the extent practicable, groundwater standards will not be met.

This alternative is protective of human health and the environment as evidenced by an evaluation score of 20 (Relative Weight = 20) on this criterion. However, this alternative scored a 4 (Relative Weight = 15) on the long-term effectiveness evaluation. This is because no waste treatment takes place in this scenario. Operation and maintenance, as well as extensive monitoring, would be required indefinitely with this alternative.

Alternative #2 also scored poorly (1) on the reduction of toxicity, mobility or volume evaluation (Relative Weight = 15). The reason for this low score is due to the lack of treatment under this remedial action. As a result, no reduction of toxicity or volume of the waste takes place. This alternative would limit waste mobility however.

In terms of short-term effectiveness, Alternative #2 scores a 10 (Relative Weight = 10). This is due to the fact that this alternative would not result in any significant short-term risks to the community or environment and the time required to implement the alternative would be minimal.

The alternative scored a 14 (Relative Weight = 15) on implementability. Alternative #2 would not be difficult to construct and would be reliable in meeting the specified performance goals. The technologies under consideration are readily available and minimal coordination would be required with agencies.

A present worth analysis based on capital costs and operation and maintenance costs to complete Alternative #2 is presented in Table 4-2. Capital costs consist of installing the slurry wall, placement of the clay - soil cap, deed restrictions and repairs, if required, of the existing fencing. The operation and maintenance costs consists of performing groundwater analyses on the selected monitoring wells at specified intervals; performing normal maintenance on the installed cap and fencing; and re-evaluating the site every five years.

TABLE 4-2
ALTERNATIVE 2 - PRESENT WORTH ANALYSES*

Item	Total Costs
Capital Costs**	$2,000,000
Annual Operation and Maintenance Costs	
- fencing and cap maintenance, groundwater analyses - first 5 years	$ 34,000
- fencing and cap maintenance, groundwater analyses - from year 5 to year 10	$ 19,000
- re-evaluate site - every five years	$ 50,000
Present Worth Cost of Operation and Maintenance Costs	$ 260,000
Present Worth Cost of All Costs	$2,260,000

* Assumed 10 year period of performance and 10% discount rate.

** See Appendix E for detailed capital cost estimate.

Alternative #3: Vitrification

Alternative #3 meets all the appropriate SCGs to the extent practicable and therefore scores a 10 (Relative Weight = 10) on SCG compliance. In terms of the protection of human health and the environment, this alternative scored a 20 (Relative Weight = 20). This scoring reflects the fact that this remedial strategy would significantly reduce exposure risks at the site.

This alternative scores a 14 (Relative Weight = 15) on long-term effectiveness and permanence. This scoring reflects the fact that vitrification results in a permanent site remedy. A minimum degree of long-term monitoring would be required.

Vitrification would result in treatment of almost all hazardous wastes on-site. This treatment is irreversible. Therefore, scoring of Alternative #3 for the reduction of toxicity, mobility or volume is a 15 (Relative Weight = 15).

In terms of short-term effectiveness, vitrification scores a 9 (Relative Weight = 10). Minor short-term risks would be associated with this alternative, however, the risks can be controlled easily.

A drawback of this alternative is it's implementability, on which it scored an 8 (Relative

Weight = 15). This results from the fact that it is difficult to implement and has uncertainties associated with it. Delays due to technical problems would be likely and extensive coordination with agencies would be required. Vitrification is a patented process and as such, only one vendor is available to provide a bid.

A present worth analysis based on capital costs and operation and maintenance costs to complete Alternative #3 is presented in Table 4-3. Capital costs consist of in-situ vitrification, treatment of off gases, deed restrictions and repairs, if required, of the existing fencing. The operation and maintenance costs consist of performing groundwater analyses on the selected monitoring wells at specific intervals, performing normal maintenance on the fencing, and re-evaluating the site in five years.

Alternative #4: Containment with Groundwater Treatment

Alternative #4 complies with all appropriate SCGs to the extent practicable and therefore scores a 10 (Relative Weight = 10) on SCG compliance. It is also protective of human health and the environment, scoring a 20 (Relative Weight = 20) on this evaluation. The containment and treatment of hazardous waste results in contaminant exposures that are acceptable in this scenario.

TABLE 4-3
ALTERNATIVE 3 - PRESENT WORTH ANALYSES*

Item	Total Costs
Capital Costs**	$61,000,000
Annual Operation and Maintenance Costs	
- fencing maintenance and groundwater analyses - five years	$34,000/year
- re-evaluate site - at end of five years	$50,000/5 years
Present Worth Cost of Operation and Maintenance Costs	$ 160,000
Present Worth Cost of All Costs	$61,160,000

* Assumed 5 year period of performance and 10% discount rate.

** See Appendix E for detailed capital cost estimate.

In terms of long-term effectiveness and permanence, Alternative #4 scored a 13 (Relative Weight = 15). This remedial strategy would treat the majority of wastes on-site and this treatment would be classified as permanent. A minimum degree of monitoring would be required as a result of treatment.

On the reduction of toxicity, mobility or volume evaluation, this alternative scored a 13 (Relative Weight = 15). Installation of a slurry wall would reduce mobility of contaminants and treatment would reduce the volume and toxicity of wastes on-site. The treatment of wastes would be irreversible.

Alternative #4 scored a 9 (Relative Weight = 10) on the short-term effectiveness evaluation. No significant short-term risks to the community or the environment would result from implementation of this alternative. The required time to implement the remedy may be greater than two years due to the constraints of weather on construction.

This alternative scored 15 (Relative Weight = 15) on implementability. This score is a result of the fact that the alternative is not difficult to construct and is reliable in meeting performance goals. Minimal coordination with agencies would be required with this alternative. The technologies are commercially available from a variety of vendors so more than one vendor will be available to provide a competitive bid.

A present worth analysis based on capital costs and operation and maintenance costs to complete Alternative #4 is presented in Table 4-4. Capital costs consist of installing the slurry wall, groundwater collection system, groundwater treatment system, clay and soil cap and soil venting system; deed restrictions; and repairs, if required of the existing fencing. The operation and maintenance costs consist of performing groundwater analyses on the selected monitoring wells at specified intervals; performing normal maintenance on the installed cap and fencing; and re-evaluating the site every five years.

Alternative #5: Source Removal

Alternative #5 does not comply to the extent practicable with all appropriate SCGs such as Air Quality Standards because excavation and dewatering of site materials may release VOCs into the nearby residential neighborhood, and therefore scored a 7 (Relative Weight = 10) on the SCG compliance evaluation. This alternative is protective of human health and the environment in a long-term sense however, and scored a 20 (Relative Weight = 20) on this evaluation.

This alternative scored a 15 (Relative Weight = 15) on long-term effectiveness and permanence. This is due to the source removal that constitutes the strategy of this alternative. In terms of the evaluation of the reduction of toxicity, mobility or volume, Alternative #5 scored a 12 (Relative Weight = 15). The alternative consists of off-site

TABLE 4-4
ALTERNATIVE 4 - PRESENT WORTH ANALYSES*

Item	Total Costs
Capital Costs**	$3,700,000
Annual Operation and Maintenance Costs	
- fencing and cap maintenance, groundwater analyses - first 5 years	$ 34,000/year
- fencing and cap maintenance, groundwater analyses - from year 5 to year 10	$ 19,000/year
- re-evaluate site - every five years	$ 50,000/5 years
- groundwater and soil venting system maintenance - first 5 years	$420,000/year
- from 5 years to year 10	reduce each year by $20,000
Present Worth Cost of Operation and Maintenance Costs	$3,490,000
Present Worth Cost of All Costs	$7,190,000

* Assumed 10 year period of performance and 10% discount rate.

** See Appendix E for detailed capital cost estimate.

treatment and disposal, with groundwater treatment carried out on-site. The treatments are irreversible.

Due to the excavation of industrial fill soils, there would be minor short-term risks to the community and environment that would be easily controlled. The required time to implement the alternative, and the duration of the mitigative effort could be greater than two years due to weather constraints. Because of these time factors, Alternative #5 scored an 8 (Relative Weight = 10) on the short-term effectiveness evaluation.

Some uncertainties are associated with this alternative. These uncertainties make delays due to technical problems likely. The alternative would also require extensive coordination with agencies. Alternative #5 scored an 11 (Relative Weight = 15) on implementability for these reasons.

A present worth analysis based on capital costs and operation and maintenance costs to complete Alternative #5 is presented in Table 4-5. Capital costs consist of excavation of contaminated soil, incineration of soil, disposal of ash at a RCRA facility, groundwater collection and treatment, deed restrictions and repairs, if required, of the existing fencing. The operation and maintenance costs consist of performing groundwater analyses on the selected monitoring wells at specific intervals, performing normal maintenance on the fencing, and re-evaluating the site in five years.

TABLE 4-5
ALTERNATIVE 5 - PRESENT WORTH ANALYSES*

Item	Total Costs
Capital Costs	$71,525,000
Annual Operation and Maintenance Costs	
- fencing maintenance and groundwater analyses - five years	$ 34,000/year
- re-evaluate site - at end of five years	$ 50,000/5 years
Present Worth cost of Operation and Maintenance Costs	$ 160,000
Present Worth cost of All Costs	$ 71,685,000

* Assumed 5 year period of performance and 10% discount rate.

4.5 Risk Assessment

This section contains a summary of a risk assessment conducted for the five remedial alternatives which were developed for the Norton Company Restoration Site. Details of the risk assessment can be found in Appendix D "Evaluation of Remedial Alternatives - Human Health and the Environment".

This assessment is an elaboration of the short-term effectiveness and overall protection of human health and the environment evaluations briefly discussed in Sections 4-3 and 4-4.

4.5.1 Alternative #1 - No Action

4.5.1.1 Impacts to Human Health and the Environment During Remediation

Since no remedial action will be taken at the site there will be no impacts to human health and the environment.

4.5.1.2 Impacts to Human Health and the Environment Following Remediation

Under the No Action Alternative, nearby residents could potentially be exposed to site contaminants by the following pathways: 1) inhalation of volatilized organics from site soils; 2) inhalation of fugitive dust emissions from site soils; 3) direct contact with off-site surface water and sediments; and 4) consumption of ground water from a hypothetical future down-gradient water supply well. Hypothetical future construction workers at the site could potentially be exposed to site contamination via direct contact with soils and inhalation of volatilized organics and fugitive dusts from soils. These potential exposure routes were quantitatively evaluated.

Based on available data, the above exposure routes do not result in unacceptable exposures to either nearby residents or future site construction workers. However, as described in Section 1.5.3.6 of the main body of this report, ground water within the industrial fill area could not be sampled due to the presence of a highly viscous product which solidified and subsequently blocked monitoring well MW-1. Therefore, it is conservatively assumed that exposures via ground water and air (due to potential volatilization of contaminants in ground water) may not be acceptable under the No Action Alternative.

No adverse effects to sensitive environmental resources are expected to occur under the No Action Alternative as a result of site contamination based on a review of location-specific SCGs (freshwater wetlands, regulated streams, navigable water bodies, and significant habitats/endangered and threatened species) and an evaluation of surface water and sediment quality data. However, because the residual soil contamination could potentially pose some threat to wildlife and aquatic life via direct contact and stormwater runoff, the risk to ecological resources under the No Action Alternative is considered to be slightly greater than acceptable.

Based on this information, the total score for protection of human health and the environment under the No Action Alternative is 8 out of 20.

4.5.2 ALTERNATIVE #2 - CONTAINMENT

4.5.2.1 Impacts to Human Health and the Environment During Remediation

Short-term exposures to the residential community and environmental resources during remediation under Alternative #2 are expected to be acceptable. Soil excavation would be required to install the slurry wall, which would be likely to result in short-term generation of fugitive dust emissions. However, exposures to off-site

residents are expected to be within acceptable ranges (risk of less than 1×10^{-6}). Impacts to local ecological resources would occur due to the disturbance and loss of habitat resulting from removal of vegetation and soil excavation. However, any adverse impacts are in all likelihood outweighed by the elimination of any further contact with contaminated soil. Although stormwater runoff from the site during excavation could potentially discharge to the adjacent intermittent stream and wetlands, these impacts are not expected to be significant and can, in any event, be mitigated through the use of erosion control devices. The total score for the short-term effectiveness of Alternative #2 with respect to human health and the environment is therefore 10 out of 10.

4.5.2.2 Impacts to Human Health and the Environment Following Remediation

The presence of the cap and slurry wall would effectively eliminate all potential exposure routes to residual contamination. The cap would prevent or significantly minimize fugitive dust emissions and volatilization of contaminants in soil. Direct contact with contaminated soil and generation of contaminated stormwater runoff would also be eliminated by the cap. The slurry wall would prevent any off-site migration of contaminants in ground water and the deed restrictions would prevent

any future use of site ground water. Therefore, this alternative is considered to be fully protective of human health and the environment with a total score of 20 out of 20.

4.5.3 ALTERNATIVE #3 - VITRIFICATION

4.5.3.1 Impacts to Human Health and the Environment During Remediation

No significant adverse impacts to the community or the environment during remediation are expected. The high temperatures and the voltage necessary to reach such high temperatures could represent a risk to illegal trespassers at the site during remediation. However, the presence of fencing and restricted access is expected to eliminate any such risk. Any evolved gases generated during remediation would be trapped and treated to prevent unacceptable inhalation exposures to the community. Impacts to local ecological resources would occur due to the disturbance and loss of habitat resulting from the vitrification process. However, any adverse impacts are in all likelihood outweighed by the elimination of any further contact with contaminated soil. Therefore, this alternative scores 10 out of 10 in terms of short-term effectiveness.

4.5.3.2 Impacts to Human Health and the Environment Following Remediation

The vitrification process will effectively eliminate all potential exposure pathways for human health and the environment. The vitrification process essentially solidifies all soil and contaminated materials into a stable glass-like material, thereby preventing migration of soil and subsequent exposure to these contaminants. The placement of clean fill on the surface would eliminate any direct contact with the treated material. Any gases which evolve are permanently trapped or escape to the surface where they are treated in an off-gas absorption system. Since temperatures reach up to 3000°F, any ground water present in the heated area is volatilized and treated in the off-gas absorption system. Therefore, this alternative scores 20 out of 20 in terms of protection of human health and the environment.

4.5.4 ALTERNATIVE #4 - CONTAINMENT WITH GROUNDWATER TREATMENT

4.5.4.1 Impacts to Human Health and the Environment During Remediation

Short-term exposures to the residential community and the environment during remediation are expected to be acceptable under Alternative #4. Soil excavation

would be required to install the slurry wall and the subsurface drain. The installation of the slurry wall would likely result in short-term generation of fugitive dust emissions. The installation of the subsurface drain would also result in short-term generation of fugitive dust emissions and an increase in volatilization of contaminants from soil. However, the projected exposures to nearby residents are within acceptable limits (risk less than 1×10^{-6}). The soil venting system would be equipped with activated carbon to trap volatile organics. If the ground water is treated on-site with a prefabricated stripping package, the water would be treated to acceptable levels prior to discharge. The necessary emissions control equipment would also be used to ensure that air emissions are at an acceptable level. Impacts to local ecological resources would occur due to the disturbance and loss of habitat resulting from removal of vegetation and soil excavation. However, any adverse impacts are in all likelihood outweighed by the prevention of any further contact with contamination. Although stormwater runoff from the site during excavation could potentially discharge to the adjacent intermittent stream and wetlands, these impacts are not expected to be significant and can, in any event, be mitigated through the use of erosion control devices. Therefore, Alternative #4 scores 9 out of 10 in terms of short-term effectiveness.

4.5.4.2 Impacts to Human Health and the Environment Following Remediation

The presence of the cap and slurry wall would effectively eliminate all potential exposure routes for human health and environmental resources. Any ground water treated on-site would be treated to acceptable levels prior to discharge. Furthermore, air emissions controls would be used with soil venting or on-site air stripping to ensure adequate protection. Therefore, this alternative is considered to be fully protective of human health and the environment with a total of 20 out of 20.

4.5.5 ALTERNATIVE #5 - SOURCE REMOVAL

4.5.5.1 Impacts to Human Health and the Environment During Remediation

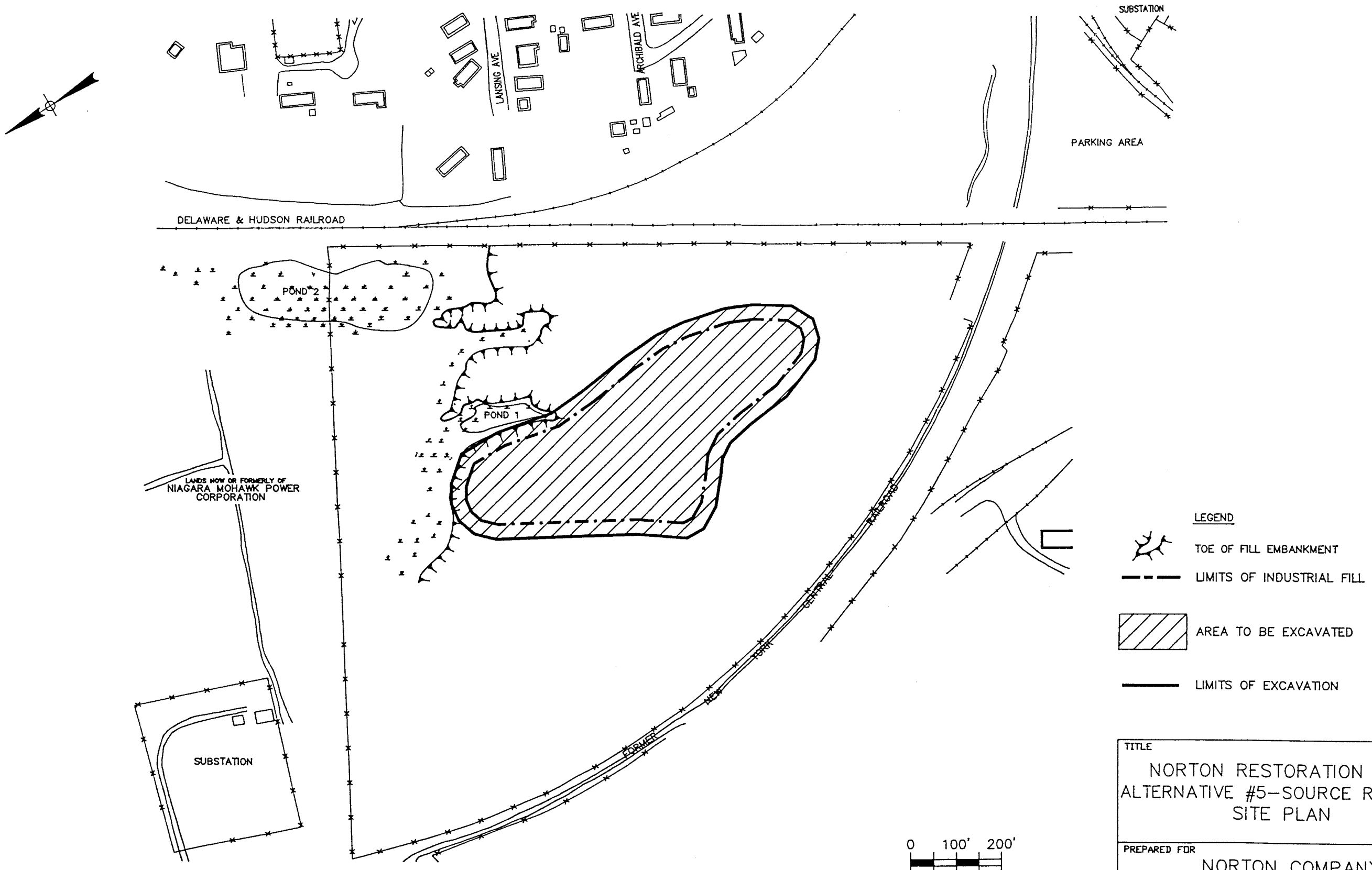
No significant risks to the community or environmental resources are expected to occur during remediation under Alternative #5. Removal of contaminated soil from the industrial fill area would require significant excavation, which is likely to result more fugitive dust generation and increased emission of volatile organics than in Alternative #4. The projected exposures to nearby residents during remediation are expected to be acceptable (risk less than 1×10^{-6}). If an on-site air stripping package is used, ground water would be treated to acceptable levels prior to discharge. The

stripper would also be equipped with carbon filters to ensure that air emissions standards are met. Impacts to local ecological resources would occur due to the disturbance and loss of habitat resulting from removal of vegetation and soil excavation. However, any adverse impacts are in all likelihood outweighed by the prevention of any further contact with contamination. Although stormwater runoff from the site during excavation could potentially discharge to the adjacent intermittent stream and wetlands, these impacts are not expected to be significant and can, in any event, be mitigated through the use of erosion control devices. Therefore, Alternative #5 scores 8 out of 10 in terms of short-term effectiveness.

4.5.5.2 Impacts to Human Health and the Environment Following Remediation

Excavation of contaminated soil and ground water collection and treatment would effectively eliminate all potential human and environmental exposure routes. Under this alternative, no significant residual contamination would remain at the site. Therefore, this alternative is expected to be fully protective of human health and the environment at the site with a total score of 20 out of 20. This evaluation however does not take into account the fact that the hazardous material has been transported for reburial or incineration with the resulting possible exposures from transportation and continued liability upon reburial of the waste or ash from the incinerator.

During the course of this disposal alternative the chances of exposure via handling, air emissions, accidents, etc. is very high.



TITLE

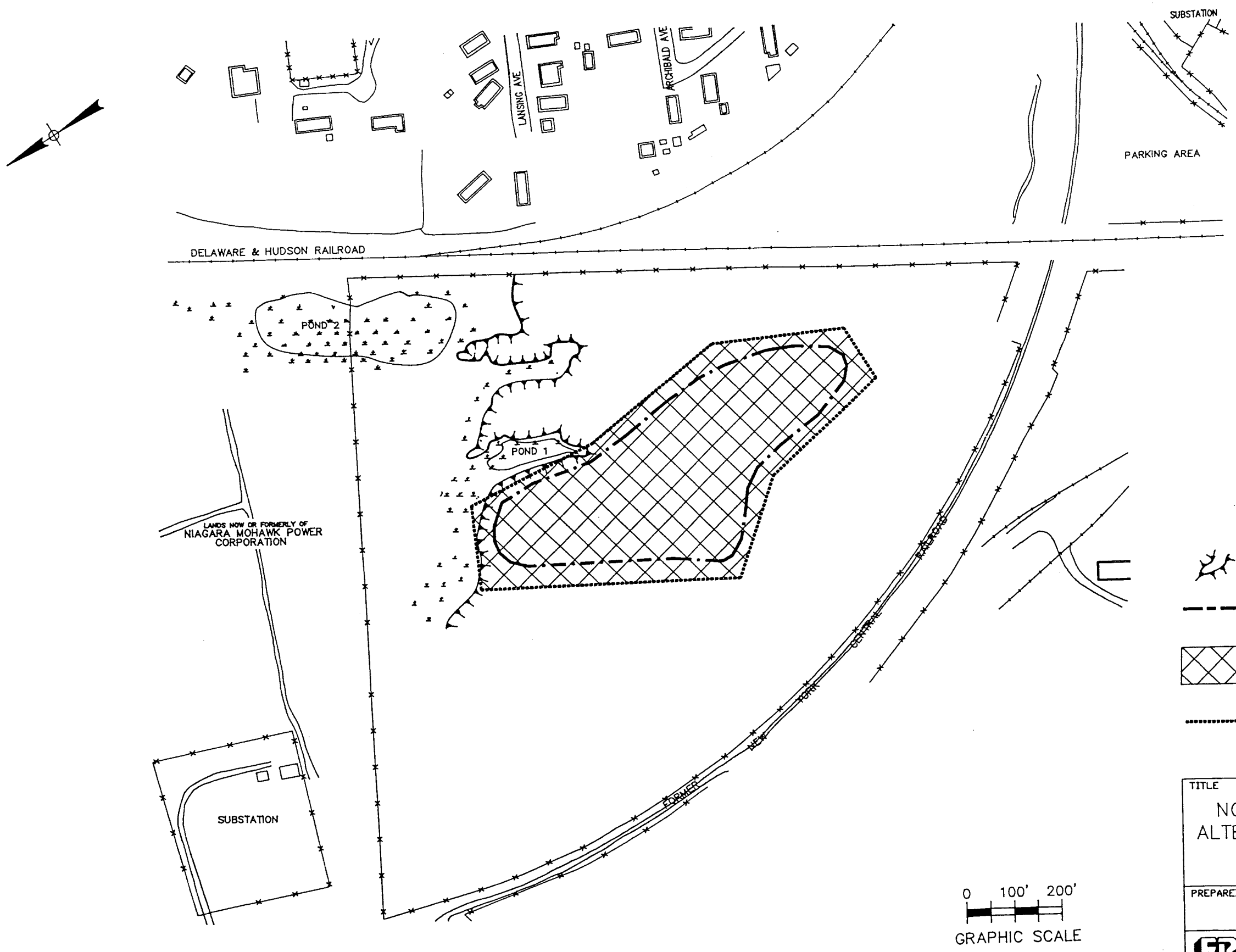
NORTON RESTORATION SITE
ALTERNATIVE #5–SOURCE REMOVAL
SITE PLAN

PREPARED FOR

NORTON COMPANY

ERM-Northeast
Environmental Resources Management

SCALE	FIGURE
GRAPHIC	4-4
DATE 9/19/90	



LEGEND

TOE OF FILL EMBANKMENT

LIMITS OF INDUSTRIAL FILL

CLAY–SOIL CAP

SLURRY WALL

TITLE

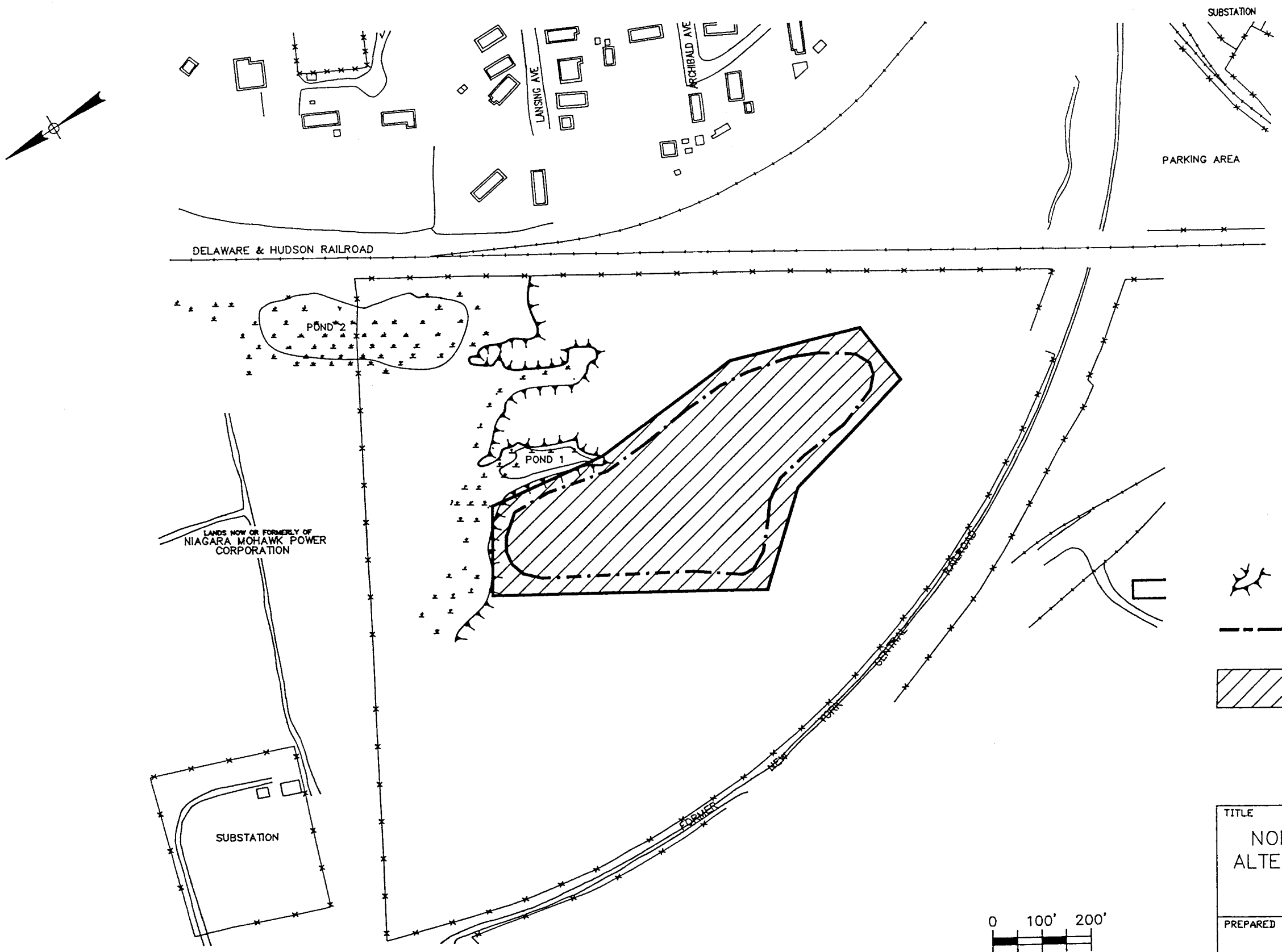
NORTON RESTORATION SITE
ALTERNATIVE #2–CONTAINMENT
SITE PLAN

PREPARED FOR

NORTON COMPANY

ERM-Northeast
Environmental Resources Management

SCALE	FIGURE
GRAPHIC	4–1
DATE 9/19/90	



LEGEND

TOE OF FILL EMBANKMENT

LIMITS OF INDUSTRIAL FILL

AREA OF IN-SITU VITRIFICATION

TITLE

NORTON RESTORATION SITE
ALTERNATIVE #3-VITRIFICATION
SITE PLAN

PREPARED FOR

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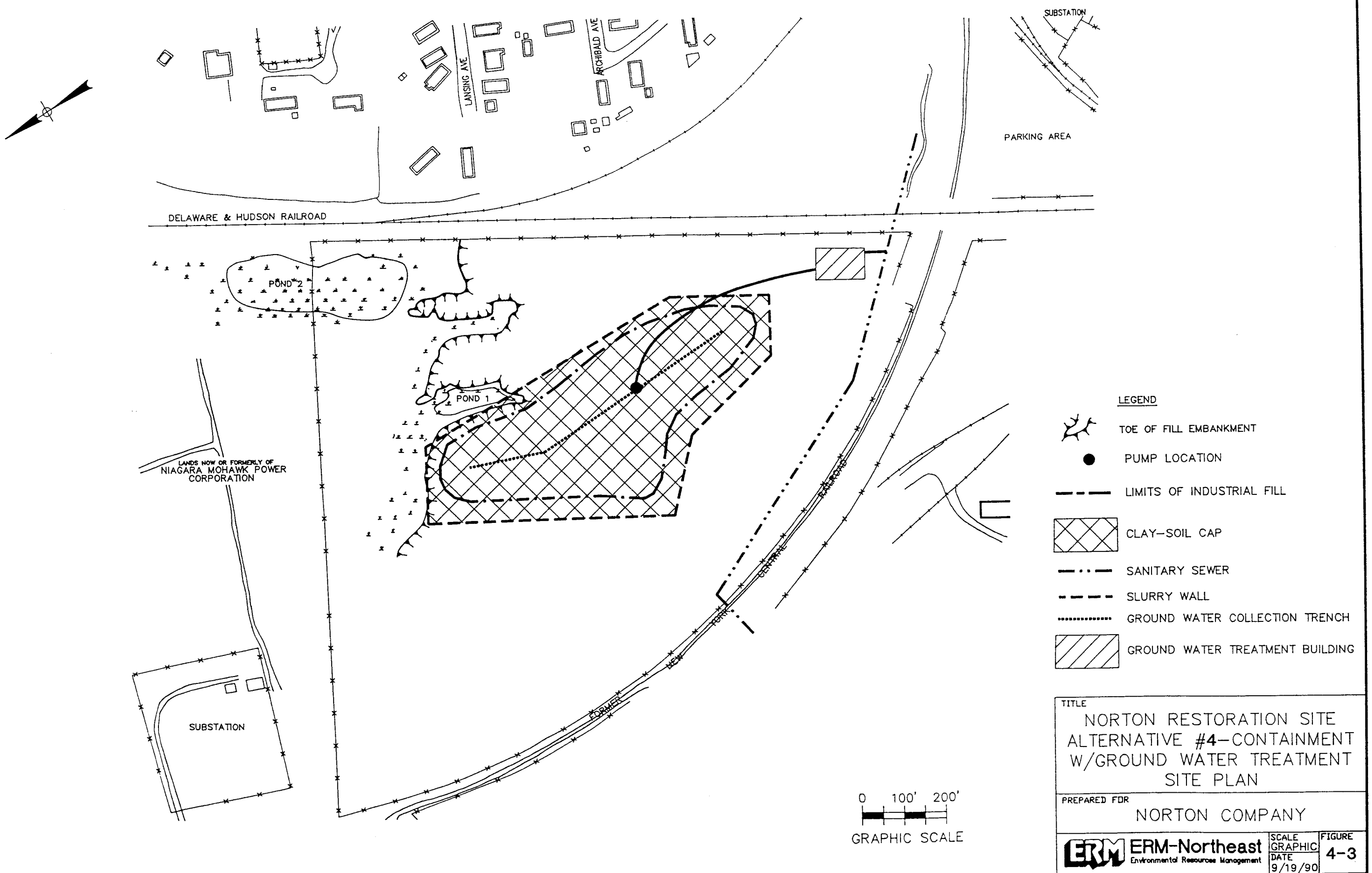
SCALE	FIGURE
GRAPHIC	4-2
DATE 9/19/90	


SUBSTATION
PARKING AREA
LANSING AVE.
ARCHIBALD AVE
DELAWARE & HUDSON RAILROAD
POND 2
POND 1
LANDS NOW OR FORMERLY OF
NIAGARA MOHAWK POWER
CORPORATION
SUBSTATION
FORMER NEW YORK CENTRAL RAILROAD
LEGEND
TOE OF FILL EMBANKMENT
PUMP LOCATION
LIMITS OF INDUSTRIAL FILL
CLAY-SOIL CAP
SANITARY SEWER
SLURRY WALL
GROUND WATER COLLECTION TRENCH
GROUND WATER TREATMENT BUILDING
0 100' 200'
GRAPHIC SCALE
TITLE
NORTON RESTORATION SITE
ALTERNATIVE #4-CONTAINMENT
W/GROUND WATER TREATMENT
SITE PLAN
PREPARED FOR
NORTON COMPANY
ERM-Northeast
Environmental Resources Management
SCALE GRAPHIC
DATE 9/19/90
FIGURE 4-3

5.0 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES AND RECOMMENDATIONS

The remedial alternatives were evaluated in Section 4 against seven criteria. These criteria are as follows:

1) Compliance to the extent practicable with SCGs;
2) Overall Protection of Human Health and the Environment;
3) Long-term Effectiveness and Permanence;
4) Reduction of Toxicity, Mobility, or Volume through Treatment;
5) Short-term Effectiveness;
6) Implementability; and
7) Cost.

The results of these evaluations are summarized in Table 5-1.

TABLE 5-1
SUMMARY OF ALTERNATIVE EVALUATIONS

CRITERIA

Alternative	SCG** Compliance (max. of 10)	Overall Protection (max. of 20)	Long-Term Effectiveness (max. of 15)	Reduction (max. of 15)	Short-Term Effectiveness (max. of 10)	Implementability (max. of 15)	Cost (max. of 15)	Point Totals (max. of 100)
1: No Action	0	8	N/A	N/A	N/A	N/A	N/A	N/A
2: Containment	6	20	4	1	10	14	15(2.260*)	70
3: Vitrification	10	20	14	15	10	8	2(61.160*)	79
4: Containment with Groundwater Treatment	10	20	13	13	9	15	14(7.360*)	94
5: Source Removal	7	20	15	12	8	11	1(71.685*)	74
Relative Weight	10	20	15	15	10	15	15	100

* Cost in millions of dollars
**SCG compliance is to the extent practicable
N/A: Not applicable

Alternative #1 was not considered for a complete evaluation against all seven criteria due to the fact that it does not comply with any standards or requirements. Additionally, as can be seen from inspection of Table 5-1, it is not protective of human health and the environment. Alternative #1 was dropped from further consideration for these reasons.

It can be seen from inspection of Table 5-1 that Alternative #2 has the lowest point total of 70. This is because the alternative provides no treatment of the hazardous waste. As a result, the alternative does not comply with appropriate SCGs to the extent practicable and scores poorly in terms of long-term effectiveness and permanence, as well as reduction of toxicity, mobility or volume through treatment.

Alternative #5 has a point total of 74. This alternative may result in releases of VOC and fugitive dust into the nearby community thereby increasing their exposures to hazardous materials. Construction of the remedial effort would be somewhat difficult and is dependent on off-site disposal of site debris and hazardous material. This alternative will reduce but not eliminate the toxicity, mobility and volume through treatment.

Alternative #3 has a point total of 79. The main technical drawback of this alternative is that it is innovative technology, and as such, it may be difficult to utilize and will have some uncertainties associated with it. Due to these uncertainties, technical delays are likely during implementation. Additionally, Alternative #3 is a patented process, which means

there is only one vendor which can be considered.

Alternative #4 has the highest point total of 94. This alternative scored well with all the technical criteria. A minor drawback of this alternative is that the time required to implement the remedial effort may take more than two years due to weather constraints on construction.

The only two alternatives which comply with all three categories of SCGs to the extent practicable are Alternatives #3 and #4. Alternative #4 scores better than Alternative #3 in the evaluations, but both are viable remedial alternatives. A comparison of costs associated with the alternatives indicates that Alternative #3 would cost an order of magnitude more than Alternative #4.

Based on consideration of the six technical criteria, the seventh criterion (cost) and the risk assessment, Alternative #4 is the recommended remedial alternative for the remediation of the Norton Company Restoration Site.

5.1 Detailed Description of the Recommended Alternative

Alternative #4: Containment with Groundwater Treatment consists of the following:

- Soil-bentonite slurry wall encircling the industrial fill;
- Soil venting system under the clay and soil cap;
- Groundwater collection system inside the slurry wall;
- Groundwater handling and/or treatment system;
- Clay and soil cap over the industrial fill;
- Deed restrictions;
- Site restrictions (fencing); and
- Monitoring.

A soil - bentonite slurry wall will be installed in the perimeter fill around the industrial fill. The slurry wall would have a width of approximately 3 feet and a total length of approximately 2,000 feet and be keyed into the bedrock at an average depth of 15 feet. This measure will serve to isolate all identified contaminants of concern at the site.

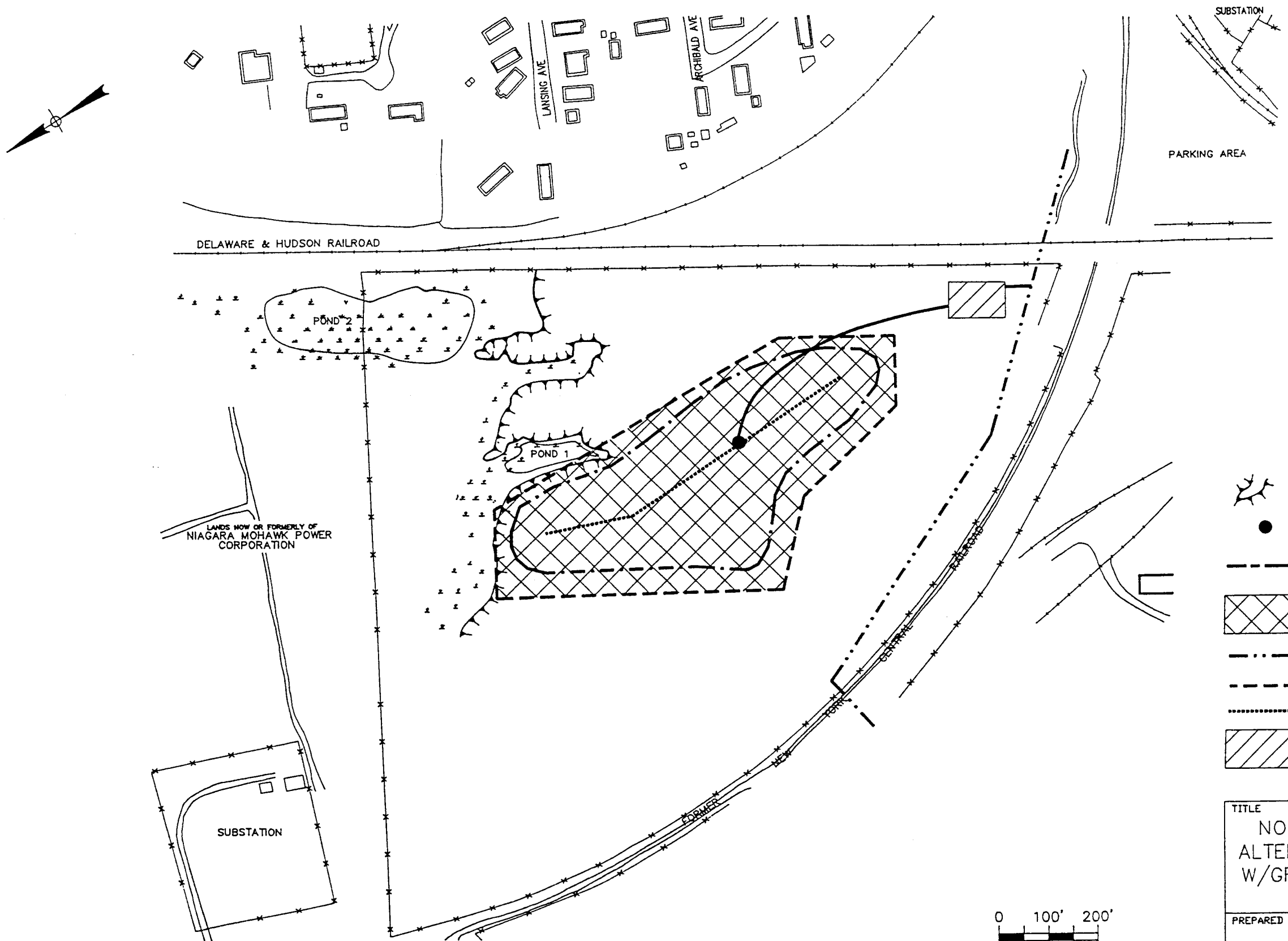
Soil - bentonite slurry walls are subsurface, non-structural walls that act as barriers to the lateral flow of groundwater and water - borne pollutants. Soil - bentonite slurry walls are constructed using the slurry trench technique and are composed primarily of soil and bentonite, a natural clay mineral forming a low permeability wall.

The major characteristic of slurry wall construction is the use of a bentonite - water slurry which allows excavation without the use of other lateral support. Slurry walls are built by

excavating a narrow trench (approximately 3 feet wide) while pumping in the slurry and maintaining its level at or near the top of the trench during the excavation process. The trench would be keyed into the underlying bedrock. Material excavated from the trench would be used as backfill. The excavated material would be mixed with a bentonite slurry and a bulldozer would be used to work the material to a consistency similar to wet concrete. This material would then be pushed back into the trench so that the backfill slope displaces the bentonite slurry forward. Excavation and backfilling would be phased to make the operation continuous with relatively small quantities of new slurry required to keep the trench full and to mix backfill. This construction technique will reduce the volatilization of contaminants in the fill and reduce construction impacts on the community. Details on the exact placement of the slurry wall are depicted in Figure 5-1. A cross-section of the slurry wall is illustrated in Figure 5-2.

Prior to installation of the clay and soil cap, a soil venting system would be installed. The venting system would consist of approximately 2,000 feet of PVC piping installed at the ground surface and overlain by a gravel layer which would serve as a pre-graded base for the cap. The soil venting piping would be connected to centrifugal blowers, which would maintain a negative pressure within the gravel layer. Collected off-gases would be scrubbed to remove VOCs.

Groundwater within the confines of the slurry wall would be collected through the use of



LEGEND

- TOE OF FILL EMBANKMENT
- PUMP LOCATION
- LIMITS OF INDUSTRIAL FILL
- CLAY–SOIL CAP
- SANITARY SEWER
- SLURRY WALL
- GROUND WATER COLLECTION TRENCH
- GROUND WATER TREATMENT BUILDING

TITLE
NORTON RESTORATION SITE
ALTERNATIVE #4–CONTAINMENT
W/GROUND WATER TREATMENT
SITE PLAN

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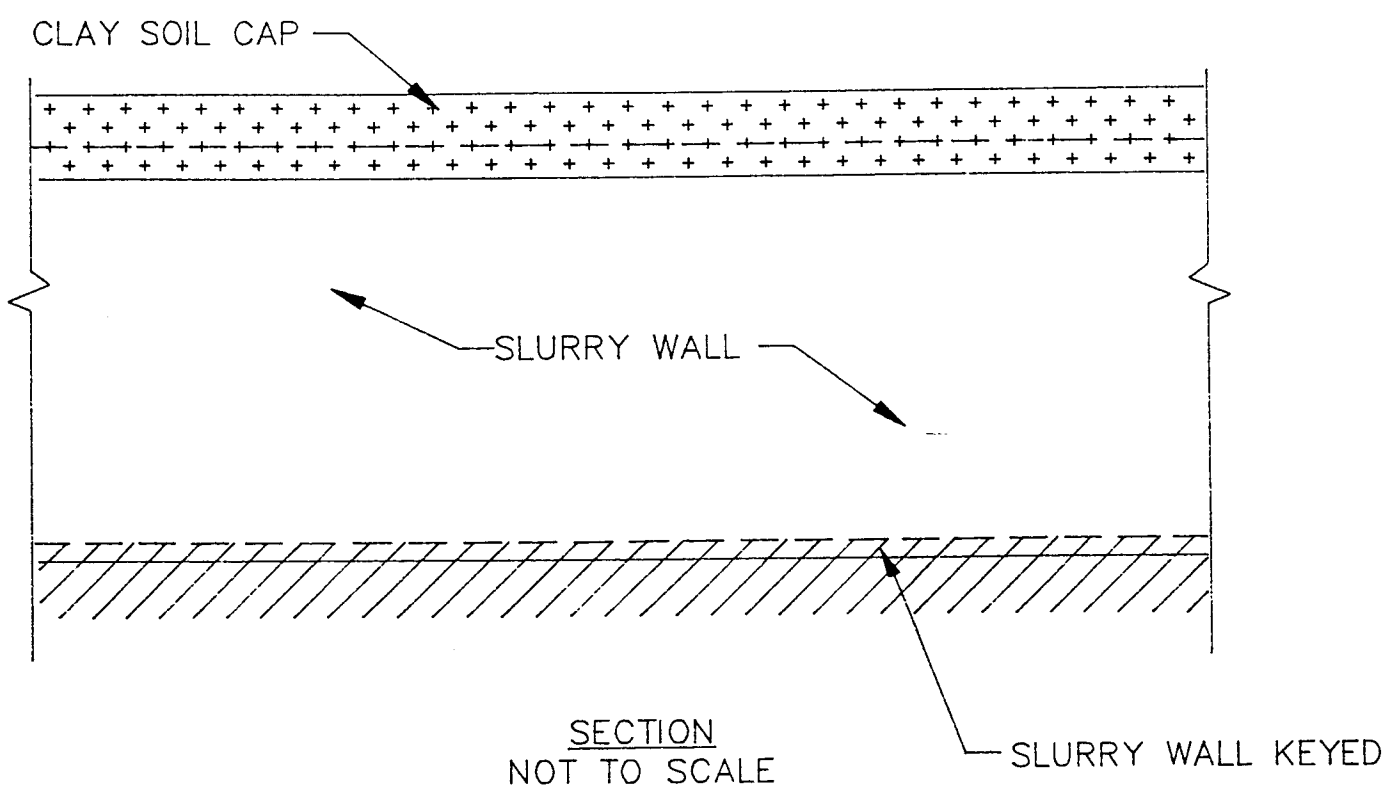
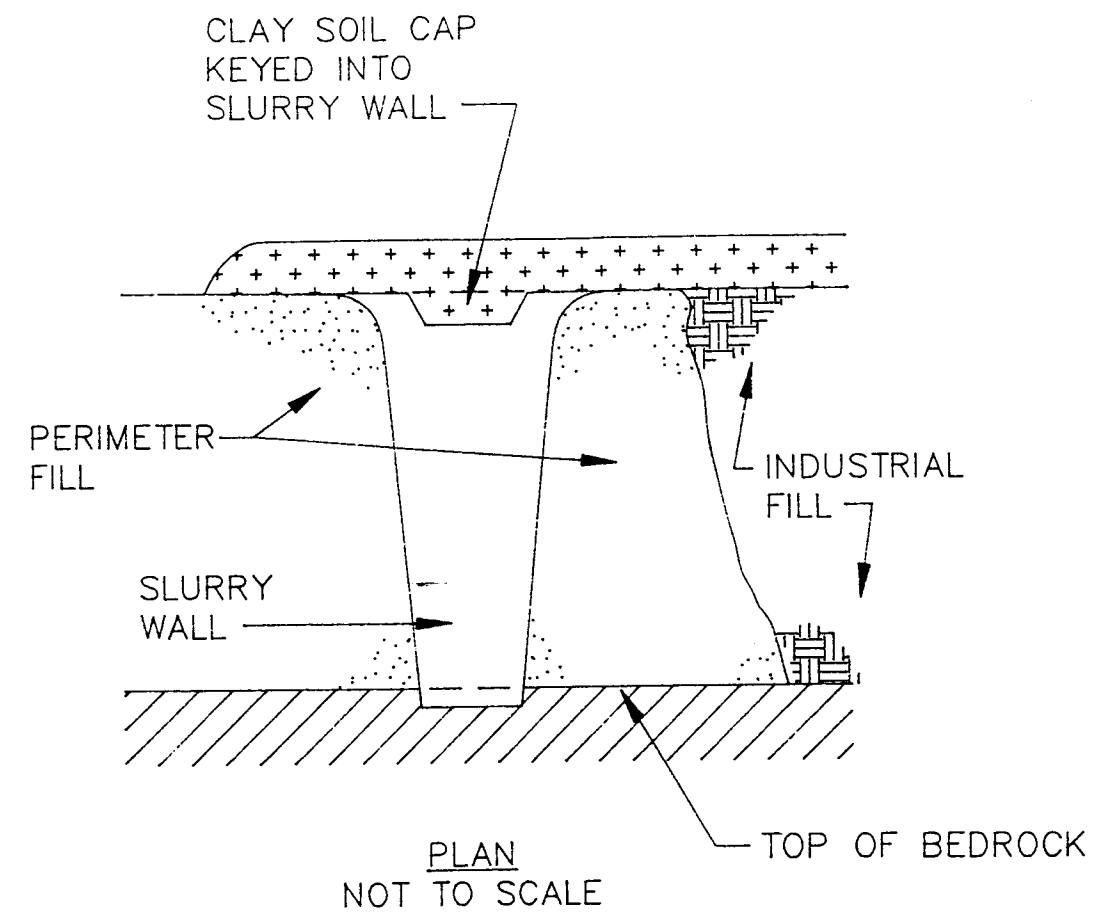
NORTON COMPANY

ERM-Northeast
Environmental Resources Management

SCALE	FIGURE
GRAPHIC	5–1
DATE 9/19/90	





TITLE NORTON RESTORATION SITE
ALTERNATIVE #4–CONTAINMENT
W/GROUND WATER TREATMENT
SLURRY WALL
PLAN AND SECTION

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Environmental Resources Management

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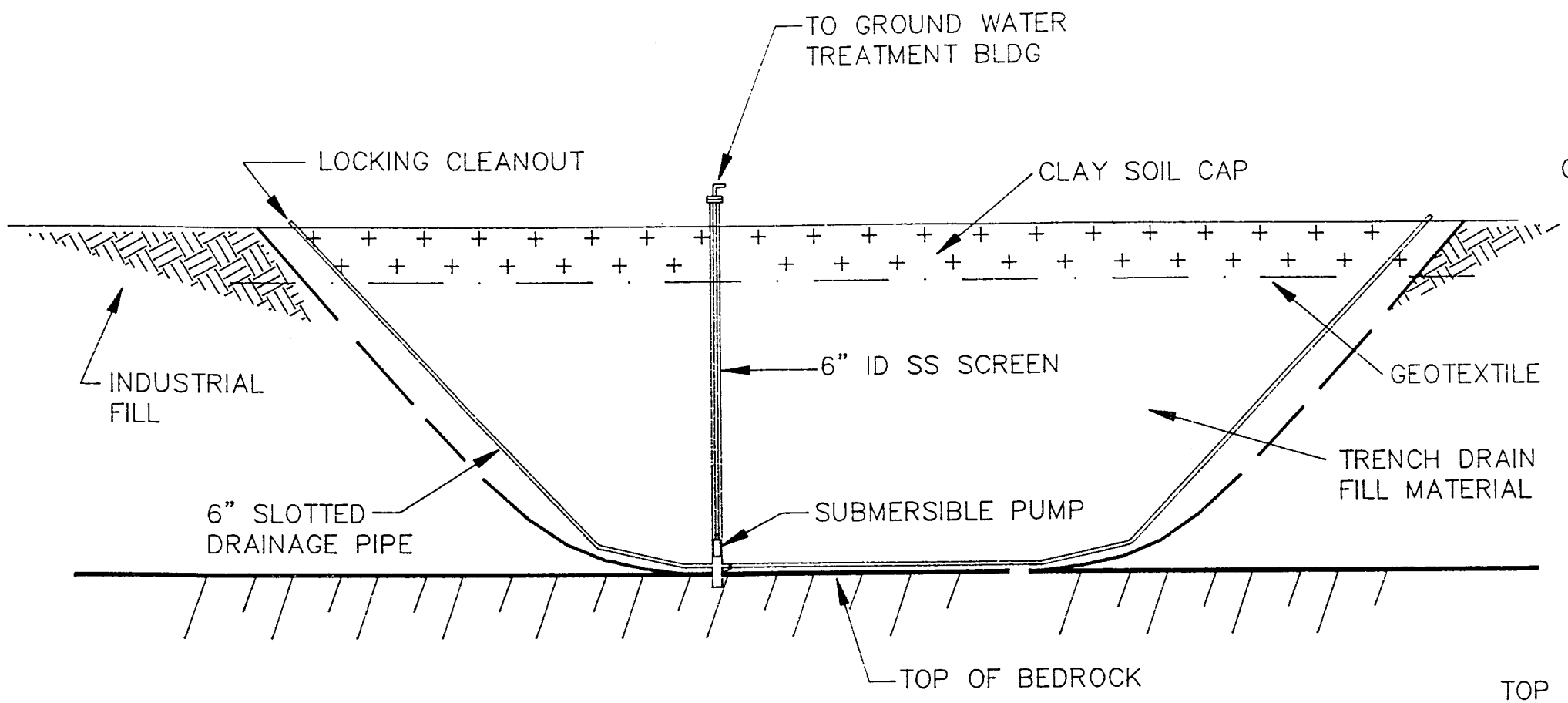
DATE 9/19/90
FIGURE 5-2

a subsurface drainage system. The subsurface drain would consist of 700 linear feet of a bio-polymer slurry drainage trench and 700 linear feet of piping. The bio-polymer slurry drainage trench would penetrate the entire overburden thickness, and would be an average of 15 feet in depth. The resultant subsurface drain would trend through the central portion of the industrial fill. The need to install laterals off the main trench will be evaluated during the final design of the system.

Bio-polymer slurry drainage trenches are a relatively new technique for the installation of groundwater extraction and interception trenches. This technique provides a quicker, safer, more cost-effective method to install drainage trenches. The method is a modification of the well-known slurry trench, and uses a biodegradable trenching slurry to temporarily support trench walls and control trench width. The drainage structure itself would consist of six inch slotted drainage pipe with cleanouts at each end of the trench (see Figure 5-3). An aggregate backfill material, sized to act as a filter and drain media, would then be backfilled into the trench. After backfilling of the drainage trench is complete, additives would be used to convert the bio-polymer slurry to water and a very small amount of natural carbohydrate. All excavated soil from the industrial fill resulting from the drainage trench installation would be moved within the industrial fill prior to the installation of the soil venting system and the cap. Any debris or visually contaminated material resulting from the drainage trench installation will be removed and disposed of properly. The drainage trench currently will pass directly through MW-1's location and therefore will provide partial removal of the hardened resin and area of known contamination.



PLAN
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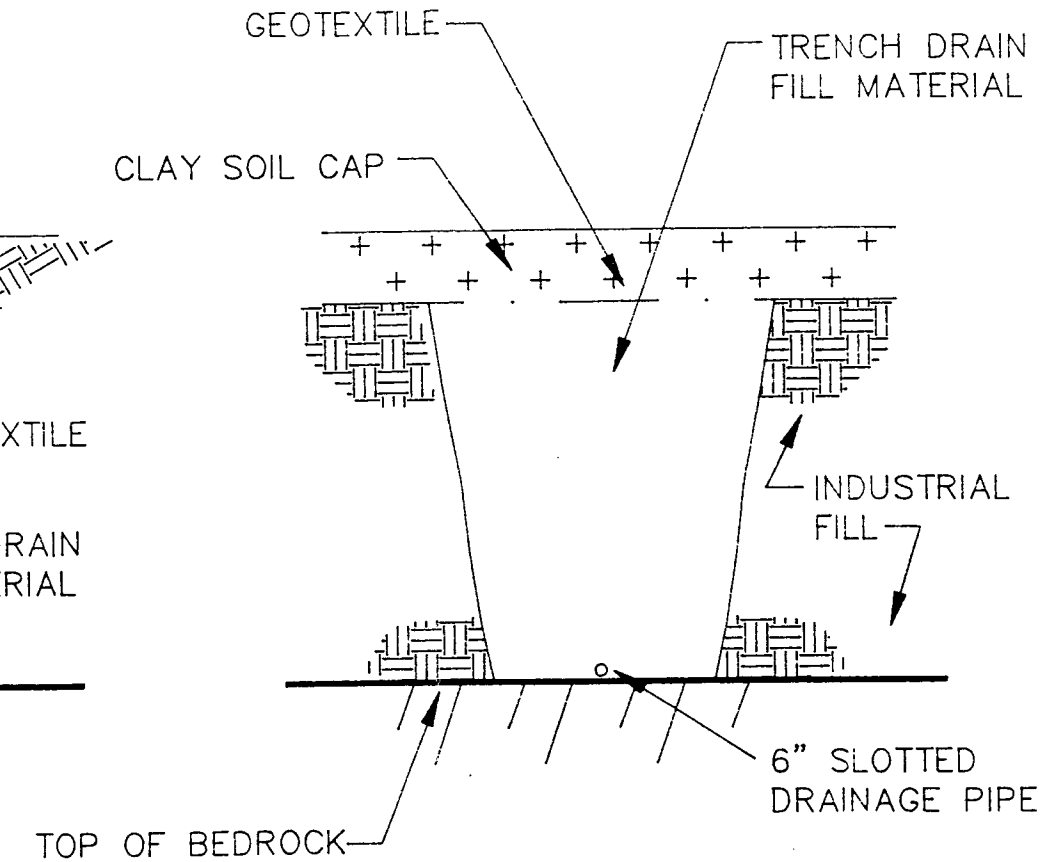

SECTION
NOT TO SCALE

TITLE NORTON RESTORATION SITE
ALTERNATIVE #4—CONTAINMENT
W/GROUND WATER TREATMENT
GROUND WATER COLLECTION TRENCH
PLAN AND SECTION

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Environmental Resources Management

SCALE AS NOTED
DATE 9/19/90
FIGURE 5-3

Once installation of the bio-polymer slurry drainage trenches and the soil venting system are complete, the area within the confines of the soil - bentonite slurry wall would be capped with a clay and soil cap. The surface area capped would be approximately 190,000 square feet (4.4 acres). A geofabric material would be placed over the gravel fill which contains the soil venting system. Subsequently, two feet of low permeability clay ($1x10^{-7}$cm/sec) would be installed. Following compaction of the clay, two feet of soil material suitable for sustaining vegetative growth or acting as subbase material for a parking area would be placed over the clay.

Groundwater collected as a result of pumping from the groundwater extraction trench would initially be stored in a large flow control tank on-site. Initial management method will consist of transporting the recovered groundwater via tanker trucks to an off-site facility for disposal. The stored groundwater would be sampled and analyzed to enable an evaluation of the need and appropriate design for a permanent treatment system. The treatment system would be tailored to remove the contaminants in the groundwater and could be any combination of air strippers, carbon adsorption units, ultraviolet light and hydrogen peroxide unit, pressure filtration unit, etc. Hydraulic analysis of the industrial fill area will also be performed during this initial period of operation.

When the appropriate treatment system is installed the flow control tank would be used to provide a controlled volume of water into the on-site treatment system. The final effluent

would be either discharged depending on acceptability of the discharge by the Albany County POTW into the sewer system which traverses the site or discharged based on appropriate permits to on-site drainage features.

It is possible that the Albany County POTW will accept partially treated or untreated groundwater. This matter will be investigated during final design. Cost estimates of Alternative #4 assume worst case conditions (i.e., complete groundwater treatment).

If the groundwater monitoring system within the slurry wall does not indicate that the installed drainage trench is performing as required, either additional drainage trenches will be installed or other means to dewater the landfill within the slurry wall will be investigated and installed.

Deed and site restrictions, as well as monitoring would also be undertaken in this alternative. A discussion on this can be found in Section 4.2.1.

5.2 Advantages/Disadvantages of the Recommended Alternative

The recommended remedial action, Alternative #4, for the Norton Restoration Site provides the advantage of including both a source control component and management of migration

component to obtain a comprehensive remedy. The recommended remedial action also has the advantage that the site can be returned to productive use with very minor restrictions at a reasonable cost.

The source control measures include:

- The in-situ vacuum extraction of contaminated soil vapor within the industrial fill. A vacuum extraction system will be installed under the clay and soil cap and used to withdraw air containing volatile organic compounds (VOCs) from the soil. The air containing VOCs will then be treated using activated carbon filters prior to discharge to the atmosphere. Spent activated carbon will be either regenerated on-site or transported off-site where they will be regenerated or disposed of.

- Institutional controls in the form of deed restrictions will be used at the site to regulate land use. The institutional controls would be focused on preventing the disturbance of the physical integrity of the remedy's components.

The management of migration remedial measures include:

- Active restoration of the groundwater within the industrial landfill will be performed using a treatment system tailored by analysis of the collected groundwater. This component of the remedy will extract and treat groundwater contaminated within the industrial fill. The goal of this remedial action is to reduce the groundwater contamination to a minimal level as compared to the NYSDEC groundwater standards. An on-site pilot system will be operated to determine to what levels the groundwater contamination can be reduced and develop disposal options.

- Groundwater will be extracted through the subsurface drain installed in the industrial fill. Groundwater extraction would act to halt any migration of contaminants and facilitate the removal of contaminants by other components of the remedy.

- The perimeter fill will be isolated from the industrial fill by the installation of a soil-bentonite slurry wall. This would prevent mixing of uncontaminated groundwater with contaminated groundwater and prevent any migration of contamination from the industrial fill.
- The clay-soil cap will be placed to prevent infiltration of water and provide a seal for proper operation of the in-situ vacuum extraction component.
- Environmental monitoring of the groundwater will be performed to ensure the effectiveness of the remedy.

The use of these source control measures and management of migration measures as discussed above would enable the return of the site to a productive use. The area of the industrial fill that would include the slurry wall and clay-soil cap would be restricted to uses that would not disturb the subsurface area such as parking areas. The remainder of the site could be used for warehouses, light industry, etc. provided minor environmental controls are constructed into the foundations of the buildings. These minor environmental controls may consist of foundation venting systems, monitoring well access, sealed foundations, etc.

Alternative #4 also provides the most economical strategy for remediating the site which complies to the extent practical with the SCGs.

This alternative could be installed and operating within two years and treatment results for the contaminated groundwater and soil vapor would be evaluated to assess the reduction

in contamination levels and predict when development of the site can proceed. Operation of the groundwater collection and soil vapor treatment systems was originally assumed for a period of ten years. The initial management for groundwater collection, as previously discussed, will provide an estimate of the hydraulic characteristics of the industrial landfill and levels of contamination of the extracted groundwater. This initial data will be used to evaluate the need and appropriate design of the permanent groundwater treatment system. Initial data will also be obtained from the soil vapor treatment system. The time frame for a performance review, to be conducted sometime within five years of the initiation of the permanent groundwater and soil vapor treatment systems, will be established based on the initial data. As a result of the initial data and the data obtained during the treatment systems operations, the performance review will establish contaminant level objectives for discontinuing or reducing the treatment systems and, subsequently, development of the site.

5.3 Summary

This recommended remedy is protective of human health and the environment, attains to the extent practicable, federal and state SCGs that are applicable or relevant and appropriate for this remedial action and is cost effective. This remedy satisfies the statutory preference for remedies that utilize treatment as a principal element to reduce the toxicity, mobility, or volume of hazardous substances. In addition, this remedy utilizes permanent solutions and applicable treatment technologies to the maximum extent practicable.

APPENDIX A

PROCESS OPTION DESCRIPTIONS

SOIL REMEDIATION

No Action

Under this response action, no remedial action will be taken. This alternative is required to be considered to provide a baseline for which all other alternatives may be compared.

This response action is applicable in any situation. It is often applied when the contaminants are organics that will degrade naturally before they can adversely affect an area or where a site is determined to pose no environmental or health risks.

ACCESS RESTRICTIONS

Deed Restrictions

Deed restrictions prevent exposure of receptors to chemicals by limiting future land use of the site. An example would be the prevention of domestic water well installation on site property.

Fencing

Fencing prevents exposure of receptors to chemicals by limiting receptor access to the site.

MONITORING

Soil Monitoring

Soil monitoring provides no treatment but is useful for documenting site contamination and determining if natural degradation of wastes is occurring.

CAPPING

Capping techniques are designed to minimize chemical concentrations in groundwater caused by infiltration and percolation through soils and to reduce the off-site transport of chemicals. Capping reduces leachate generation by preventing infiltration of precipitation and prevents direct contact with the contaminated soils. A wide variety of cap designs and capping materials are available.

Clay and Soil

A clay and soil cap consists of a layer of low-permeability soil covered with a single layer of topsoil with a vegetative cover. The clay portion of the cap significantly reduces water infiltration into the soil, reduces the generation of groundwater which may contain chemicals, and minimizes migration. This effective technology has a long service life and is highly durable. A clay and soil cap will need a minimum of maintenance throughout its service life.

Soil Cement

A soil cement cap consists of Portland cement mixed with in-situ sandy soils to create a less permeable surface cover. It can be used as a single layer cap or be used as the low-permeability layer of a multi-layer cap. Soil cements can resist moderate amounts of alkali, organics, and inorganic salts. A drawback of a soil cement cap is that it is susceptible to weathering and cracking.

Multi-Media

A multi-media cap generally consists of a synthetic membrane underlain by a clay cap and overlain by a soil layer which contains a drainage system for collecting and diverting infiltrating water. The synthetic membrane serves as the low-permeability layer with the underlying clay cap acting as a second line of defense in case of tearing or puncture of the synthetic membrane. The soil layer above, which contains the drainage system, is typically overlain by a vegetative layer.

Synthetic Membrane

A synthetic membrane cap is similar to a multi-media cap except no underlying clay layer exists. Flexible, synthetic membranes are made of polyvinyl chloride (PVC), chlorinated polyethylene (CPE), ethylene propylene rubber, butyl rubber, hypalon and neoprene (synthetic rubbers), and elastized polyolefin. High density polyethylene (HDPE), is the currently preferred synthetic liner material. Synthetic membranes require special field installation methods to ensure proper sealing of seams.

SURFACE CONTROLS

Diversion Ditches

Diversion ditches control the movement of water by channeling or by keeping water from encroaching upon a site. They can be used to collect precipitation and thereby minimize infiltration and erosion in areas of contamination.

Grading

Grading is the general term for techniques used to reshape the surface of landfills to manage surface water infiltration and run-off while controlling erosion. The equipment and methods used in grading are essentially the same for all landfill surfaces, but applications of grading technology will vary by site. Grading is often performed in conjunction with surface sealing practices and revegetation as part of an integrated landfill closure plan.

LANDFILL

A landfill is a disposal facility where hazardous wastes are placed in or on the land. Landfills for hazardous wastes frequently are considered as a technology of last resort to be used after approaches to reduce or eliminate the hazards posed by the wastes have been evaluated or utilized. The intent is to bury or alter the wastes so that they are not an environmental or public health hazard. Any soil cover must be greater than the depth of the plow zone so that subsequent use of the land will not return the landfill wastes to the surface. Barriers, liners, and covers are necessary to prevent the escape of the waste, its constituents, and leachate.

Landfilling relies on containment, rather than treatment or detoxification, for control of hazardous wastes and is a common method of hazardous waste management for both untreated wastes and the residues from treatment technologies. Landfills require careful construction, continuous maintenance and monitoring, and a high degree of management and technical attention.

Land Disposal Prohibitions must be considered for any landfill option, whether it be on or off-site. Due to the Land Disposal Prohibitions under 40 CFR 268, it may be necessary to solidify and/or stabilize all waste materials before incorporation into a landfill.

On-site Vault

This landfilling technique consists of placing the contaminated material in a below grade vault which consists of an environmentally secure barrier.

On-Site Underground

This disposal technique involves the construction of a below grade landfill. For on-site disposal of soils, a landfill disposal unit (which includes an on-site vault) can be built to meet the minimum technology requirements of the RCRA Hazardous and Solid Waste Amendments.

The RCRA minimum technology cell employs a multilayered liner and capping system laid down in the following order:

- Foundation
- Three-foot clay liner
- Secondary synthetic liner
- Leachate detection system
- Primary synthetic liner
- Leachate collection system
- Waste material
- Synthetic membrane/soil capping system

This method of landfilling results in an encapsulation of the waste material and minimizes or eliminates the potential for infiltration.

Off-Site Landfill

This involves transporting waste materials to a permitted off-site facility. Transportation regulations such as use of manifests must be adhered to. In addition, consideration of the Land Disposal Prohibitions under 40 CFR 268 must be taken into account.

BARRIERS

Containment barriers represent a technology for encapsulating an area to restrict the movement of contaminated groundwater. Barriers are installed upgradient, downgradient, or around a suspected contaminant source. Containment barriers are useful whenever it is necessary to contain, capture, or redirect groundwater flow in the vicinity of a site.

Slurry Wall

A slurry wall is a low-permeability, subsurface barrier that is constructed in a vertical trench excavated under a slurry. This slurry, usually a mixture of bentonite and water, acts like a drilling fluid. It hydraulically shores the trench to prevent collapse and, at the same time, forms a filter cake on the trench walls to prevent high fluid losses into the surrounding ground. Slurry wall types are differentiated by the materials used to backfill the slurry trench. Most commonly, an engineered soil mixture is blended with the bentonite slurry and placed in the trench to form a soil-bentonite slurry wall. Most slurry walls are constructed in a trench that has been excavated into a confining layer that forms the bottom of the contained site.

EX-SITU PHYSICAL/CHEMICAL TREATMENT

Incineration

Soils incineration is typically performed using a rotary kiln incinerator, although a variety of incinerator types exist. Rotary kiln incinerators are inclined, refractory-lined cylinders used primarily for combustion of organic solids and sludges including contaminated soils. Wastes are injected in to the high end of the kiln and passed through the combustion zone as the kiln rotates. Rotation of the combustion chamber creates turbulence and improves the degree of burnout of the solids. Wastes are oxidized to gases and inert ash within this zone. Ash is removed at the bottom end of the kiln, while flue gases are passed through a secondary combustion chamber and then through air pollution control units for removal of particulates and acid gas. Although organic solids combustion is the primary use of rotary kiln incinerators, liquid and gaseous organic wastes can also be handled by injection into either the feed end of the kiln or the secondary chamber.

Soils incineration using a rotary kiln is a viable technology for permanent destruction of organics. A mobile (transportable) unit can be used to incinerate the materials on-site, however, in New York State mobile units are subject to the same permitting process as a permanent incineration facility. The permitting and siting of such a facility typically takes years. Due to the permitting requirements, incineration would be more easily achieved by transportation of the waste material to an existing permanent incineration facility. Transportation costs for shipping waste material are high and compliance with transportation regulations is required.

Aeration

Aeration of soils generally consists of soil excavation and subsequent spreading out of the soil in an effort to expose it to the air. The process is essentially an air stripping process where volatilization of VOCs is the chief end result. Exposing soils to the atmosphere will also result in some oxidation reactions. Consideration must be given to the collection of volatilized compounds and the subsequent treatment of them. Additionally, the collection and treatment of leachate must also be considered.

SOLIDIFICATION/STABILIZATION

Solidification and stabilization are terms which are used to describe treatment systems which accomplish one or more of the following objectives:

- Improve waste handling or other physical characteristics of the waste.
- Decrease the surface area across which transfer or loss of contained pollutants can occur.
- Limit the solubility or toxicity of hazardous waste constituents.

These processes are applicable wherever changing physical characteristics of the waste would make handling easier using the handling methods available. They are also used to limit a

waste's solubility and toxicity, even if the wastes will not be transported.

Encapsulation

This treatment encapsulates large particles in an environmentally secure barrier using lime or cement pozzolan, thermoplastic, or organic polymer. A matrix is formed from reactive components, but the waste is not uniformly dispersed. The product containing the waste is in nodule form.

Encapsulation can be applied to almost all wastes. Organic solvents and oils must first be absorbed on a solid matrix, and acid wastes should be neutralized before incorporation. Oxidizers sometimes deteriorate the encapsulating materials.

DEWATERING

Volume reduction is one of the primary goals of dewatering sludges and soils. This is normally achieved by reducing the water content of the material by various methods. A certain amount of contamination will be removed from the waste material by the dewatering process.

Belt Filter Press

Belt filter presses employ single or double moving belts to continuously dewater the waste material. The belt press filtration process includes three stages: chemical conditioning of the feed, gravity drainage to a nonfluid consistency, and dewatering. A flocculent is added prior to feeding the slurry to the belt press. In the next step, free water drains from the conditioned material. The waste material then enters a two-belt contact zone where the material is dewatered by compression.

Belt press filters use less energy than other filters, but they are very sensitive to feed characteristics and chemical conditioning. This method is not applicable where sensing and prescreening devices are not available. Belt press filters can achieve 70 to 80 percent solids.

Drying Beds

Drying beds are essentially dewatering lagoons which use a gravity drainage system to remove water. The base of the bed is lined with clay plus a synthetic liner or other appropriate liner material to prevent migration of contaminants into the underlying soils and groundwater. Gravity drainage systems can achieve 99 percent water removal and a solids concentration of 35 to 40 percent after 10 to 15 days. They are the least expensive

to operate but require more land than other methods.

IN-SITU PHYSICAL/CHEMICAL TREATMENT

Soil Venting

Soil venting is basically an organic vapor recovery technique. A vapor collection system generally consisting of perforated piping or gravel filled trenches is installed in the area of organic contamination. Volatiles are either allowed to be released naturally or withdrawn by creating a vacuum under the cap by using a series of centrifugal blowers. Released gases are vented directly to the atmosphere or discharged through a carbon adsorption bed.

Vitrification

Vitrification is accomplished by passing an electric current between electrodes sunk into the ground. Resistance heating melts the soil, decomposing organic materials. Metallics and other inorganics are either dissolved or encapsulated in the vitrified solid. When current is cut off, the molten soil cools and solidifies, resulting in a durable block of glass-like material which retains its physical and chemical integrity for very long times.

It is necessary to vitrify wastes in increments across the site area because the process is limited to the volume that can be treated between the electrodes. Volume reduction will occur due to the vaporization of material and the resulting elimination of pore spaces in the soil matrix.

OFF-SITE PHYSICAL/CHEMICAL TREATMENT

Incineration

See incineration subsection in the Groundwater Remediation section of this appendix.

Disposal

See off-site landfill subsection in the Groundwater Remediation section of this appendix.

GROUNDWATER REMEDIATION

Extraction Wells

Groundwater pumping techniques actively manipulate groundwater in order to contain, divert, or remove a plume or to adjust groundwater levels. Types of wells used in groundwater management include suction wells and injector wells. Selection of the appropriate well type depends upon the depth, hydrologic, and geologic characteristics of the aquifer.

Where plume containment or removal is the objective, either extraction wells or a combination of extraction and injection wells can be used. Extraction wells alone are best suited to situations where chemicals are miscible and move readily with water; where the hydraulic gradient is steep and hydraulic conductivity is high; and where quick removal is not necessary.

A combination of extraction and injection wells is frequently used in containment or removal where the hydraulic gradient is relatively flat and hydraulic conductivities are only moderate. The injection well directs groundwater flow to the extraction wells. This method has been used with success for plumes which are not miscible with water. One problem with such an arrangement of wells is that dead spots can occur when these configurations are used. The size of the dead spot is directly related to the amount of overlap between adjacent radii of influence; the greater the overlaps, the smaller the dead spots. Injection wells can also suffer from operational problems, including air locks and the need for frequent maintenance

and well rehabilitation.

Extraction or injection wells can also adjust groundwater levels. In this approach, plume development can be controlled at sites where the water table intercepts disposed wastes by lowering the water table with extraction wells. In order for this pumping technique to be effective, infiltration into the waste pile must be eliminated and liquid wastes must be completely removed. If these conditions are not met, the potential exists for development of a plume. The major drawback to using well systems for lowering water tables is the continued costs associated with maintenance of the system.

SUBSURFACE DRAINS

Interceptor Trenches

Interceptor trenches are ditches filled with gravel which capture groundwater and divert it to collection locations such as sumps or pumping wells.

Interceptor trenches can be used where the amount of water to be drained is small and flow velocities are low. If used to handle high volumes or rapid flows, these drains are likely to fail due to excessive siltation, particularly in fine-grained soils.

EX-SITU PHYSICAL/CHEMICAL TREATMENT

Air Stripping

Air stripping is a mass transfer process which transfers volatile compounds in water to gas. It is usually carried out in a packed tower equipped with an air blower, employing the principal of counter current flow. Water flows down through the packing, while the air flows upward. The air, saturated with volatiles, exhausts through the top of the tower for treatment if necessary. Volatile, soluble components tend to leave the aqueous stream for the gas phase.

Air stripping has found widespread use for effective removal of volatile organics from aqueous waste streams. It is cost-effective for treatment of low concentrations of volatiles or as a pretreatment step for cleanup with activated carbon. Air stripping is relatively simple and start-up and shutdown can be carried out quickly.

Steam Stripping

Steam stripping is similar to air stripping except instead of air, steam is used to remove organics from aqueous wastes. Steam stripping is most applicable to the removal of low boiling-point organics contained in water at dilute concentrations. It typically does not

significantly out-perform air stripping.

Carbon Adsorption

Carbon adsorption removes chemicals from water by physical and chemical adsorption onto the surface of carbon particles. Granular activated carbon (GAC) is most frequently used in wastewater treatment. For GAC treatment, groundwater is pumped through a bed of GAC where close contact with carbon particles promotes adsorption. Carbon adsorption removes a wide range of organic chemicals from groundwater and can remove certain inorganic chemicals. When the carbon reaches its adsorption capacity it can be regenerated. This can take place in either an on-site or off-site regenerator unit. Off-site regeneration by the carbon manufacturer is usually less costly. Carbon adsorption is a highly effective technology for groundwater remediation. The process requires skilled, well-trained operators, and frequent monitoring to track chemical breakthrough. Operating and maintenance costs may be high for replacement or regeneration of carbon.

Oxidation

Oxidation reactions serve to alter the oxidation state of a compound through a loss of electrons. Oxidation can precipitate, detoxify, or solubilize inorganics and decompose, detoxify, or solubilize organics. Oxidation can be a pretreatment for organics before

biodegradation. These techniques are widely used for wastewater treatment.

A variety of oxidation techniques exist, including hydrogen peroxide oxidation, hypochlorite oxidation, ozonation, wet air oxidation, and electrolyte oxidation. The applications of the different techniques vary.

ON-SITE DISCHARGE

Spray Irrigation

This action involves the application of aerated water to a waste mass to enhance biodegradation and infiltration. This alternative assumes that some type of active groundwater capture system is operating simultaneously to collect the induced leachate. Recirculating the water through the wastes in this manner leads to decreasing concentrations.

Spray irrigation is applicable in shallow water level areas where the leachate can easily be captured. The contaminants present must be organics which are readily biodegraded into harmless or less toxic transformation products. This is a cost-effective procedure with fewer health and safety considerations than excavation of the waste mass.

Overland Flow

Overland flow is similar to spray irrigation except that the aerated water is discharged directly on the surface through the use of a perforated discharge pipe.

OFF-SITE TREATMENT

RCRA Facility

This option consists of transporting the waste to a permitted facility for treatment and/or disposal at that facility. Transportation regulations such as manifesting would have to be adhered to and a facility willing to accept the waste would have to be identified. This option typically has large transportation costs associated with it.

Publicly Owned Treatment Works (POTW)

POTWs are allowed to receive small quantities of hazardous wastes. These wastes can be transported to the head of the treatment plant or conveyed to the plant through an existing sewer system. It is necessary to obtain a permit from the facility to exercise this option. If wastes are conveyed through a sewer system, it may be necessary to obtain permits from the

Overland Flow

Overland flow is similar to spray irrigation except that the aerated water is discharged directly on the surface through the use of a perforated discharge pipe.

OFF-SITE TREATMENT

RCRA Facility

This option consists of transporting the waste to a permitted facility for treatment and/or disposal at that facility. Transportation regulations such as manifesting would have to be adhered to and a facility willing to accept the waste would have to be identified. This option typically has large transportation costs associated with it.

Publicly Owned Treatment Works (POTW)

POTWs are allowed to receive small quantities of hazardous wastes. These wastes can be transported to the head of the treatment plant or conveyed to the plant through an existing sewer system. It is necessary to obtain a permit from the facility to exercise this option. If wastes are conveyed through a sewer system, it may be necessary to obtain permits from the local municipality as well as from the POTW.

APPENDIX B

TABLE 1-1
ALTERNATIVE 1: NO ACTION

SHORT-TERM/LONG-TERM EFFECTIVENESS
(MAXIMUM SCORE = 25)

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING PRELIMINARY SCREENING		SCORE
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ____ No _X_	0 4
	o Can the short-term risk be easily controlled?	Yes ____ No ____	1 0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ____ No ____	0 4
Subtotal (maximum = 4)			
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ____ No _X_	0 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ____ No ____	3 0
Subtotal (maximum = 4)			

TABLE 1-1 (cont'd)
ALTERNATIVE 1

3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤ 2 yr. X > 2 yr. ____	1 0
	o Required duration of the mitigative effort to control short-term risk.	≤ 2 yr. X > 2 yr. ____	1 0
Subtotal (maximum = 2)			
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	____ ____ X	3 1 0
Subtotal (maximum = 3)			
* treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes			
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 7.)	Yes ____ No X	3 0
Subtotal (maximum = 3)			
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr. X 20-25 yr. ____ 15-20 yr. ____ < 15 yr. ____	3 2 1 0
Subtotal (maximum = 3)			

TABLE 1-1 (cont'd)
ALTERNATIVE 1

7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None ____	3
		≥25% ____	2
		25-50% ____	1
		≥50% _X_	0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 8.)	Yes _X_	0
		No ____	2
	iii) Is the treated residual toxic?	Yes _X_	0
		No ____	1
	iv) Is the treated residual mobile?	Yes _X_	0
		No ____	1
Subtotal (maximum = 5)			
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	< 5 yr. ____	1
		> 5 yr. _X_	0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv")	Yes _X_	0
		No ____	1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_	1
		Somewhat to not confident ____	0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum ____	2
		Moderate ____	1
		Extensive _X_	0
Subtotal (maximum = 4)			

TOTAL (maximum = 25) . . . . . _14_

TABLE 1-2
ALTERNATIVE 1: NO ACTION

IMPLEMENTABILITY
(MAXIMUM SCORE = 15)

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING PRELIMINARY SCREENING		SCORE
1. Technical Feasibility			
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X	3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___	2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___	1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___	3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X	2
c. Schedule of delays due to technical problems.	i) Unlikely	X	2
	ii) Somewhat likely	___	1

TABLE 1-2 (cont'd)
ALTERNATIVE 1

d.	Need of undertaking additional remedial action, if necessary.	i)	No future remedial actions may be anticipated.	____	2
		ii)	Some future remedial actions may be necessary.	_X_	1

Subtotal (maximum = 10)

2. Administrative Feasibility

a.	Coordination with other agencies.	i)	Minimal coordination is required.	____	2
		ii)	Required coordination is normal.	_X_	1
		iii)	Extensive coordination is required.	____	0

Subtotal (maximum = 2)

3. Availability of Services and Materials

a.	Availability of prospective technologies.	i)	Are technologies under consideration generally commercially available for the site-specific application?	Yes _X_ No ____	1 0
		ii)	Will more than one vendor be available to provide a competitive bid?	Yes _X_ No ____	1 0

TABLE 1-2 (cont'd)
ALTERNATIVE 1

b.	Availability of necessary equipment and specialists.	i)	Additional equipment and specialists may be available without significant delay.	Yes X No ___	1 0

Subtotal (maximum = 3)

TOTAL (maximum = 15) 12

TABLE 2-1
ALTERNATIVE 2: CONTAINMENT

SHORT-TERM/LONG-TERM EFFECTIVENESS
(MAXIMUM SCORE = 25)

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING PRELIMINARY SCREENING		SCORE
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ____ No _X_	0 4
	o Can the short-term risk be easily controlled?	Yes ____ No ____	1 0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ____ No ____	0 4
Subtotal (maximum = 4)			
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ____ No _X_	0 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ____ No ____	3 0
Subtotal (maximum = 4)			

TABLE 2-1 (cont'd)
ALTERNATIVE 2

3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤ 2 yr. _X_ > 2 yr. ____	1 0
	o Required duration of the mitigative effort to control short-term risk.	≤ 2 yr. _X_ > 2 yr. ____	1 0
Subtotal (maximum = 2)			
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	____ ____ _X_	3 1 0
Subtotal (maximum = 3)			
* treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes			
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 7.)	Yes ____ No _X_	3 0
Subtotal (maximum = 3)			
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr. _X_ 20-25 yr. ____ 15-20 yr. ____ < 15 yr. ____	3 2 1 0
Subtotal (maximum = 3)			

TABLE 2-1 (cont'd)
ALTERNATIVE 2

7. Quantity and nature of waste or residual left at the site after remediation.	i)	Quantity of untreated hazardous waste left at the site.	None ____	3
			≥25% ____	2
			25-50% ____	1
			≥50% _X_	0
	ii)	Is there treated residual left at the site? (If answer is no, go to Factor 8.)	Yes _X_	0
			No ____	2
	iii)	Is the treated residual toxic?	Yes _X_	0
			No ____	1
	iv)	Is the treated residual mobile?	Yes ____	0
			No _X_	1
Subtotal (maximum = 5)				
8. Adequacy and reliability of controls.	i)	Operation and maintenance required for a period of:	< 5 yr. ____	1
			> 5 yr. _X_	0
	ii)	Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv")	Yes _X_	0
			No ____	1
	iii)	Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_	
			Somewhat to not confident ____	1
				0
	iv)	Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum ____	2
			Moderate ____	1
			Extensive _X_	0
Subtotal (maximum = 4)				

TOTAL (maximum = 25) 15

TABLE 2-2
ALTERNATIVE 2: CONTAINMENT

IMPLEMENTABILITY
(MAXIMUM SCORE = 15)

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING PRELIMINARY SCREENING		SCORE
1. Technical Feasibility			
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X	3
	ii) Somewhat difficult to construct. No uncertainties in construction.	____	2
	iii) Very difficult to construct and/or significant uncertainties in construction.	____	1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X	3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	____	2
c. Schedule of delays due to technical problems.	i) Unlikely	X	2
	ii) Somewhat likely	____	1

TABLE 2-2 (cont'd)
ALTERNATIVE 2

d.	Need of undertaking additional remedial action, if necessary.	i)	No future remedial actions may be anticipated.	____	2
		ii)	Some future remedial actions may be necessary.	_X_	1

Subtotal (maximum = 10)

2. Administrative Feasibility

a.	Coordination with other agencies.	i)	Minimal coordination is required.	_X_	2
		ii)	Required coordination is normal.	____	1
		iii)	Extensive coordination is required.	____	0

Subtotal (maximum = 2)

3. Availability of Services and Materials

a.	Availability of prospective technologies.	i)	Are technologies under consideration generally commercially available for the site-specific application?	Yes _X_ No ____	1 0
		ii)	Will more than one vendor be available to provide a competitive bid?	Yes _X_ No ____	1 0

TABLE 2-2 (cont'd)
ALTERNATIVE 2

b.	Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes _X_ No ____	1 0

Subtotal (maximum = 3)

TOTAL (maximum = 15) 14

TABLE 3-1
ALTERNATIVE 3: VITRIFICATION

SHORT-TERM/LONG-TERM EFFECTIVENESS
(MAXIMUM SCORE = 25)

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING PRELIMINARY SCREENING		SCORE
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes _X_ No ____	0 4
	o Can the short-term risk be easily controlled?	Yes _X_ No ____	1 0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ____ No _X_	0 4
Subtotal (maximum = 4)			
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ____ No _X_	0 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ____ No ____	3 0
Subtotal (maximum = 4)			

TABLE 3-1 (cont'd)
ALTERNATIVE 3

3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤ 2 yr. X > 2 yr. ____	1 0
	o Required duration of the mitigative effort to control short-term risk.	≤ 2 yr. X > 2 yr. ____	1 0
Subtotal (maximum = 2)			
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	X ____ ____	3 1 0
Subtotal (maximum = 3)			
* treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes			
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 7.)	Yes X No ____	3 0
Subtotal (maximum = 3)			
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr. ____ 20-25 yr. ____ 15-20 yr. ____ < 15 yr. ____	3 2 1 0
Subtotal (maximum = 3)			

TABLE 3-1 (cont'd)
ALTERNATIVE 3

7. Quantity and nature of waste or residual left at the site after remediation.	i)	Quantity of untreated hazardous waste left at the site.	None _X_ ≥25% ____ 25-50% ____ ≥50% ____	3 2 1 0
	ii)	Is there treated residual left at the site? (If answer is no, go to Factor 8.)	Yes _X_ No ____	0 2
	iii)	Is the treated residual toxic?	Yes ____ No _X_	0 1
	iv)	Is the treated residual mobile?	Yes ____ No _X_	0 1
Subtotal (maximum = 5)				
8. Adequacy and reliability of controls.	i)	Operation and maintenance required for a period of:	< 5 yr. ____ > 5 yr. _X_	1 0
	ii)	Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv")	Yes ____ No _X_	0 1
	iii)	Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident ____ Somewhat to not confident ____	1 0
	iv)	Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum _X_ Moderate ____ Extensive ____	2 1 0
Subtotal (maximum = 4)				

TOTAL (maximum = 25) . . . . . _25_

TABLE 3-2
ALTERNATIVE 3: VITRIFICATION

IMPLEMENTABILITY
(MAXIMUM SCORE = 15)

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING PRELIMINARY SCREENING		SCORE
1. Technical Feasibility			
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	___	3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___	2
	iii) Very difficult to construct and/or significant uncertainties in construction.	X	1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X	3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	___	2
c. Schedule of delays due to technical problems.	i) Unlikely	___	2
	ii) Somewhat likely	X	1

TABLE 3-2 (cont'd)
ALTERNATIVE 3

d.	Need of undertaking additional remedial action, if necessary.	i)	No future remedial actions may be anticipated.	X	2
		ii)	Some future remedial actions may be necessary.	____	1

Subtotal (maximum = 10)

2. Administrative Feasibility

a.	Coordination with other agencies.	i)	Minimal coordination is required.	____	2
		ii)	Required coordination is normal.	____	1
		iii)	Extensive coordination is required.	X	0

Subtotal (maximum = 2)

3. Availability of Services and Materials

a.	Availability of prospective technologies.	i)	Are technologies under consideration generally commercially available for the site-specific application?	Yes X No ____	1 0
		ii)	Will more than one vendor be available to provide a competitive bid?	Yes ____ No X	1 0

TABLE 3-2 (cont'd)
ALTERNATIVE 3

b.	Availability of necessary equipment and specialists.	i)	Additional equipment and specialists may be available without significant delay.	Yes ____ 1 No _X_ 0

Subtotal (maximum = 3)

TOTAL (maximum = 15) 8

TABLE 4-1
ALTERNATIVE 4: CONTAINMENT WITH GROUNDWATER TREATMENT

SHORT-TERM/LONG-TERM EFFECTIVENESS
(MAXIMUM SCORE = 25)

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING PRELIMINARY SCREENING		SCORE
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ____ No _X_	0 4
	o Can the short-term risk be easily controlled?	Yes ____ No ____	1 0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ____ No ____	0 4
Subtotal (maximum = 4)			
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ____ No _X_	0 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ____ No ____	3 0
Subtotal (maximum = 4)			

TABLE 4-1 (cont'd)
ALTERNATIVE 4

3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤ 2 yr. ____ > 2 yr. __X__	1 0
	o Required duration of the mitigative effort to control short-term risk.	≤ 2 yr. __X__ > 2 yr. ____	1 0
Subtotal (maximum = 2)			
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	__X__ ____ ____	3 1 0
Subtotal (maximum = 3)			
* treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes			
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 7.)	Yes __X__ No ____	3 0
Subtotal (maximum = 3)			
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr. ____ 20-25 yr. ____ 15-20 yr. ____ < 15 yr. ____	3 2 1 0
Subtotal (maximum = 3)			

TABLE 4-1 (cont'd)
ALTERNATIVE 4

7. Quantity and nature of waste or residual left at the site after remediation.	i)	Quantity of untreated hazardous waste left at the site.	None ____	3
			≥25% _X_	2
			25-50% ____	1
			≥50% ____	0
	ii)	Is there treated residual left at the site? (If answer is no, go to Factor 8.)	Yes ____	0
			No _X_	2
	iii)	Is the treated residual toxic?	Yes ____	0
			No ____	1
	iv)	Is the treated residual mobile?	Yes ____	0
			No ____	1
Subtotal (maximum = 5)				
8. Adequacy and reliability of controls.	i)	Operation and maintenance required for a period of:	< 5 yr. ____	1
			> 5 yr. _X_	0
	ii)	Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv")	Yes _X_	0
			No ____	1
	iii)	Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_	
			Somewhat to not confident ____	1
				0
	iv)	Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum _X_	2
			Moderate ____	1
			Extensive ____	0
Subtotal (maximum = 4)				

TOTAL (maximum = 25) 22

TABLE 4-2
ALTERNATIVE 4: CONTAINMENT WITH GROUNDWATER TREATMENT

IMPLEMENTABILITY
(MAXIMUM SCORE = 15)

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING PRELIMINARY SCREENING		SCORE
1. Technical Feasibility			
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X	3
	ii) Somewhat difficult to construct. No uncertainties in construction.	____	2
	iii) Very difficult to construct and/or significant uncertainties in construction.	____	1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X	3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	____	2
c. Schedule of delays due to technical problems.	i) Unlikely	X	2
	ii) Somewhat likely	____	1

TABLE 4-2 (cont'd)
ALTERNATIVE 4

d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X	2
	ii) Some future remedial actions may be necessary.	____	1

Subtotal (maximum = 10)

2. Administrative Feasibility

a. Coordination with other agencies.	i) Minimal coordination is required.	X	2
	ii) Required coordination is normal.	____	1
	iii) Extensive coordination is required.	____	0

Subtotal (maximum = 2)

3. Availability of Services and Materials

a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X No ____	1 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X No ____	1 0

TABLE 4-2 (cont'd)
ALTERNATIVE 4

b.	Availability of necessary equipment and specialists.	i)	Additional equipment and specialists may be available without significant delay.	Yes _X_ 1 No ____ 0

Subtotal (maximum = 3)

TOTAL (maximum = 15) 15

TABLE 5-1
ALTERNATIVE 5: SOURCE REMOVAL

SHORT-TERM/LONG-TERM EFFECTIVENESS
(MAXIMUM SCORE = 25)

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING PRELIMINARY SCREENING		SCORE
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes _X_ No ____	0 4
	o Can the short-term risk be easily controlled?	Yes ____ No _X_	1 0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes _X_ No ____	0 4
Subtotal (maximum = 4)			
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes _X_ No ____	0 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes _X_ No ____	3 0
Subtotal (maximum = 4)			

TABLE 5-1 (cont'd)
ALTERNATIVE 5

3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤ 2 yr. ____ > 2 yr. _X_	1 0
	o Required duration of the mitigative effort to control short-term risk.	≤ 2 yr. ____ > 2 yr. _X_	1 0
Subtotal (maximum = 2)			
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	____ _X_ ____	3 1 0
Subtotal (maximum = 3)			
* treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes			
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 7.)	Yes _X_ No ____	3 0
Subtotal (maximum = 3)			
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr. _X_ 20-25 yr. ____ 15-20 yr. ____ < 15 yr. ____	3 2 1 0
Subtotal (maximum = 3)			

TABLE 5-1 (cont'd)
ALTERNATIVE 5

7. Quantity and nature of waste or residual left at the site after remediation.	i)	Quantity of untreated hazardous waste left at the site.	None _X_	3
			≥25% ___	2
			25-50% ___	1
			≥50% ___	0
	ii)	Is there treated residual left at the site? (If answer is no, go to Factor 8.)	Yes ___	0
			No _X_	2
	iii)	Is the treated residual toxic?	Yes ___	0
			No ___	1
	iv)	Is the treated residual mobile?	Yes ___	0
			No ___	1
Subtotal (maximum = 5)				
8. Adequacy and reliability of controls.	i)	Operation and maintenance required for a period of:	< 5 yr. ___	1
			> 5 yr. _X_	0
	ii)	Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv")	Yes _X_	0
			No ___	1
	iii)	Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_	
			Somewhat to not confident ___	1
				0
	iv)	Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum _X_	2
			Moderate ___	1
			Extensive ___	0
Subtotal (maximum = 4)				

TOTAL (maximum = 25) 18

TABLE 5-2
ALTERNATIVE 5: SOURCE REMOVAL

IMPLEMENTABILITY
(MAXIMUM SCORE = 15)

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING PRELIMINARY SCREENING		SCORE
1. Technical Feasibility			
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	____	3
	ii) Somewhat difficult to construct. No uncertainties in construction.	X	2
	iii) Very difficult to construct and/or significant uncertainties in construction.	____	1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X	3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	____	2
c. Schedule of delays due to technical problems.	i) Unlikely	____	2
	ii) Somewhat likely	X	1

TABLE 5-2 (cont'd)
ALTERNATIVE 5

d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X	2
	ii) Some future remedial actions may be necessary.	____	1

Subtotal (maximum = 10)

2. Administrative Feasibility

a. Coordination with other agencies.	i) Minimal coordination is required.	____	2
	ii) Required coordination is normal.	____	1
	iii) Extensive coordination is required.	X	0

Subtotal (maximum = 2)

3. Availability of Services and Materials

a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X No ____	1 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X No ____	1 0

TABLE 5-2 (cont'd)
ALTERNATIVE 5

b.	Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes _X_ No ___	1 0

Subtotal (maximum = 3)

TOTAL (maximum = 15) 11

APPENDIX C

TABLE 1-1
ALTERNATIVE 1: NO ACTION
*****
COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Compliance with chemical-specific SCGs	Meets chemical specific SCGs such as groundwater standards	Yes ____ No _X_	4 0
2. Compliance with action-specific SCGs	Meets SCGs such as technology standards for incineration or landfill	Yes ____ No _X_	3 0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act	Yes ____ No _X_	3 0

TOTAL (Maximum = 10) . . . . . _0_

* Compliance to the extent practicable

TABLE 1-2
ALTERNATIVE 1

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes ____ No _X_	20 0
TOTAL (maximum = 20)			____
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes ____ No _X_	3 0
	ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes ____ No _X_	4 0
	iii) Is the exposure to contaminants via sediments/soils acceptable?	Yes _X_ No ____	3 0
Subtotal (maximum = 10)			
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤ 1 in 1,000,000____ ≤ 1 in 100,000 _X_	5
	ii) Health risk		2
Subtotal (maximum = 5)			
4. Magnitude of residual environmental risks after the remediation.	i) Less than acceptable	____	5
	ii) Slightly greater than acceptable	_X_	3
Subtotal (maximum = 5)	iii) Significant risk still exists	____	0
TOTAL (maximum = 20)			_8_

TABLE 2-1
ALTERNATIVE 2: CONTAINMENT

COMPLIANCE* WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Compliance with chemical-specific SCGs	Meets chemical specific SCGs such as groundwater standards	Yes ____ No _X_	4 0
2. Compliance with action-specific SCGs	Meets SCGs such as technology standards for incineration or landfill	Yes _X_ No ____	3 0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act	Yes _X_ No ____	3 0

TOTAL (Maximum = 10) 6

* Compliance to the extent practicable

TABLE 2-2
ALTERNATIVE 2

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes ____ No _X_	20 0
TOTAL (maximum = 20)			_0_
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes _X_ No ____	3 0
	ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes _X_ No ____	4 0
	iii) Is the exposure to contaminants via sediments/soils acceptable?	Yes _X_ No ____	3 0
Subtotal (maximum = 10)			
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤ 1 in 1,000,000 _X_	5
	ii) Health risk	≤ 1 in 100,000 ____	2
Subtotal (maximum = 5)			
4. Magnitude of residual environmental risks after the remediation.	i) Less than acceptable	_X_	5
	ii) Slightly greater than acceptable	____	3
Subtotal (maximum = 5)	iii) Significant risk still exists	____	0
TOTAL (maximum = 20)			_20_

TABLE 2-3
ALTERNATIVE 2: CONTAINMENT

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. On-site or off-site treatment or land disposal	o On-site treatment*	____	3
	o Off-site treatment*	____	1
	o On-site or off-site land disposal	X	0
Subtotal (maximum = 3)			
* treatment is defined as destruction or separations/treatment or solidification/chemical fixation of inorganic wastes			
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes ____	3
		No X	0
Subtotal (maximum = 3)			
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr. X	3
		20-25 yr. ____	2
		15-20 yr. ____	1
		< 15 yr. ____	0
Subtotal (maximum = 3)			
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None ____	3
		≤ 25% ____	2
		25-50% ____	1
		≥ 50% X	0

TABLE 2-3 (cont'd)
ALTERNATIVE 2

	ii)	Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes _X_ No ____	0 2
	iii)	Is the treated residual toxic?	Yes _X_ No ____	0 1
	iv)	Is the treated residual mobile?	Yes ____ No _X_	0 1
Subtotal (maximum = 5)				
5. Adequacy and reliability of controls.	i)	Operation and maintenance required for a period of:	< 5 yr. ____ > 5 yr. _X_	1 0
	ii)	Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv")	Yes _X_ No ____	0 1
	iii)	Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_ Somewhat to not confident ____	1 0
	iv)	Relative degree of long-term monitoring required. (compare with other remedial alternatives)	Minimum ____ Moderate ____ Extensive _X_	2 1 0
Subtotal (maximum = 4)				

TOTAL (maximum =15) 4

TABLE 2-4
ALTERNATIVE 2: CONTAINMENT

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ____	8
		90- 99% ____	7
		80- 90% ____	6
		60- 80% ____	4
		40- 60% ____	2
		20- 40% ____	1
		< 20% _X_	0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes _X_	0
		No ____	2
Subtotal (maximum = 10) If subtotal = 10, go to Factor 3.	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ____	0
		On-site land disposal _X_	1
		Off-site destruction or treatment ____	2
2. Reduction in mobility of hazardous waste.	i) <u>Quality of Available Wastes Immobilized After Destruction/ Treatment</u>	90-100% ____	2
		60- 90% ____	1
		<60% _X_	0
If Factor 2 is not applicable, go to Factor 3.			

TABLE 2-4 (cont'd)
ALTERNATIVE 2

	ii) Method of Immobilization		
	- Reduced mobility by containment	X	0
	- Reduced mobility by alternative treatment technologies	____	3
Subtotal (maximum = 5)			
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	____	5
	Irreversible for most of the hazardous waste constituents.	____	3
	Irreversible for only some of the hazardous waste constituents.	____	2
	Reversible for most of the hazardous waste constituents.	X	0
Subtotal (maximum = 5			

TOTAL (maximum = 15) 1

TABLE 2-5
ALTERNATIVE 2: CONTAINMENT

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ____ No _X_	0 4
	o Can the risk be easily controlled?	Yes ____ No ____	1 0
	o Does the mitigative effort to control risk impact the community life-style?	Yes ____ No ____	0 2
Subtotal (maximum = 4)			
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ____ No _X_	0 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ____ No ____	3 0
Subtotal (maximum = 4)			
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤ 2 yr. _X_ > 2 yr. ____	1 0
	o Required duration of the mitigative effort to control short-term risk.	≤ 2 yr. _X_ > 2 yr. ____	1 0
Subtotal (maximum = 2)			

TOTAL (maximum = 10) 10

TABLE 2-6
ALTERNATIVE 2: CONTAINMENT

IMPLEMENTABILITY
(Relative Weight = 15)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Technical Feasibility			
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X	3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___	2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___	1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X	3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	___	2
c. Schedule of delays due to technical problems.	i) Unlikely	X	2
	ii) Somewhat likely	___	1

TABLE 2-6 (cont'd)
ALTERNATIVE 2

d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	____	2
	ii) Some future remedial actions may be necessary.	X	1

Subtotal (maximum = 10)

2. Administrative Feasibility

a. Coordination with other agencies.	i) Minimal coordination is required.	X	2
	ii) Required coordination is normal.	____	1
	iii) Extensive coordination is required.	____	0

Subtotal (maximum = 2)

3. Availability of Services and Materials

a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X No ____	1 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X No ____	1 0

TABLE 2-6 (cont'd)
ALTERNATIVE 2

b.	Availability of necessary equipment and specialists.	i)	Additional equipment and specialists may be available without significant delay.	Yes X No ____	1 0

Subtotal (maximum = 3)

TOTAL (maximum = 15) 14

TABLE 3-1
ALTERNATIVE 3: VITRIFICATION

COMPLIANCE* WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Compliance with chemical-specific SCGs	Meets chemical specific SCGs such as groundwater standards	Yes _X_ No ____	4 0
2. Compliance with action-specific SCGs	Meets SCGs such as technology standards for incineration or landfill	Yes _X_ No ____	3 0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act	Yes _X_ No ____	3 0

TOTAL (Maximum = 10) 10

* Compliance to the extent practicable

TABLE 3-2
ALTERNATIVE 3: VITRIFICATION

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis			SCORE
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)		Yes ____ No _X_	20 0
TOTAL (maximum = 20)				_0_
2. Human health and the environment exposure after the remediation.	i)	Is the exposure to contaminants via air route acceptable?	Yes _X_ No ____	3 0
	ii)	Is the exposure to contaminants via groundwater/surface water acceptable?	Yes _X_ No ____	4 0
	iii)	Is the exposure to contaminants via sediments/soils acceptable?	Yes _X_ No ____	3 0
Subtotal (maximum = 10)				
3. Magnitude of residual public health risks after the remediation.	i)	Health risk	≤ 1 in 1,000,000_X_	5
	ii)	Health risk	≤ 1 in 100,000 ___	2
Subtotal (maximum = 5)				
4. Magnitude of residual environmental risks after the remediation.	i)	Less than acceptable	_X_	5
	ii)	Slightly greater than acceptable	____	3
	iii)	Significant risk still exists	____	0
Subtotal (maximum = 5)				
TOTAL (maximum = 20)				_20_

TABLE 3-3
ALTERNATIVE 3: VITRIFICATION

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. On-site or off-site treatment or land disposal	o On-site treatment*	X	3
	o Off-site treatment*	___	1
	o On-site or off-site land disposal	___	0
Subtotal (maximum = 3)			
* treatment is defined as destruction or separations/treatment or solidification/chemical fixation of inorganic wastes			
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes X	3
		No ___	0
Subtotal (maximum = 3)			
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr. ___	3
		20-25 yr. ___	2
		15-20 yr. ___	1
		< 15 yr. ___	0
Subtotal (maximum = 3)			
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None X	3
		≤ 25% ___	2
		25-50% ___	1
		≥ 50% ___	0

TABLE 3-3 (cont'd)
ALTERNATIVE 3

	ii)	Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes _X_ No ____	0 2
	iii)	Is the treated residual toxic?	Yes ____ No _X_	0 1
	iv)	Is the treated residual mobile?	Yes ____ No _X_	0 1
Subtotal (maximum = 5)				
5. Adequacy and reliability of controls.	i)	Operation and maintenance required for a period of:	< 5 yr. ____ > 5 yr. _X_	1 0
	ii)	Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv")	Yes ____ No _X_	0 1
	iii)	Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident ____ Somewhat to not confident ____	1 0
	iv)	Relative degree of long-term monitoring required. (compare with other remedial alternatives)	Minimum _X_ Moderate ____ Extensive ____	2 1 0
Subtotal (maximum = 4)				

TOTAL (maximum =15) 14

TABLE 3-4
ALTERNATIVE 3: VITRIFICATION
REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% _X_	8
		90- 99% ____	7
		80- 90% ____	6
		60- 80% ____	4
		40- 60% ____	2
		20- 40% ____	1
		< 20% ____	0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes ____	0
		No _X_	2
Subtotal (maximum = 10) If subtotal = 10, go to Factor 3.	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ____	0
		On-site land disposal ____	1
		Off-site destruction or treatment ____	2
2. Reduction in mobility of hazardous waste.	i) <u>Quality of Available Wastes Immobilized After Destruction/ Treatment</u>	90-100% ____	2
		60- 90% ____	1
		<60% ____	0
If Factor 2 is not applicable, go to Factor 3.			

TABLE 3-4 (cont'd)
ALTERNATIVE 3

	ii) Method of Immobilization		
	- Reduced mobility by containment	____	0
	- Reduced mobility by alternative treatment technologies	____	3
Subtotal (maximum = 5)			
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	X	5
	Irreversible for most of the hazardous waste constituents.	____	3
	Irreversible for only some of the hazardous waste constituents.	____	2
	Reversible for most of the hazardous waste constituents.	____	0
Subtotal (maximum = 5			

TOTAL (maximum = 15) 15

TABLE 3-5
ALTERNATIVE 3: VITRIFICATION

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ____ No _X_	0 4
	o Can the risk be easily controlled?	Yes ____ No ____	1 0
	o Does the mitigative effort to control risk impact the community life-style?	Yes ____ No ____	0 2
Subtotal (maximum = 4)			
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ____ No _X_	0 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ____ No ____	3 0
Subtotal (maximum = 4)			
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤ 2 yr. _X_ > 2 yr. ____	1 0
	o Required duration of the mitigative effort to control short-term risk.	≤ 2 yr. _X_ > 2 yr. ____	1 0
Subtotal (maximum = 2)			

TOTAL (maximum = 10) 10

TABLE 3-6
ALTERNATIVE 3: VITRIFICATION

IMPLEMENTABILITY
(Relative Weight = 15)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Technical Feasibility			
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	____	3
	ii) Somewhat difficult to construct. No uncertainties in construction.	____	2
	iii) Very difficult to construct and/or significant uncertainties in construction.	X	1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X	3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	____	2
c. Schedule of delays due to technical problems.	i) Unlikely	____	2
	ii) Somewhat likely	X	1

TABLE 3-6 (cont'd)
ALTERNATIVE 3

d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X	2
	ii) Some future remedial actions may be necessary.	____	1

Subtotal (maximum = 10)

2. Administrative Feasibility

a. Coordination with other agencies.	i) Minimal coordination is required.	____	2
	ii) Required coordination is normal.	____	1
	iii) Extensive coordination is required.	X	0

Subtotal (maximum = 2)

3. Availability of Services and Materials

a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X No ____	1 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes ____ No X	1 0

TABLE 3-6 (cont'd)
ALTERNATIVE 3

b.	Availability of necessary equipment and specialists.	i)	Additional equipment and specialists may be available without significant delay.	Yes ____ 1 No _X_ 0

Subtotal (maximum = 3)

TOTAL (maximum = 15) 8

TABLE 4-1
ALTERNATIVE 4: CONTAINMENT WITH GROUNDWATER TREATMENT

COMPLIANCE* WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Compliance with chemical-specific SCGs	Meets chemical specific SCGs such as groundwater standards	Yes X No ____	4 0
2. Compliance with action-specific SCGs	Meets SCGs such as technology standards for incineration or landfill	Yes X No ____	3 0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act	Yes X No ____	3 0

TOTAL (Maximum = 10) 10

* Compliance to the extent practicable

TABLE 4-2
ALTERNATIVE 4: CONTAINMENT WITH GROUNDWATER TREATMENT

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes ___ No _X_	20 0
TOTAL (maximum = 20)			___
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes _X_ No ___	3 0
	ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes _X_ No ___	4 0
	iii) Is the exposure to contaminants via sediments/soils acceptable?	Yes _X_ No ___	3 0
Subtotal (maximum = 10)			
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤ 1 in 1,000,000_X_	5
	ii) Health risk	≤ 1 in 100,000 ___	2
Subtotal (maximum = 5)			
4. Magnitude of residual environmental risks after the remediation.	i) Less than acceptable	_X_	5
	ii) Slightly greater than acceptable	___	3
	iii) Significant risk still exists	___	0
Subtotal (maximum = 5)			
TOTAL (maximum = 20)			_20_

TABLE 4-3
ALTERNATIVE 4: CONTAINMENT WITH GROUNDWATER TREATMENT

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. On-site or off-site treatment or land disposal	o On-site treatment*	X	3
	o Off-site treatment*	____	1
	o On-site or off-site land disposal	____	0
Subtotal (maximum = 3)			
* treatment is defined as destruction or separations/treatment or solidification/chemical fixation of inorganic wastes			
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes X	3
		No ____	0
Subtotal (maximum = 3)			
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr. ____	3
		20-25 yr. ____	2
		15-20 yr. ____	1
		< 15 yr. ____	0
Subtotal (maximum = 3)			
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None ____	3
		≤ 25% X	2
		25-50% ____	1
		≥ 50% ____	0

TABLE 4-3 (cont'd)
ALTERNATIVE 4

	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes ____ No _X_	0 2
	iii) Is the treated residual toxic?	Yes ____ No ____	0 1
	iv) Is the treated residual mobile?	Yes ____ No ____	0 1
Subtotal (maximum = 5)			
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	< 5 yr. ____ > 5 yr. _X_	1 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv")	Yes _X_ No ____	0 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_ Somewhat to not confident ____	1 0
	iv) Relative degree of long-term monitoring required. (compare with other remedial alternatives)	Minimum _X_ Moderate ____ Extensive ____	2 1 0
Subtotal (maximum = 4)			

TOTAL (maximum = 15) 13

TABLE 4-4
ALTERNATIVE 4: CONTAINMENT WITH GROUNDWATER TREATMENT REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ____	8
		90- 99% ____	7
		80- 90% _X_	6
		60- 80% ____	4
		40- 60% ____	2
		20- 40% ____	1
		< 20% ____	0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes _X_	0
		No ____	2
Subtotal (maximum = 10) If subtotal = 10, go to Factor 3.	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ____	0
		On-site land disposal ____	1
		Off-site destruction or treatment _X_	2
2. Reduction in mobility of hazardous waste.	i) Quality of Available Wastes Immobilized After Destruction/ Treatment	90-100% ____	2
		60- 90% ____	1
		<60% ____	0
If Factor 2 is not applicable, go to Factor 3.			

TABLE 4-4 (cont'd)
ALTERNATIVE 4

	ii) Method of Immobilization		
	- Reduced mobility by containment	____	0
	- Reduced mobility by alternative treatment technologies	____	3
Subtotal (maximum = 5)			
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	X	5
	Irreversible for most of the hazardous waste constituents.	____	3
	Irreversible for only some of the hazardous waste constituents.	____	2
	Reversible for most of the hazardous waste constituents.	____	0
Subtotal (maximum = 5			

TOTAL (maximum = 15) 13

TABLE 4-5
ALTERNATIVE 4: CONTAINMENT WITH GROUNDWATER TREATMENT

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ____ No _X_	0 4
	o Can the risk be easily controlled?	Yes ____ No ____	1 0
	o Does the mitigative effort to control risk impact the community life-style?	Yes ____ No ____	0 2
Subtotal (maximum = 4)			
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ____ No _X_	0 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ____ No ____	3 0
Subtotal (maximum = 4)			
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤ 2 yr. ____ > 2 yr. _X_	1 0
	o Required duration of the mitigative effort to control short-term risk.	≤ 2 yr. _X_ > 2 yr. ____	1 0
Subtotal (maximum = 2)			

TOTAL (maximum = 10) 9

TABLE 4-6
ALTERNATIVE 4: CONTAINMENT WITH GROUNDWATER TREATMENT

IMPLEMENTABILITY
(Relative Weight = 15)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Technical Feasibility			
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X	3
	ii) Somewhat difficult to construct. No uncertainties in construction.	____	2
	iii) Very difficult to construct and/or significant uncertainties in construction.	____	1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X	3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	____	2
c. Schedule of delays due to technical problems.	i) Unlikely	X	2
	ii) Somewhat likely	____	1

TABLE 4-6 (cont'd)
ALTERNATIVE 4

d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X	2
	ii) Some future remedial actions may be necessary.	____	1

Subtotal (maximum = 10)

2. Administrative Feasibility

a. Coordination with other agencies.	i) Minimal coordination is required.	X	2
	ii) Required coordination is normal.	____	1
	iii) Extensive coordination is required.	____	0

Subtotal (maximum = 2)

3. Availability of Services and Materials

a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X No ____	1 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X No ____	1 0

TABLE 4-6 (cont'd)
ALTERNATIVE 4

b.	Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X No ____	1 0

Subtotal (maximum = 3)

TOTAL (maximum = 15) 15

TABLE 5-1
ALTERNATIVE 5: SOURCE REMOVAL

COMPLIANCE* WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Compliance with chemical-specific SCGs	Meets chemical specific SCGs such as groundwater standards	Yes X No ___	4 0
2. Compliance with action-specific SCGs	Meets SCGs such as technology standards for incineration or landfill	Yes X No ___	3 0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act	Yes ___ No X	3 0

TOTAL (Maximum = 10) 7

* Compliance to the extent practicable

TABLE 5-2
ALTERNATIVE 5: SOURCE REMOVAL

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis			SCORE
1. Use of the site after remediation.		Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes ___ No _X_	20 0
TOTAL (maximum = 20)				20
2. Human health and the environment exposure after the remediation.	i)	Is the exposure to contaminants via air route acceptable?	Yes _X_ No ___	3 0
	ii)	Is the exposure to contaminants via groundwater/surface water acceptable?	Yes _X_ No ___	4 0
	iii)	Is the exposure to contaminants via sediments/soils acceptable?	Yes _X_ No ___	3 0
Subtotal (maximum = 10)				
3. Magnitude of residual public health risks after the remediation.	i)	Health risk	≤ 1 in 1,000,000 _X_	5
	ii)	Health risk	≤ 1 in 100,000 ___	2
Subtotal (maximum = 5)				
4. Magnitude of residual environmental risks after the remediation.	i)	Less than acceptable	_X_	5
	ii)	Slightly greater than acceptable	___	3
	iii)	Significant risk still exists	___	0
Subtotal (maximum = 5)				
TOTAL (maximum = 20)				20

TABLE 5-3
ALTERNATIVE 5: SOURCE REMOVAL

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. On-site or off-site treatment or land disposal	o On-site treatment*	____	3
	o Off-site treatment*	X	1
	o On-site or off-site land disposal	____	0
Subtotal (maximum = 3)			
* treatment is defined as destruction or separations/treatment or solidification/chemical fixation of inorganic wastes			
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes X	3
		No ____	0
Subtotal (maximum = 3)			
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr. X	3
		20-25 yr. ____	2
		15-20 yr. ____	1
		< 15 yr. ____	0
Subtotal (maximum = 3)			
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None X	3
		≤ 25% ____	2
		25-50% ____	1
		≥ 50% ____	0

TABLE 5-3 (cont'd)
ALTERNATIVE 5

	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes ____ No _X_	0 2
	iii) Is the treated residual toxic?	Yes ____ No ____	0 1
	iv) Is the treated residual mobile?	Yes ____ No ____	0 1
Subtotal (maximum = 5)			
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	< 5 yr. ____ > 5 yr. _X_	1 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv")	Yes _X_ No ____	0 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_ Somewhat to not confident ____	1 0
	iv) Relative degree of long-term monitoring required. (compare with other remedial alternatives)	Minimum _X_ Moderate ____ Extensive ____	2 1 0
Subtotal (maximum = 4)			

TOTAL (maximum =15) 15

TABLE 5-4
ALTERNATIVE 5: SOURCE REMOVAL
REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ____	8
		90- 99% _X_	7
		80- 90% ____	6
		60- 80% ____	4
		40- 60% ____	2
		20- 40% ____	1
		< 20% ____	0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes _X_	0
		No ____	2
Subtotal (maximum = 10) If subtotal = 10, go to Factor 3.	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal _X_	0
		On-site land disposal ____	1
		Off-site destruction or treatment ____	2
2. Reduction in mobility of hazardous waste.	i) <u>Quality of Available Wastes Immobilized After Destruction/ Treatment</u>	90-100% ____	2
		60- 90% ____	1
		<60% ____	0
If Factor 2 is not applicable, go to Factor 3.			

TABLE 5-4 (cont'd)
ALTERNATIVE 5

	ii) Method of Immobilization		
	- Reduced mobility by containment	____	0
	- Reduced mobility by alternative treatment technologies	____	3
Subtotal (maximum = 5)			
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	X	5
	Irreversible for most of the hazardous waste constituents.	____	3
	Irreversible for only some of the hazardous waste constituents.	____	2
	Reversible for most of the hazardous waste constituents.	____	0
Subtotal (maximum = 5			

TOTAL (maximum = 15) 12

TABLE 5-5
ALTERNATIVE 5: SOURCE REMOVAL

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ____ No _X_	0 4
	o Can the risk be easily controlled?	Yes ____ No ____	1 0
	o Does the mitigative effort to control risk impact the community life-style?	Yes ____ No ____	0 2
Subtotal (maximum = 4)			
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ____ No _X_	0 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ____ No ____	3 0
Subtotal (maximum = 4)			
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤ 2 yr. ____ > 2 yr. _X_	1 0
	o Required duration of the mitigative effort to control short-term risk.	≤ 2 yr. ____ > 2 yr. _X_	1 0
Subtotal (maximum = 2)			

TOTAL (maximum = 10) 8

TABLE 5-6
ALTERNATIVE 5: SOURCE REMOVAL

IMPLEMENTABILITY
(Relative Weight = 15)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Technical Feasibility			
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	____	3
	ii) Somewhat difficult to construct. No uncertainties in construction.	X	2
	iii) Very difficult to construct and/or significant uncertainties in construction.	____	1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X	3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	____	2
c. Schedule of delays due to technical problems.	i) Unlikely	____	2
	ii) Somewhat likely	X	1

TABLE 5-6 (cont'd)
ALTERNATIVE 5

d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X	2
	ii) Some future remedial actions may be necessary.	____	1

Subtotal (maximum = 10)

2. Administrative Feasibility

a. Coordination with other agencies.	i) Minimal coordination is required.	____	2
	ii) Required coordination is normal.	____	1
	iii) Extensive coordination is required.	X	0

Subtotal (maximum = 2)

3. Availability of Services and Materials

a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X No ____	1 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X No ____	1 0

TABLE 5-6 (cont'd)
ALTERNATIVE 5

b.	Availability of necessary equipment and specialists.	i)	Additional equipment and specialists may be available without significant delay.	Yes _X_ 1 No ___ 0

Subtotal (maximum = 3)

TOTAL (maximum = 15) 11

APPENDIX D

EVALUATION OF REMEDIAL ALTERNATIVES - HUMAN HEALTH AND THE ENVIRONMENT

TABLE OF CONTENTS

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LIST OF TABLES

The NYSDEC Technical and Administrative Guidance Memorandum for the Selection of Remedial Actions at Inactive Hazardous Waste Sites (NYSDEC, 1990) requires that selection of a final remedy be based on a number of specific criteria, one of which is impacts to human health and the environment. Both potential impacts during remediation as well the long-term protectiveness of each alternative following remediation must be addressed. This appendix provides a comparative evaluation of each of the proposed remedial alternatives with respect to impacts on human health and the environment.

As described in Section 3-2 of the main body of the report, a total of five remedial alternatives were selected for detailed evaluation. These include:

1) No Action;
2) Containment;
3) Vitrification;
4) Containment with Groundwater Treatment;
5) Source Removal.

In the following sections (Sections 1.0 through 5.0), a brief description of each alternative is provided followed by an evaluation of: (1) potential impacts to human health and the environment during remedial activities; and (2) the long-term effectiveness of the remedy in terms of reducing risk to human health and the environment. The final section (Section 6.0) summarizes the conclusions of this study and presents the relevant NYSDEC criteria

1.0 NO ACTION ALTERNATIVE

Under Alternative #1, the No Action Alternative, no remedial actions would be taken at the site. Deed restrictions would be placed on the property which would permanently prevent any development which would disturb the integrity of the industrial fill area. The deed restrictions would also preclude the installation of any on-site water supply wells. The six foot high fence currently surrounding the entire site would be maintained, and access to the site would continue to be limited to authorized personnel through the use of locked gates. Monitoring of ground water, soil, air and surface water would be conducted regularly.

1.1 Impacts to Human Health and the Environment During Remediation

Because no remediation would take place under the No Action Alternative, there are no short-term risks to human health and the environment to be evaluated under this alternative.

1.2 Impacts to Human Health and the Environment Following Remediation

1.2.1 Impacts to Human Health

Public health risks under the No Action Alternative were quantitatively evaluated in the baseline risk assessment which was conducted as part of the Remedial Investigation (RI) (ERM, 1990). A summary of the potential exposure routes, chemicals of concern, and potential risks as calculated in that study is provided below.

Table 1-1 lists all potential exposure routes under the No Action Alternative. As indicated in this table, under current conditions there are three potentially significant exposure routes for nearby residents: (1) inhalation of volatilized organics from site soils; (2) inhalation of fugitive dust emissions from site soils; and (3) direct contact with off-site surface waters and sediment. Under future conditions, in addition to these exposure routes, it was assumed that a water supply well was installed in the immediate site vicinity for residential drinking water. Although deed restrictions would prevent the use of ground water at the site under the No Action Alternative, it is theoretically possible that ground water could migrate off-site. It should be noted that this represents an unlikely exposure scenario since the area is well-served by public water supply. In order to address potential future on-site exposures, it was assumed that construction workers were employed in developing the site for industrial purposes.

Construction workers are expected to represent the most exposed population to on-site contamination because employees at an industrial facility would not normally be expected to come into direct contact with site soils with any frequency. Potential exposure pathways for construction workers include both inhalation of volatilized chemicals and fugitive dust emissions from site soils, as well as direct contact with site soils (dermal absorption and/or incidental soil ingestion).

Table 1-2 list the chemicals of greatest concern (indicator chemicals) in site soil and ground water as identified in the baseline risk assessment. Potential exposures to each of these chemicals were quantitatively evaluated. Table 1-3 provides a summary of the models and assumptions used in estimating exposure point concentrations and resulting intakes.

Table 1-4 presents a summary of the risks to human health under the No Action Alternative. As indicated in this table, none of the potential exposure routes identified above results in unacceptable exposures to nearby residents or hypothetical future short-term construction workers based on available data. However, as described in Section 1.5.3.6 of the main body of this report, groundwater within the industrial fill area could not be sampled due to the presence

TABLE 1-1
POTENTIAL HUMAN EXPOSURE PATHWAYS UNDER THE NO ACTION ALTERNATIVE

1. Current Conditions - Residential Exposures

   - o volatilization of contaminants in soil
   - o fugitive dust emissions
   - o direct contact with off-site surface water/sediments

2. Future Conditions - Residential Exposures

   - o ingestion of ground water
   - o volatilization of contaminants in soil
   - o fugitive dust emissions

3. Future Conditions - Hypothetical Site Construction Workers

   - o direct contact with soil
   - o volatilization of contaminants in soil
   - o fugitive dust emissions

TABLE 1-2
INDICATOR CHEMICALS EVALUATED IN THE BASELINE RISK ASSESSMENT

Soil	Ground Water
Acetone	Arsenic
Arsenic	Barium
Barium	Copper
Benzene	Lead
Chromium	Mercury
Copper	Nickel
Lead	Zinc
Nickel	
Polycyclic Aromatic Hydrocarbons	
Benzo(a)anthracene	
Benzo(a)pyrene	
Benzo(b)fluoranthene	
Benzo(k)fluoranthene	
Chrysene	
Indeno(1,2,3-cd)pyrene	

TABLE 1-3
SUMMARY OF ASSUMPTIONS USED IN EVALUATION OF THE NO ACTION ALTERNATIVE (BASELINE RISK ASSESSMENT)

Exposure Route	Model/Assumptions Used (1)
Current Conditions - Residential Exposures	
o Inhalation of volatilized contaminants from site soils	o Due to the proximity of residences, ambient concentrations were estimated at the site itself using a box model. o The average concentration of each chemical in soil was used as input to the model. The average was calculated using the highest concentration detected at any depth at a given location. o One centimeter of clean soil occurs over the contaminated soil. o Exposure occurs 24 hours per day for 30 years.
o Inhalation of fugitive dust emissions from site soils	o Fugitive dust emissions are due to wind erosion only. o Due to the proximity of residences, ambient concentrations were estimated at the site itself using a box model. o The average concentration of each chemical in the top two feet of soil was used as input to the model. o Exposure occurs 24 hours per day for 30 years.
o Direct contact with off-site surface waters/sediments	o Qualitative evaluation based on projected exposures by neighboring children and comparison of detected concentrations to drinking water standards (MCLs).
Future Conditions - Residential Exposures	
o Ingestion of groundwater	o Intakes estimated based on average concentration of each chemical in all on-site wells. o Exposure occurs for 30 years (2 liters of water consumed per day).
Future Conditions - Construction Workers	
o Direct contact with site soils	o Intakes estimated based on average concentration of each chemical in soil. o Exposure occurs for six months.

TABLE 1-3 (cont'd)
SUMMARY OF ASSUMPTIONS USED IN EVALUATION OF THE NO ACTION ALTERNATIVE (BASELINE RISK ASSESSMENT)

Exposure Route	Model/Assumptions Used (1)
o Inhalation of volatilized contaminants from site soils	o Ambient air concentrations estimated using a box model. o The average concentration of each chemical was used as input to the model. the average was calculated using the highest concentration detected at any depth at a given location. o Exposure occurs for six months.
o Inhalation of fugitive dust emissions	o Ambient air concentrations of the chemicals of concern are estimated based on worst-case maximum allowable nuisance dust concentrations under OSHA (PEL=5 mg/m3 respirable particulates) with chemical concentrations in dust being the same as in average site soils. o Exposure occurs for six months.

(1) For further details on the models and assumptions used, see the Baseline Risk Assessment (ERM, 1990).

TABLE 1-4

RISKS TO HUMAN HEALTH UNDER THE NO ACTION ALTERNATIVE

Routes Evaluated	Carcinogenic Risk	Noncarcinogenic Risk
1. Current - Residents		
A. Volatilization	--	--
B. Fugitive Dust	--	--
C. Direct Contact with Off-Site Surface Water/Sediment[1]	--	--
2. Future - Residents		
A. Ground water	--[2]	--
B. Volatilization	--	--
C. Fugitive Dust	--	--
3. Future - On-Site Construction Workers		
A. Direct Contact	--	--
B. Volatilization	--	--
C. Fugitive Dust	--[3]	--

NOTE: -- = Risk is within the acceptable range. For carcinogenic effects, a risk of less than $1x10^{-6}$ (one in one million) is considered acceptable. For noncarcinogenic effects, a hazard index of less than one is considered acceptable.

(1) Exposures were qualitatively evaluated.

(2) The baseline risk assessment indicated that the concentrations of arsenic in ground water would result in a $1x10^{-4}$ risk if ingested. However, this risk was calculated on a very conservative basis, as summarized below:

- U.S. EPA has indicated that the arsenic potency factor presently used may overestimate the true health risks associated with arsenic (U.S. EPA, 1989).

TABLE 1-4 (cont'd)

RISKS TO HUMAN HEALTH UNDER THE NO ACTION ALTERNATIVE

- The average arsenic concentration in site ground water was calculated assuming that arsenic is present at 5 ug/l (one-half the detection limit) in all samples in which arsenic was reported as below the detection limit. This may result in an overestimate of actual site-wide arsenic concentrations since arsenic was not detected in 26 of 36 samples analyzed.

- The conservatively estimated average concentration of arsenic in site ground water (5.6 ug/l) is well within the average background concentration of arsenic in well water (<20 ug/l) as reported in the Toxicological Profile for Arsenic prepared by the ATDSR (1989). The maximum arsenic concentration detected at the site is also less than Federal and New York State Maximum Contaminant Level of 50 ug/l.

Based on the conservative nature of the risk assessment, no unacceptable adverse health effects due to arsenic in ground water are expected.

(3) The risk associated with inhalation of chromium in fugitive dusts marginally exceeds the de minimus risk of 1×10^{-6} (1.9×10^{-6}). However, this calculation conservatively assumes that all chromium present in the site soils occurs as hexavalent chromium. Under ambient conditions, hexavalent chromium is reduced to trivalent chromium in soils; therefore, it is unlikely that all chromium is present as hexavalent chromium.

of a highly viscous product which solidified and subsequently blocked monitoring well MW-1. Therefore, it is conservatively assumed that exposures via ground water and air (due to potential volatilization of contaminants in ground water) may not be acceptable under the No Action Alternative.

1.2.2 Impacts to the Environment

Potential environmental impacts under the No Action Alternative were also evaluated in the baseline risk assessment conducted as part of the RI. That study concluded that no adverse effects to sensitive environmental resources are expected to occur as a result of site contamination based on a review of location-specific Applicable or Relevant and Appropriate Requirements (ARARs) (freshwater wetlands, regulated streams, navigable water bodies, and significant habitats/endangered and threatened species) (ERM, 1990). Surface water and sediment criteria for the protection of aquatic life were exceeded in some of the samples collected as part of the RI. However, many of these criteria were also exceeded in the upstream (background) samples. Based on the guidelines provided in the draft NYSDEC guidance document on Habitat Based Assessment (NYSDEC, 1989), remediation of sediments was not considered necessary. However, because the residual soil contamination could potentially pose some threat to wildlife and aquatic

life via direct contact and stormwater runoff, the risk to ecological resources under the No Action Alternative is considered to be slightly greater than acceptable.

2.0 ALTERNATIVE #2 - CONTAINMENT

Alternative #2 (Slurry Wall with Cap) would involve construction of a slurry wall around the industrial fill area. The wall would be constructed from the surface down to bedrock and would therefore essentially prevent any migration of ground water into or out of the industrial fill area. In addition, the industrial fill area would be capped with clay and soil, thereby preventing or significantly reducing any further infiltration of rain and volatile and fugitive dust air emissions. Deed restrictions, fencing and monitoring would also be implemented as described under the No Action Alternative.

2.1 Impacts to Human Health and the Environment During Remediation

2.1.1 Protection of the Community During Remedial Actions

Soil excavation would be required to install the slurry wall, which would be likely to result in short-term generation of fugitive dust emissions and an increase in volatilization of contaminants from soils. Because the nearest residents are immediately adjacent to the site, potential exposures via inhalation of airborne contamination during these activities is possible.

Potential exposures via inhalation of airborne contamination by hypothetical on-site construction workers engaged in earth-moving activities were evaluated in the baseline risk assessment (No Action Alternative). A number of conservative assumptions were used in that evaluation, as summarized in Table 1-4. For example, it was assumed that ambient dust levels are equivalent to the maximum allowable dust levels under OSHA for 8 hours per day, five days per week for the entire 6-month hypothetical construction period. It was further assumed that only one centimeter of clean soil was present over soil contaminated with volatile organics. Because of the conservative nature of that evaluation, exposures to residents in off-site areas during remediation are expected to be no greater than (and perhaps significantly less than) the exposures to on-site construction workers under the No Action Alternative. Since exposures to hypothetical construction workers resulted in no unacceptable risks, short-term exposures to the residential community during remediation are also expected to be acceptable.

2.1.2 Protection of Environmental Resources During Remedial Actions

As described in the No Action Alternative, there are no sensitive environmental resources in the site vicinity. Impacts to local ecological resources would occur due to the disturbance and loss of habitat resulting from removal of vegetation and soil

excavation. However, any adverse impacts are in all likelihood outweighed by the elimination of any further contact with contaminated soil. Stormwater runoff from the site during excavation could potentially discharge to the adjacent intermittent stream and wetlands. These impacts are not expected to be significant and can, in any event, be mitigated through the use of erosion control devices.

2.2 Impacts to Human Health and the Environment Following Remediation

2.2.1 Impacts to Human Health

The presence of the cap and slurry wall would effectively eliminate all potential exposure routes to residual contamination. The cap would prevent or significantly minimize fugitive dust emissions and volatilization of contaminants in soil. Direct contact with contaminated soil and generation of contaminated stormwater runoff would also be eliminated by the cap. The slurry wall would prevent any off-site migration of contaminants in ground water and the deed restrictions would prevent any future use of site ground water. Therefore, this alternative is considered to be fully protective of human health and to adequately reduce the risks posed under the No Action Alternative.

2.2.2 Impacts to the Environment

Capping of the industrial fill area would effectively eliminate the only potentially significant impacts to environmental resources under the No Action Alternative (direct contact with contaminated soil and discharge of contaminated stormwater runoff to the adjacent stream and wetlands). Therefore, Alternative #2 is considered to reduce the risk to environmental resources to well below acceptable levels.

3.0 ALTERNATIVE #3 - VITRIFICATION

The in-situ vitrification process is a patented process which converts soil and contaminants to a stable glass-like material. An electric current is passed between two electrodes in the ground and heats soil and other materials to approximately 3000°F. Metallic and inorganic materials are dissolved in or encapsulated within the vitrified mass. Gases evolve from the melt or go into solution. Evolved gases which reach the surface are collected in a hood and processed in an off-gas absorption system. Following remediation, a layer of clean fill would be placed on the treated area. The same deed restrictions, fencing and monitoring requirements as described in the No Action Alternative would also apply.

3.1 Impacts to Human Health and the Environment During Remediation

3.1.1 Protection of the Community During Remedial Actions

The high temperatures and the voltage necessary to reach such high temperatures could represent a risk to illegal trespassers at the site during remediation. However, the presence of fencing and restricted access is expected to eliminate any such risk. Any evolved gases generated during remediation would be trapped and treated to prevent

unacceptable inhalation exposures to the community. Therefore, no significant adverse effects to the community during remediation are expected.

3.1.2 Protection of Environmental Resources During Remedial Actions

Impacts to local ecological resources would occur due to the disturbance and loss of habitat resulting from the vitrification process. However, any adverse impacts are in all likelihood outweighed by the elimination of any further contact with contaminated soil. It is expected that wildlife in the site vicinity will avoid entering the area undergoing vitrification due to the elevated temperatures. Therefore, no significant adverse impacts to environmental resources are expected to result during remediation.

3.2 Impacts to Human Health and the Environment Following Remediation

3.2.1 Impacts to Human Health

The vitrification process will effectively eliminate all potential human exposure pathways. The vitrification process essentially solidifies all soil and contaminated materials into a stable glass-like material, thereby preventing migration of soil and

subsequent exposure to these contaminants. The placement of clean fill on the surface would eliminate any direct contact with the treated material. Any gases which evolve are permanently trapped or escape to the surface where they are treated in an off-gas absorption system. Since temperatures reach up to 3000°F, any ground water present in the heated area is volatilized and treated in the off-gas absorption system. Therefore, this alternative is considered to be fully protective of human health and to adequately reduce the risks posed under the No Action Alternative.

3.2.2 Impacts to the Environment

The containment of contamination in a vitrified mass and the placement of clean fill on the surface would effectively prevent any exposures to environmental resources. Therefore, this alternative is expected to reduce the risk to environmental resources to well below acceptable levels.

4.0 ALTERNATIVE #4 - CONTAINMENT WITH GROUNDWATER TREATMENT

Alternative #4 is the same as Alternative #2 (Containment) with the addition of ground water collection and treatment and soil venting. Ground water within the slurry wall would be collected and either treated on-site using a prefabricated air stripping package or sent off-site to the Albany POTW. The soil venting system would vent to the atmosphere via a system of pipes. Exhaust blowers would be connected to the piping to enhance extraction of volatile organics. A carbon filter would be added to the system to trap any such organics. Deed restrictions, fencing and monitoring would also be implemented as described in the No Action Alternative.

4.1 Impacts to Human Health and the Environment During Remediation

4.1.1 Protection of the Community During Remedial Actions

Soil excavation would be required to install the slurry wall and the subsurface drain, which would be likely to result in short-term generation of fugitive dust emissions and an increase in volatilization of contaminants from soil. As described under Alternative #2 (Containment), the projected exposures to nearby residents during remediation are expected to be less than those incurred by hypothetical on-site short-term construction

workers under the No Action Alternative because of the conservative assumptions used in that evaluation (see Table 1-4). Since exposures to hypothetical construction workers resulted in no unacceptable risks, short-term exposures to the residential community during remediation are also expected to be acceptable.

As described above, the soil venting system would be equipped with activated carbon to trap volatile organics. Therefore, no additional inhalation risks are expected during the operation of this system. If the ground water is treated on-site with a prefabricated stripping package, the water would be treated to acceptable levels prior to discharge. The necessary emissions equipment would also be used to ensure that air emissions are at an acceptable level. Therefore, no significant short-term risks to human health are anticipated during remediation under this alternative.

4.1.2 Protection of Environmental Resources During Remedial Actions

As described in Alternative #2 (Containment), impacts to local ecological resources would occur due to the disturbance and loss of habitat resulting from removal of vegetation and soil excavation. However, any adverse impacts are in all likelihood outweighed by the prevention of any further contact with contamination. Stormwater runoff from the site during excavation could potentially discharge to the adjacent

intermittent stream and wetlands. These impacts are not expected to be significant and can, in any event, be mitigated through the use of erosion control devices.

4.2 Impacts to Human Health and the Environment Following Remediation

4.2.1 Impacts to Human Health

As described in Alternative #2, the presence of the cap and slurry wall would effectively eliminate all potential exposure routes to residual contamination. Any ground water treated on-site or air emissions resulting from remedial measures would be treated to acceptable levels prior to discharge. Therefore, this alternative is considered to be fully protective of human health and to adequately reduce the risks posed under the No Action Alternative.

4.2.2 Impacts to the Environment

As discussed under Alternative #2, capping of the industrial fill area would effectively eliminate the only potentially significant impacts to environmental resources under the No Action Alternative (direct contact with contaminated soil and discharge of

contaminated stormwater runoff to the adjacent stream and wetlands). Therefore, Alternative #4 is considered to reduce the risk to environmental resources to well below acceptable levels.

5.0 ALTERNATIVE #5 - SOURCE REMOVAL

Alternative #5 would involve complete excavation of the industrial fill area. These soils would be dewatered and incinerated, and the residuals disposed of in a secure RCRA landfill. Vacuum extraction of volatile organics may be implemented prior to excavation if volatile organic emissions are significant. Although on-site incineration and on-site disposal in a landfill is technically feasible, neither of these options is likely due to economic and political constraints. Further analysis of these options may be found in Section 3.2.2 of the main body of this report under the discussion of Alternative #5. For purposes of this assessment, it is assumed that the fill material is transported off-site for incineration and permanent disposal. A ground water collection and treatment system would also be installed under this alternative. Ground water would either be treated on-site using a prefabricated air stripping package or sent off-site to the Albany POTW. Deed restrictions, fencing and monitoring would also be implemented as described in the No Action Alternative.

5.1 Impacts to Human Health and the Environment During Remediation

5.1.1 Protection of the Community During Remedial Actions

Removal of contaminated soil from the industrial fill area would require significant excavation. Soil excavation is likely to result in fugitive dust generation and increased emission of volatile organics. As described under Alternative #2 (Containment), the projected exposures to nearby residents during remediation are expected to be less than those incurred by hypothetical on-site short-term construction workers under the No Action Alternative because of the conservative assumptions used in that evaluation (see Table 1-4). Since exposures to hypothetical construction workers resulted in no unacceptable risks, short-term exposures to the residential community during remediation are also expected to be acceptable. If an on-site air stripping package is used, ground water would be treated to acceptable levels prior to discharge. The stripper would also be equipped with carbon filters to ensure that air emissions standards are met. Therefore, no unacceptable risks to the community are expected to be posed by remediation.

5.1.2 Protection of Environmental Resources During Remedial Actions

As described in the baseline risk assessment, there are no sensitive environmental resources in the site vicinity. Impacts to local ecological resources will occur due to the disturbance and loss of habitat resulting from removal of vegetation and soil excavation. However, any adverse impacts are in all likelihood outweighed by the prevention of any further contact with contamination. Stormwater runoff from the site during excavation could potentially discharge to the adjacent intermittent stream and wetlands. These impacts are not expected to be significant and can, in any event, be mitigated through the use of erosion control devices. If ground water is treated on-site, it will be treated to acceptable levels prior to discharge and, therefore, will not have a significant impact on fish and wildlife.

5.2 Impacts to Human Health and the Environment Following Remediation

5.2.1 Impacts to Human Health

Excavation of contaminated soil and ground water collection and treatment would effectively eliminate all potential human exposure routes. Under this alternative, no significant residual contamination would remain at the site. Therefore, this alternative

is expected to be fully protective of human health and to effectively mitigate any adverse impacts associated with the site under current conditions.

5.2.2 Impacts to the Environment

As described above, this alternative would effectively result in complete removal of all significant soil and ground water contamination. Therefore, this alternative is considered to be fully protective of the environment.

6.0 SUMMARY AND CONCLUSIONS

The NYSDEC Technical and Administrative Guidance Memorandum for the Selection of Remedial Actions at Inactive Hazardous Waste Sites (NYSDEC, 1990) provides summary tables for each of the criteria to be evaluated in selection of a remedial alternative. Impacts to human health and the environment during remedial actions are included in the table labelled Short-Term Effectiveness (see Table 6-1). Scores can range from 0 to 4 for both human impacts and environmental impacts, resulting in a total maximum score of 8 for impacts during remediation. In addition, the time required to implement the alternative and the duration of the mitigative effort are scored, making a score of 10 the maximum for the overall short-term effectiveness evaluation. Impacts to human health and the environment following remediation are addressed in the table labelled Protection of Human Health and the Environment (see Table 6-3). Scores can range from 0 to a maximum of 20, with 20 being the most protective score. Each of the five remedial alternatives is scored based on the information presented in the preceding sections, as shown in Tables 6-1 through 6-9 and summarized below.

As discussed in Section 1.1, the No Action Alternative was evaluated in the baseline risk assessment. That study indicated that none of the potential exposure routes represents a significant threat to human health. However, because ground water in the industrial fill area could not be sampled, it was conservatively assumed that exposures via ground water and

air could potentially be unacceptable with a risk level of less than 1×10^{-5}. The risk to environmental resources is rated at slightly greater than acceptable resulting in a total score of 8 (out of 20) for long-term protection of human health and the environment.

All of the remaining remedial alternatives (#2 through #5) received the maximum score of 8 for protection of the community and the environment during remedial actions. Any waste streams generated as a result of remediation (e.g., air and water from the air stripper and air from the soil venting system) would be adequately treated prior to discharge. Each of the remaining four remedial alternatives also received the maximum score of 20 for protection of human health and the environment following remediation. Each of these alternatives effectively eliminates all potential human or environmental exposure routes by either source control or removal.

TABLE 6-1
ALTERNATIVE 1: NO ACTION

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes ____ No _X_	20 0
TOTAL (maximum = 20)			20
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes ____ No _X_	3 0
	ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes ____ No _X_	4 0
	iii) Is the exposure to contaminants via sediments/soils acceptable?	Yes _X_ No ____	3 0
Subtotal (maximum = 10)			
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤ 1 in 1,000,000____	5
	ii) Health risk	≤ 1 in 100,000 _X_	2
Subtotal (maximum = 5)			
4. Magnitude of residual environmental risks after the remediation.	i) Less than acceptable	____	5
	ii) Slightly greater than acceptable	_X_	3
Subtotal (maximum = 5)	iii) Significant risk still exists	____	0
TOTAL (maximum = 20)			8

TABLE 6-2
ALTERNATIVE 2: CONTAINMENT

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ____ No _X_	0 4
	o Can the risk be easily controlled?	Yes ____ No ____	1 0
	o Does the mitigative effort to control risk impact the community life-style?	Yes ____ No ____	0 2
Subtotal (maximum = 4)			
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ____ No _X_	0 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ____ No ____	3 0
Subtotal (maximum = 4)			
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤ 2 yr. _X_ > 2 yr. ____	1 0
	o Required duration of the mitigative effort to control short-term risk.	≤ 2 yr. _X_ > 2 yr. ____	1 0
Subtotal (maximum = 2)			

TOTAL (maximum = 10) 10

TABLE 6-3
ALTERNATIVE 2: CONTAINMENT

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes ____ No _X_	20 0
TOTAL (maximum = 20)			20
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes _X_ No ____	3 0
	ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes _X_ No ____	4 0
	iii) Is the exposure to contaminants via sediments/soils acceptable?	Yes _X_ No ____	3 0
Subtotal (maximum = 10)			
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤ 1 in 1,000,000_X_	5
	ii) Health risk	≤ 1 in 100,000 ___	2
Subtotal (maximum = 5)			
4. Magnitude of residual environmental risks after the remediation.	i) Less than acceptable	_X_	5
	ii) Slightly greater than acceptable	____	3
	iii) Significant risk still exists	____	0
Subtotal (maximum = 5)			
TOTAL (maximum = 20)			20

TABLE 6-4
ALTERNATIVE 3: VITRIFICATION

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ____ No _X_	0 4
	o Can the risk be easily controlled?	Yes ____ No ____	1 0
	o Does the mitigative effort to control risk impact the community life-style?	Yes ____ No ____	0 2
Subtotal (maximum = 4)			
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ____ No _X_	0 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ____ No ____	3 0
Subtotal (maximum = 4)			
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤ 2 yr. _X_ > 2 yr. ____	1 0
	o Required duration of the mitigative effort to control short-term risk.	≤ 2 yr. _X_ > 2 yr. ____	1 0
Subtotal (maximum = 2)			
TOTAL (maximum = 10)			10

TABLE 6-5
ALTERNATIVE 3: VITRIFICATION

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes ___ No _X_	20 0
TOTAL (maximum = 20)			20
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes _X_ No ___	3 0
	ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes _X_ No ___	4 0
	iii) Is the exposure to contaminants via sediments/soils acceptable?	Yes _X_ No ___	3 0
Subtotal (maximum = 10)			
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤ 1 in 1,000,000 _X_	5
	ii) Health risk	≤ 1 in 100,000 ___	2
Subtotal (maximum = 5)			
4. Magnitude of residual environmental risks after the remediation.	i) Less than acceptable	_X_	5
	ii) Slightly greater than acceptable	___	3
Subtotal (maximum = 5)	iii) Significant risk still exists	___	0
TOTAL (maximum = 20)			20

TABLE 6-6
ALTERNATIVE 4: CONTAINMENT WITH GROUNDWATER TREATMENT

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis			SCORE
1. Protection of community during remedial actions.	o	Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ____ No _X_	0 4
	o	Can the risk be easily controlled?	Yes ____ No ____	1 0
	o	Does the mitigative effort to control risk impact the community life-style?	Yes ____ No ____	0 2
Subtotal (maximum = 4)				
2. Environmental Impacts	o	Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ____ No _X_	0 4
	o	Are the available mitigative measures reliable to minimize potential impacts?	Yes ____ No ____	3 0
Subtotal (maximum = 4)				
3. Time to implement the remedy.	o	What is the required time to implement the remedy?	≤ 2 yr. ____ > 2 yr. _X_	1 0
	o	Required duration of the mitigative effort to control short-term risk.	≤ 2 yr. _X_ > 2 yr. ____	1 0
Subtotal (maximum = 2)				

Total (maximum = 10) 9

TABLE 6-7
ALTERNATIVE 4: CONTAINMENT WITH GROUNDWATER TREATMENT

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes ___ No _X_	20 0
TOTAL (maximum = 20)			20
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes _X_ No ___	3 0
	ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes _X_ No ___	4 0
	iii) Is the exposure to contaminants via sediments/soils acceptable?	Yes _X_ No ___	3 0
Subtotal (maximum = 10)			
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤ 1 in 1,000,000 _X_	5
	ii) Health risk	≤ 1 in 100,000 ___	2
Subtotal (maximum = 5)			
4. Magnitude of residual environmental risks after the remediation.	i) Less than acceptable	_X_	5
	ii) Slightly greater than acceptable	___	3
Subtotal (maximum = 5)	iii) Significant risk still exists	___	0
TOTAL (maximum = 20)			20

TABLE 6-8
ALTERNATIVE 5: SOURCE REMOVAL

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis			SCORE
1. Protection of community during remedial actions.	o	Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ____ No _X_	0 4
	o	Can the risk be easily controlled?	Yes ____ No ____	1 0
	o	Does the mitigative effort to control risk impact the community life-style?	Yes ____ No ____	0 2
Subtotal (maximum = 4)				
2. Environmental Impacts	o	Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ____ No _X_	0 4
	o	Are the available mitigative measures reliable to minimize potential impacts?	Yes ____ No ____	3 0
Subtotal (maximum = 4)				
3. Time to implement the remedy.	o	What is the required time to implement the remedy?	≤ 2 yr. ____ > 2 yr. _X_	1 0
	o	Required duration of the mitigative effort to control short-term risk.	≤ 2 yr. ____ > 2 yr. _X_	1 0
Subtotal (maximum = 2)				
TOTAL (maximum = 10)				8

TABLE 6-9
ALTERNATIVE 5: SOURCE REMOVAL

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

ANALYSIS FACTOR	Basis for Evaluation During Detailed Analysis		SCORE
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes ___ No _X_	20 0
TOTAL (maximum = 20)			20
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes _X_ No ___	3 0
	ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes _X_ No ___	4 0
	iii) Is the exposure to contaminants via sediments/soils acceptable?	Yes _X_ No ___	3 0
Subtotal (maximum = 10)			
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤ 1 in 1,000,000 _X_	5
	ii) Health risk	≤ 1 in 100,000 ___	2
Subtotal (maximum = 5)			
4. Magnitude of residual environmental risks after the remediation.	i) Less than acceptable	_X_	5
	ii) Slightly greater than acceptable	___	3
Subtotal (maximum = 5)	iii) Significant risk still exists	___	0
TOTAL (maximum = 20)			20

REFERENCES

ATSDR, 1989. Draft Toxicological Profile for Arsenic.

ERM, 1990. Remedial Investigation Report. Norton Company Restoration Site. Watervliet, New York. January 19.

NYSDEC, 1990. Technical and Administrative Guidance Memorandum (TAGM) for the Selection of Remedial Actions at Inactive Hazardous Waste Sites. Division of Hazardous Waste Remediation. Revised May 15, 1990.

NYSDEC, 1989. Draft Habitat Based Assessment Guidance Document. Division of Fish and Wildlife.

U.S. EPA, 1989. Memo from Bruce Means, Manager, Health Effects Program, dated March 1, 1989.

APPENDIX E

Alternative 2 - Capital Cost Estimate Details

Slurry Wall Installation - $350,000

250,50 ft^2 x \$12.50/ft^2 = \$313,125 round to \$350,000

Cap Installation - $430,000

190,000 ft^2 x \$2.20/ft^2 = \$418,000 round to \$430,000

Additional Capital Costs - $1,220,000

- includes mob/demob; miscellaneous items (insurance, fencing, etc.); regulatory issues; site management; design; supervision; health and safety; contingency; and overhead and profit.

Total Capital costs - $2,000,000

Alternative 3 - Capital Cost Estimate Details

In-Situ Vitrification

• Treatability Testing and Analysis	$60,000
• Mobilization/Demobilization	$300,000
• Technical Support	$100,000
• Melting 180,000 tons x $300/ton =	$54,000,000
Subtotal =	$54,460,000

Additional Capital Costs - $6,540,000

- includes mob/demob; miscellaneous items (insurance, fencing, etc.) regulatory issues; site management; design; supervision; health and safety; contingency; and overhead and profit.

Total Capital Costs - $61,000,000

Alternative 4 - Capital Cost Estimate Details

Slurry Wall Installation -	$350,000
25,050 ft^2 x $12.50/$ft^2$ = $313,125 round to $350,000	
Cap Installation -	$430,000
190,000 ft^2 x $2.20/$ft^2$ = $418,000 round to $430,000	
Bio-Polymer Drainage Trench -	$600,000
Bio-Polymer Trench - 700 lin. ft. x 15 ft x $45/$ft^2$ = $472,500	
Piping - (700 lin. ft. + 450 lin. ft.) x $50/lin. ft. = $57,500	
Vapor Extraction System -	$200,000
Building and Unit - $80,000	
Installation - 2000 lin. ft. x $50/lin. ft. = $100,000	
Anticipated Groundwater Treatment System -	$75,000
Limited Excavated Soil Disposal -	$100,000
Additional Capital Costs -	$1,945,000

- includes mob/demob; miscellaneous items (insurance, fencing, etc.); regulatory issues; site management; design; supervision; health and safety; contingency; and overhead and profit.

Total Capital Costs -	$3,700,000

Alternative 5 - Capital Cost Estimate Details

Excavation of Industrial Fill - $2,650,000

(190,000 ft^2 x 15 ft) /27 ft^3/cu.yd. x $25/cu.yd. = $2,638,888

Disposal of Contaminated Soil (assumed 20%) - $56,100,000

22,000 cu.yd. x 1.5 ton/cu.yd. x $1700/ton = $56,100,000

Disposal of Industrial Debris (assumed 20%) - $9,900,000

22,000 cu.yd. x 1.5 ton/cu.yd x $300/ton = $9,900,000

Replacement Fill - $1,550,000

44,000 cu.yd. x $35/cu.yd. = $1,540,000

Water Treatment System - $50,000

Additional Capital Costs - $1,275,000

- includes mob/demob; miscellaneous items (insurance, fencing, etc.); regulatory issues; site management; design; supervision; health and safety; contingency; and overhead and profit.

Total Capital Costs - $71,525,000

Site Name: Norton Company

Site Number: 4-01-010

Administrative Record File Index

1. File Index
2. Record of Decision, March 1991
3. Order on Consent, December 1987
4. Order on Consent, July 1989
5. Phase II Investigation, March 1988
6. Phase II Investigation, Appendices, March 1988
7. Phase II Investigation, Addendum, April 1988
8. QA/QC Protocol for Collection of Environmental Samples, October 1988
9. Draft Citizen Participation Plan
10. Remedial Investigation Report, January 1990
11. Feasibility Study, October 1990, Revised January 1991
12. Proposed Remedial Action Plan, February 1991
13. The Stenographic Record, February 1991
14. Remedial Design, March 1992
15. Remedial Program, Operation and Maintenance Manual, April 1993
16. Norton Construction Blueprints
17. Norton Final Grading Plan

18. Correspondence File

19. Norton Sampling Data