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Site Investigation and Remedial Alternatives Report Tract II Site Niagara Falls, New York

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List of Acronyms

ACM	asbestos-containing material
ASC	Analytical Services Center
ASP	Analytical Services Protocol
BGS	below ground surface
C&D	construction and demolition
CERCLA	Comprehensive Environmental Response, Compensation, and Liabilities Act
CPP	Community Participation Plan
E & E	Ecology and Environment Engineering, P.C.
EPA	United States Environmental Protection Agency
FSP	Field Sampling Plan
HASP	Health and Safety Plan
ICR	industrial code rule
mg	milligram
mg/kg	milligram per kilogram
NGVC	National Geodetic Vertical Datum
NTU	nephelometric turbidity units
NYSDOH	New York State Department of Health
NYSDOL	New York State Department of Labor
O&M	operations and maintenance
OVA	organic vapor analyzer
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PEL	permissible exposure limit
PLM	polarized light microscopy
PVC	polyvinyl chloride
QAPjP	Quality Assurance Project Plan

List of Acronyms (Cont.)

RBC	risk-based concentration
ROW	right-of-way
SI/RAR	Site Investigation/Remedial Alternatives Report
SVOC	semivolatile organic compound
TAGM	Technical and Administrative Guidance Memorandum
TAL	target analyte list
TCL	target compound list
TSCA	Toxic Substances Control Act
TSI	thermal systems insulation
USDA	United States Department of Agriculture
USGS	United States Geological Survey
VAT	vinyl asbestos tile
VOC	volatile organic compound

Executive Summary

Ecology and Environment Engineering, P.C. (E & E), conducted a site investigation (SI) at the Tract II property in Niagara Falls, New York, to characterize the site's environmental condition, including the nature and extent of contamination in various site media. Based on the data obtained during the SI, several remedial alternatives for the site were examined to determine their cost and feasibility. This project was performed under the Brownfields Program of the New York State Clean Water/Clean Air Bond Act. The primary objective of this project was to determine whether environmental conditions at the site pose an unacceptable risk to human health and the environment and review cost effective remedial alternatives that would make the site suitable for redevelopment and compliant with applicable statutes.

The 24.5-acre site is located on Highland Avenue. Beech Avenue runs along the south side of the site. A right-of-way for Niagara Mohawk Power Corporation bisects the east and west sides of the site and runs north from the current terminus of 15th Street. The site is bordered on the north by a large brick building formerly used as a battery manufacturing facility and other industrial properties. Residential communities are located east, west, and south of the site. These areas include a school, a park, churches, and a few small businesses.

As of the dates of field activities for this investigation, there is no activity at the site. Currently, access to the site is unrestricted. The site is vacant except for a concrete foundation located in the central part of the property and a dilapidated cinder block building at the northeast area. The former structure built above the concrete foundation was used by the Moore Business Form Manufacturing Company. Below this foundation is an underground parking garage, which is in an advanced state of disrepair. It contains numerous fallen pipes and asbestos insulation, as well as a concrete pit that appears to be a floor sump. A berm containing burned packaging material and construction and demolition (C & D) fill is located northwest of the garage. The building at the northeast part of the site is also severely dilapidated. Abundant scrap material and refuse such as old wire, carts, and junk televisions have been disposed at the ground surface on the north side of this building.

Refuse, tires, and C & D dumped indiscriminately about the site. The surface soil over the majority of the site appears to be a mixture of industrial fill, sand, and silt.

Initial field investigations were conducted during late November and early December 1998. These activities consisted of surface soil sampling and test pit excavation and sampling; subsurface soil boring; sump water and sludge sampling; a groundwater study which included monitoring well installation, sampling, and permeability testing; and collection of suspected asbestos-containing material (ACM). Following the initial field tasks, the sampling points and other site features were surveyed by a subcontractor to E & E. Additional field activities consisting of an asbestos survey of the underground parking garage, surface soil sampling, suspected ACM sampling at the dilapidated building, and an inventory of potentially hazardous materials in the dilapidated building were conducted on June 6, 2000. All field activities were conducted according to the methods described in the Project Work Plan (E & E 1998). This document included a Field Sampling Plan (FSP), a Quality Assurance Project Plan (QAPjP), a Health and Safety Plan (HASP), and a Community Participation Plan (CPP).

All soil and water samples collected during the 1998 investigation activities were analyzed for a full compliment of target compound list (TCL) organics and target analyte list (TAL) inorganics plus cyanide. In addition, a total of three samples of suspected ACM were collected in the garage and analyzed for positive asbestos identification. Soil samples collected in June 2000 were submitted for TAL metals plus mercury analyses. Also, seven building material samples were collected and submitted for either polarized light microscopy (PLM) or transmission electron microscopy (TEM) analysis.

Data interpretation for this investigation consisted primarily of screening the analytical results against applicable standards and guidance values issued by the New York State Department of Environmental Conservation (NYSDEC). The Technical Assistance and Guidance Memorandum (TAGM) 4046 was used for screening analytical results for soil. The United States Environmental Protection Agency (EPA) OSWER Directive No. 9355.4-12, July 1994, establishes a health-based soil screening value of 400 mg/kg for protection of children in residential areas. Groundwater results were compared to New York State Ambient Water Quality Standards and Guidance (6 NYCRR Parts 700-706, 1998). New York State Department of Health (NYSDOH) cleanup goals for achieving unrestricted or restricted use conditions were used for developing remedial alternatives in this study.

A risk evaluation consisting of a screening-level assessment was conducted to determine which site contaminants pose significant threats to human health and the environment. In order to address contaminants posing significant threats, several remedial alternatives were considered on a feasibility and cost basis, and soil cleanup goals were developed for two site conditions: unrestricted and restricted use. Based on the evolving Highland Avenue redevelopment plan, reuse of the site seems likely. However, the site's proximity to existing industry and the prevalence of C & D fill material at the site preclude the likelihood that it will be redeveloped as residential property.

Analytical data showed elevated lead (32,500 mg/kg maximum) and polyaromatic hydrocarbons (PAHs) concentrations are present in site surface and subsurface soil. These contaminants are most prevalent on the east side of the site. The polychlorinated biphenyl (PCB) Aroclor-1260 was found at an elevated concentration (1.4 mg/kg estimated) in a near-surface soil sample from the boring for well MW-2 at the south-central part of the site. This PCB compound was also found at a high concentration (3.1%) in sludge collected from the bottom of the concrete pit (sump) in the underground garage. High concentrations of lead and other metals were also found in this sample. The VOC methylene chloride was found at an elevated concentration in the ground water at monitoring well MW-04, located at the southeast corner of the site.

In addition, each of the three ACM samples collected in the underground garage contained asbestos: chrysotile asbestos at percentages ranging from 10% to 68%. Four of the seven building material samples collected at the dilapidated building also contained asbestos. Concentrations ranged from <1% to 80% chrysotile in five of the seven samples. (Samples containing < 1% asbestos are not classified as ACM.)

The risk analysis performed on the investigation results showed elevated levels of lead in surface soils currently pose an unacceptable level of risk to children who may repeatedly enter the unrestricted site. Also, repeated exposure to these high concentrations of lead could pose adverse health effects to future site workers. Access to the sump located in the underground garage is not completely restricted. PCBs, PAHs, and metals (including lead) in the sump sludge pose an unacceptable level of risk.

Based on the maximum concentrations of carcinogenic PAHs detected in surface soils, the estimated upper-bound cancer risk for future site workers is approximately 5.4×10^{-5}, which is within EPA's acceptable range of 10^{-6} to 10^{-4}. The estimated cancer risk posed to a site worker based on the maximum level of arsenic found at the site would be 2×10^{-5}, within the acceptable range.

Methylene chloride and four inorganic analytes were detected at concentrations exceeding NYSDEC Class GA standards. Methylene chloride is classified as a Group 2 human carcinogen. However, under the current and likely future site conditions, there are no plausible pathways for human exposure to contamination in site groundwater. The site area is served by a municipal water system and groundwater is not a current or anticipated future potable water source.

Remedial action objectives were developed for unrestricted and restricted use conditions. Remedial alternatives considered were containment, excavation and removal, installation of institutional controls to limit site access, and no action. The cost to return the site to unrestricted use cleanup goals by containing the site with a vegetated cap, performing excavation in two localized "hot spots," and establishing long-term deed restrictions would cost approximately $851,800. Using the same methods but returning the site to restricted use cleanup goals would entail containing a smaller area and very limited excavation at a cost of approximately $468,800.

Excavation and off-site disposal of contaminated soil to return the site to unrestricted use cleanup goals would cost approximately $8,935,000. Using the same methods but returning the site to restricted use cleanup goals would cost approximately $1,238,200.

Implementation of institutional controls such as fencing, warning signs, and deed restrictions would cost approximately $142,500. This alternative is not specific to returning the site to either unrestricted or restricted use conditions.

A "No action" (Alternative 4) approach at the site would not involve any remediation or use of institutional controls. There are no capital costs associated with this alternative.

In addition, inspections of both buildings on site have indicated the presence of asbestos. It is recommended that the asbestos be removed to eliminate public health risks. The cost to remove asbestos in both buildings is approximately $139,750, including engineering, oversight, and contingencies.

Demolition of the concrete garage and the dilapidated building at the site are recommended, as portions of these structures have collapsed. The estimated cost to demolish the garage and dilapidated building is approximately $485,000, including engineering, oversight, and contingencies. (Cost estimates presented in this report are based on data available at the time this report was written.)

1

Introduction

This Site Investigation/Remedial Alternatives Report (SI/RAR) describes activities performed by Ecology and Environment Engineering, P.C. (E & E), in the site investigation, characterization, and remedial alternatives review program conducted at the Tract II Site located in Niagara Falls, New York.

1.1 Purpose of Report

The purpose of this report is to present a concise summary of the site investigation activities and findings, as well as the results of contaminant risk and remedial alternative evaluations for the Tract II Site.

1.2 Site Background

1.2.1 Site Description

The Tract II Site is a 24.5-acre parcel located on Highland Avenue in the City of Niagara Falls (see Figure 1-1). The site is bordered on the north by a large brick building formerly used as a battery manufacturing facility and other industrial properties (see Figure 1-2). Highland Avenue and Beech Avenue run along the west and south sides of the site, respectively. 17th Street residences and a church back up to the east side of the site. A right-of-way (ROW) for Niagara Mohawk Power Corporation bisects the east and west sides of the site and runs north from the current terminus of 15th Street. Residences and a park are located on 15th Street south of the site.

Currently, the site is vacant except for a concrete foundation located in the central part of the property and a dilapidated cinder block building in the northeast area. Below the concrete foundation is an underground parking garage which is in an advanced state of disrepair. The garage contains an abundance of collapsing walls, fallen pipes and asbestos insulation, junk car parts, and a sump. Prior to its demolition, the structure above the garage was used by the Moore Business Form Manufacturing Company. A

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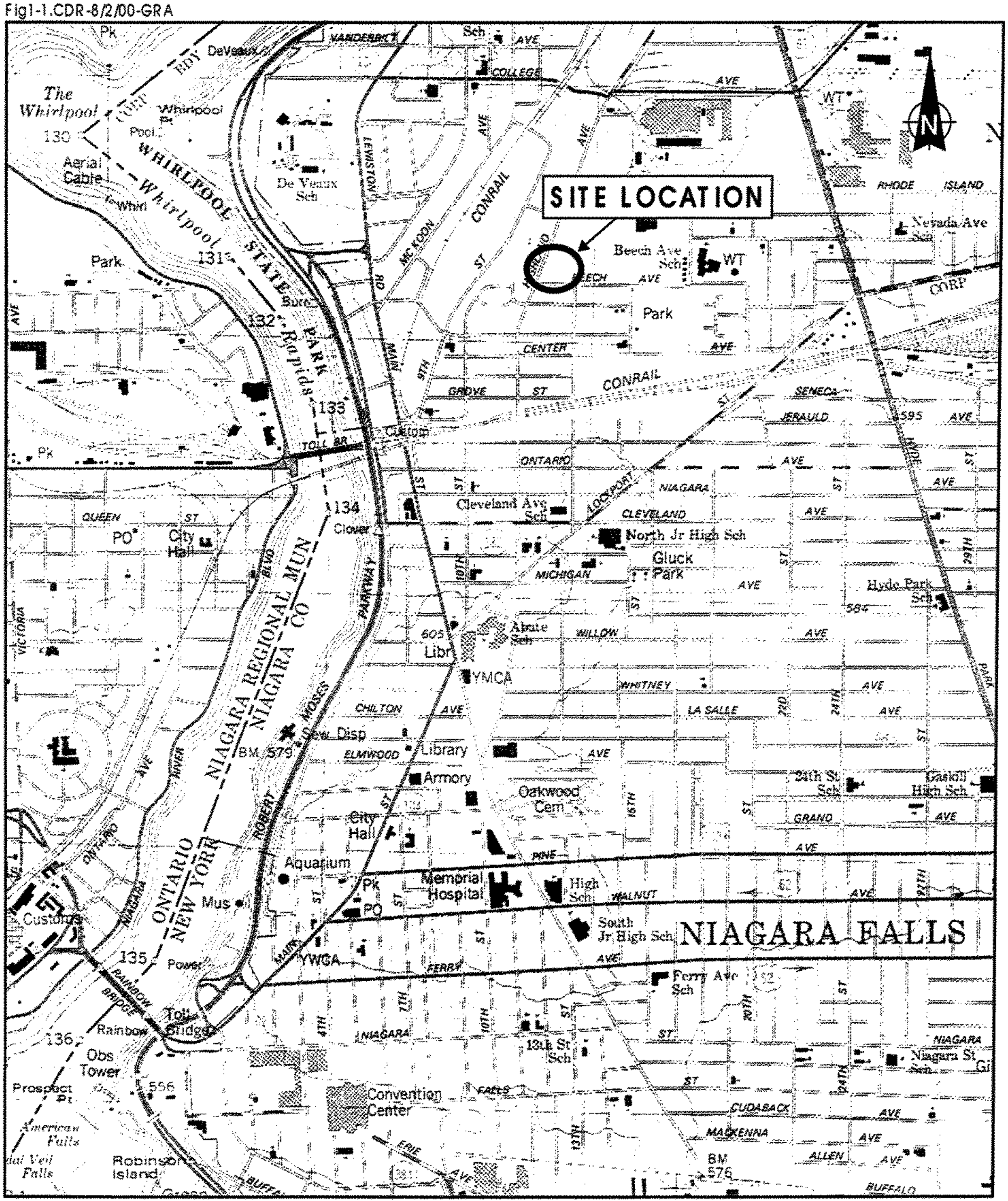


SOURCE: Ecology and Environment, Inc. 1998

SCALE

0 ½ 1 Mile

Figure 1-1 SITE LOCATION MAP, TRACT II SITE, NIAGARA FALLS, NEW YORK

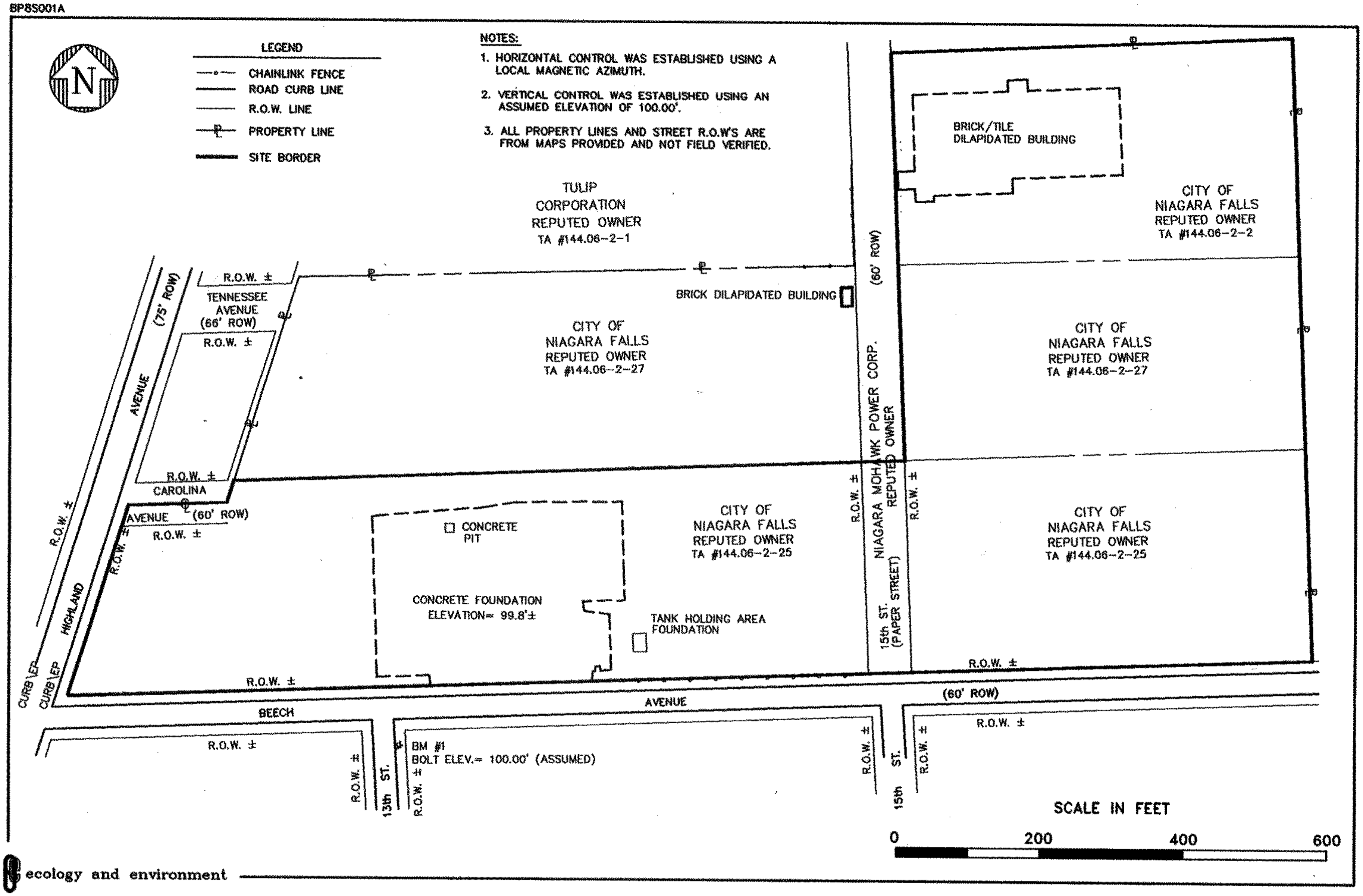


FIGURE 1-2 SITE BASE MAP, TRACT II SITE, NIAGARA FALLS, NEW YORK

railway spur was located between this former building and the battery manufacturing plant directly north of the site. The cinder block building at the northeast part of the site appears to be used currently for general storage, although some sections are collapsing. Abundant scrap material and refuse such as old wire, carts, and junk televisions have been disposed on the north side of this building.

Access from the west side of the site is unrestricted from Highland Avenue, and limited access exists along the south and east sides of the site. A 3-foot-tall berm comprised of concrete and other fill material exists on the east and southeast edges of the site. Subsurface fill material consisting mainly of debris from demolished buildings is prevalent beneath most of the site, particularly the east side. This side of the site is overgrown with tall brush (mostly Japanese knotweed) and small trees. Minor remains of a building destroyed by fire are located on the eastern part of the site, and a former aboveground storage tank area containing several concrete tank cradles is located near the southeast of the parking garage.

Currently, there is no activity at the site, however, there is an abundance of surface debris and refuse, including indiscriminately dumped tires, construction and demolition C & D) debris, and garbage. The surface soil over the majority of the site appears to be a mixture of industrial fill, gravel, and sand.

1.2.2 Site History

Sanborn Map Company fire insurance maps, aerial photographs, and historic newspaper articles pertaining to the Tract II Site were studied as part of this investigation. Prior to 1903, the undeveloped parcel of land which included the site was the property of the Deveaux Trust. After 1903, the Carter Crume Co., Ltd. purchased the parcel and opened a business form factory on the site. This business evolved into the American Sales Book Co., Ltd. and eventually into Moore Business Forms, Inc. The facility was known as the "Highland Ave. Plant," with bindery buildings on the west side of the property. It was one of the largest operations of its kind in the world, with as many as 1,200 employees at its peak production. The plant operated for almost 70 years before closing in approximately 1971.

An aerial photograph dated May 5, 1991, shows that the bindery section of the plant is still intact as of that date, but the large building directly east of it had been demolished. As of the time of the latent field investigation activities for this report, the concrete foundation for this section of the plant remains in place over the underground parking garage. The bindery buildings on the west side of the site have since been demolished. The dilapidated building currently located on the northeast part of the site was formerly used by the battery manufacturing plant, which operated directly north of Moore Business Forms.

1.2.3 Surrounding Land Uses

The site is located within the Highland Avenue Redevelopment Area. The areas surrounding the site have a variety of land uses. Industrial use dominates the areas north of the site, while residential communities are located south, east, and west of the site. The residences east and west of the site are primarily managed by the Niagara Falls Housing Authority, although some individual homes also exist on separate lots.

Homes and a few closed small businesses are located on the west side of Highland Avenue across from the site. Residential communities continue west toward a Conrail ROW and Niagara University (Deveaux campus). The concentration of industry along Highland Avenue increases northward from the site and small businesses become more prevalent toward its southern extent. The south side of Beech Avenue, between Highland Avenue and 13th Street, includes individual homes and a sheet metal business. An electric power transformer building, homes, and a church occupy the south side of Beech Avenue between 13th and 15th Streets. A community park is located directly south of Beech Avenue, east of 15th Street.

Residential communities and a Girls Club are located further south leading to a wide Conrail ROW. The rail yard separates this area from those areas further south. Individual homes and a church which front on 17th Street, back up to the east side of the site. Kalfas Magnet Elementary School is located on the east side of 17th Street, north of Beech Avenue. Residential communities continue to the east, across Hyde Park Boulevard. Interspersed in the residential areas are a few community service buildings and small businesses such as convenience stores.

A large expanse of industrial properties lies directly north of the site, continuing to the intersection of Highland Avenue and Hyde Park Boulevard.

1.3 Report Organization

The remainder of this report is divided into seven sections. The site investigation field activities are discussed in Section 2, followed by a presentation of analytical findings in Section 3. Section 4 presents the physical characteristics of the site, and Section 5 provides an evaluation, based on analytical data, of human health risks posed by the site. An engineering study presenting remedial goals and the feasibility of implementing various remedial alternatives follows in Sections 6 and 7, respectively. A project summary is presented in Section 8.

2

Site Investigation Field Activities

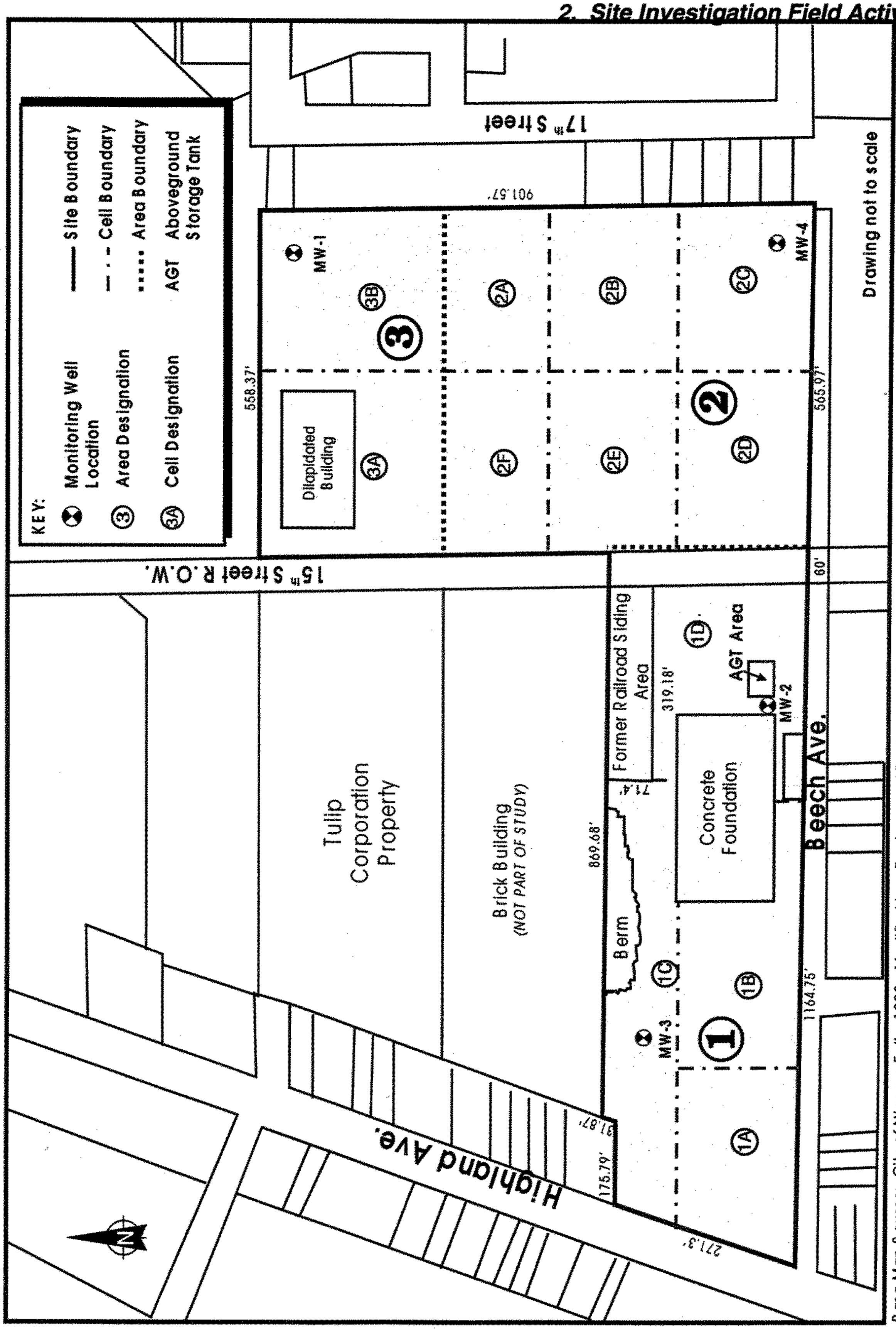
2.1 Introduction

Field investigation activities at the Tract II Site consisted of surface soil sampling; test pit excavation and sampling; subsurface soil boring and sampling; sump sludge and water sampling; collection of suspected asbestos-containing material (ACM); and a groundwater study which included monitoring well installation, sampling, and permeability testing. Following these efforts, the sampling points and other site features were surveyed by Lu Engineers, P.C., a subcontractor to E & E. All field activities were conducted according to the methods described in the Project Work Plan (E & E 1998). This document included a Field Sampling Plan (FSP), a Quality Assurance Project Plan (QAPjP), a Health and Safety Plan (HASP), and a Community Participation Plan (CPP).

In order to achieve accurate site representation and distribute unbiased surface soil sample and test pit locations, the site was partitioned into 12 approximately equal cells (see Figure 2-1). The cells' dimensions were delineated using a Brunton compass and a survey tape. Cell intersections were staked in the field, as were all sampling and drilling locations.

2.2 Surface Soil Sampling

Two surface soil samplings were conducted. In November 1998, 12 surface soil composite samples were collected from depths between 0 and 2 feet below ground surface (BGS) at the site. Eleven of these soil samples were taken from 0 to 0.5 foot BGS because of the prevalence of coarse fill material (demolition debris) below the site. A black, fine-grained sand found in Cell 1-C allowed for a sampling depth to 2 feet BGS. A five-way composite was taken in each of the cell areas. A star configuration, with a center point and four arms 50 feet in length, was used to provide adequate coverage within each cell. It should be noted that the surface soil at the site appeared to be comprised mainly of fine to medium-grained industrial fill.



Base Map Source: City of Niagara Falls, 1998. Modified by: Ecology and Environment Engineering, P.C., 1998

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Figure 2-1 SITE SKETCH SHOWING CELL LOCATIONS, TRACT II SITE, NIAGARA FALLS, NEW YORK

In addition to the surface soil samples described above, one background surface soil sample was collected northeast of Cell 3B at the northern extent of 17th Street. This soil sample was composited in the same manner as for those samples described above. Trees and brush were present where the background samples were collected. It appears that industrial activity has had relatively little impact on this location. Each of the surface soil samples was analyzed for target compound list (TCL) volatile organic compounds (VOCs), TCL semivolatile organics compounds (SVOCs), TCL pesticide/polychlorinated biphenyls (PCBs), target analyte list (TAL) metals, and cyanide.

On June 6, 2000, an investigation team collected three composite surface soil samples and one duplicate sample from around the dilapidated building at the northeast corner of the site. Sample SST2-A contained 5 aliquots collected around the loading dock area of the building. Sample SST2-B contained 3 aliquots collected around the television debris piles located north of the building. Sample SST2-C contained 5 aliquots collected around the perimeter of the building in areas not previously sampled. Each sample was submitted for TAL metals and mercury analyses. Analytical data are discussed in Section 3.2 sample locations are indicated on Figure 2-2.

2.3 Subsurface Soil Investigation

Subsurface soils were investigated using two methods: excavation of test pits and split-spoon sampling with a drill rig. Digging of the test pits was performed using a track-mounted excavator and the split-spoon soil samples were collected using a truck-mounted drill rig.

All areas where excavation or drilling were performed were initially checked for the presence of utilities by the Underground Facilities Protection Organization. These locations were also surveyed in advance of the investigation using a Heliflux magnetic locator. There were no significant anomalies found during this survey and no large metal objects were found during excavation or drilling.

2.3.1 Test Pit Excavation

Using a track-mounted backhoe, a total of 12 test pits were excavated at the site, one in each cell area. Each test pit was approximately 2 feet wide, 10 feet long, and 8 feet deep. One of the test pits transected the berm located at the north border of Cell 1C, and two test pits were excavated in areas where depressions were observed in Cells 2A and 2F. Three test pits were excavated at Cells 2B, 2C, and 3B where old battery casings were observed at the ground surface.

Each of the test pits was logged by the on-site geologist. An organic vapor analyzer (OVA) was used to screen each of the test pits for the presence of VOCs. Soil samples were collected where OVA responses were encountered, or chemical contamination or staining were observed. If no signs of contamination were visible, soil samples were taken at the ground surface where the potential for exposure by direct contact would be the highest. In Cell 2D, a soil sample was collected from the natural clay-rich soil at 7.5 to 8 feet BGS to determine if leaching of contaminants from the overlying fill has occurred. Each of the soil samples from the test pits was analyzed for TCL VOCs, TCL SVOCs, TCL pesticide/PCBs, TAL metals, and cyanide. Test pit locations are indicated on Figure 2-2.

2.3.2 Subsurface Soil Sampling

For the purpose of installing groundwater monitoring wells, four boreholes were drilled at the site. Overburden soils were continuously sampled from grade to bedrock using a split-spoon sampler. The stratigraphy was logged by the on-site geologist and each of the split-spoon recoveries was screened for the presence of VOCs using an OVA. Borehole logs are presented in Appendix A. Based on the presence of visible contamination, such as staining, one soil sample from each boring was collected for chemical analysis. Each of the subsurface soil samples was analyzed for TCL VOCs, TCL SVOCs, TCL pesticide/PCBs, TAL metals, and cyanide.

Two of the split-spoon recoveries were submitted for geotechnical analysis; one from the upper unsaturated interval and one at the groundwater interface. This geotechnical testing consisted of grain size determination by sieve and hydrometer, moisture content, and Atterburg Limits.

2.4 Groundwater Investigation

2.4.1 Monitoring Well Installation and Development

A monitoring well was installed in each of the four subsurface soil borings. These wells were used to provide information regarding groundwater quality, flow direction, and hydraulic gradient. Rising-head slug tests were performed at the wells to determine the hydraulic conductivity of the aquifer. Well boring data are discussed below.

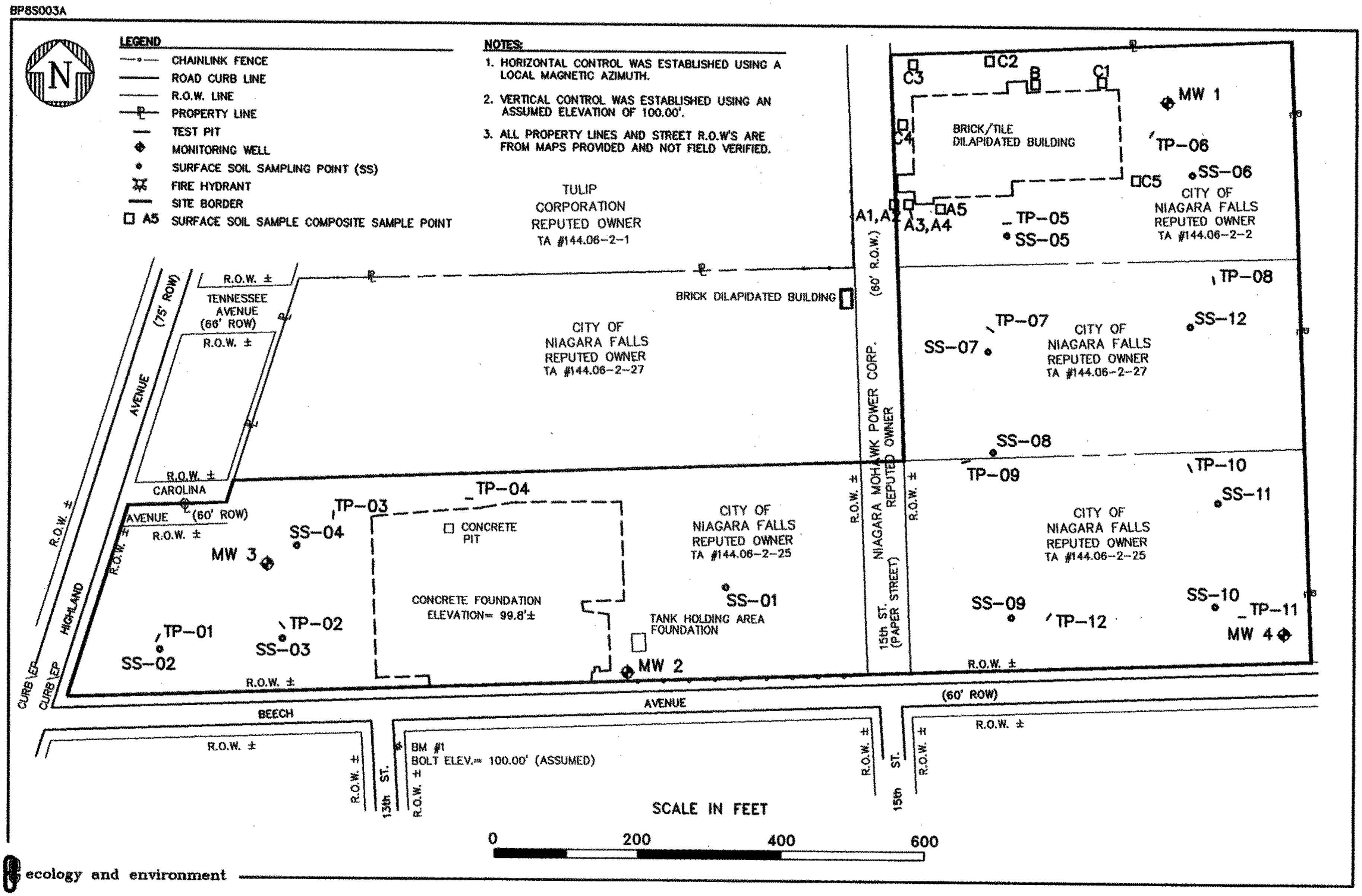

FIGURE 2-2 SAMPLE LOCATIONS, TRACT II SITE, NIAGARA FALLS, NEW YORK

The overburden was penetrated using 4 ¼-inch hollow-stem augers as per the methodology prescribed in the FSP. As shown on the well construction summary in Table 2-1, the Lockport dolostone bedrock was encountered between 12.5 and 23.5 feet BGS. The tight, clay-rich soil above the bedrock did not appear capable of supplying an appreciable quantity of groundwater to a well, therefore, the upper portion of the bedrock was reamed using a 4 ⅞-inch roller bit. Four bedrock interface wells were installed at the site. These wells were constructed with a 2-inch inner diameter polyvinyl chloride (PVC) riser and screen. Each screen was 10 feet in length, with No. 10 (0.010-inch wide) slot size. The screening depth intervals are specified in Table 2-1. Well locations are indicated on Figure 2-2.

Table 2-1 Groundwater Monitoring Well Construction Summary, Tract II Site

Well Number	Well Type	Depth to Bedrock (ft. bgs)	Total Depth (ft. bgs)	Screen Interval (ft. bgs)	Ground Elevation[a] (ft.)	Top of PVC Inner Casing Elevation[a] (ft.)
MW-01	Bedrock	23.5	25.9	15.5-25.5	95.68	98.11
MW-02	Bedrock	14.8	19.5	9-19	96.04	98.24
MW-03	Bedrock	19.5	24.5	14-24	95.15	97.55
MW-04	Bedrock	12.5	19	8.5-18.5	94.92	97.62

[a] Reference datum used for site is 100 feet at the northeast corner of 13th Street.

Key:

bgs = Below ground surface.
ft. = Feet.
PVC = Polyvinyl chloride.

After a period of at least 24 hours, the wells were developed by purging at least five well volumes and then further purged until pH, temperature, and specific conductance readings were stabilized.

2.4.2 Groundwater Sampling

Groundwater samples were collected from each of the wells using clean, stainless steel bailers. Prior to sample collection, at least five measured well volumes were purged from the wells. Field measurements of pH, temperature, specific conductance, and turbidity were taken at the time of sample collection as shown on Table 2-2. In wells MW-1, -2, and -3, initially high turbidities lowered to less than 50 nephelometric turbidity units (NTUs) prior to collection of the samples for total (unfiltered) TAL metals analysis. In MW-4, the final turbidity of the metals sample was 50.9 NTUs due to the clay-rich composition of the soil at this location. Each of the groundwater samples was analyzed for TCL VOCs, TCL SVOCs, TCL pesticide/PCBs, TAL metals, and cyanide.

Table 2-2 Groundwater Field Chemistry Measurements During Groundwater Sampling, Tract II Site

Well Number	pH (s.u.)	Temperature (°F)	Conductivity (µS/cm)	Initial Turbidity (NTUs)	Turbidity Following Respite Period
MW-01	8.11	49	575	>1000	25.3
MW-02	7.39	51.1	754	984	35.7
MW-03	7.82	49.8	540	>1000	24.7
MW-04	6.40	49.3	1043	>1000	50.9

Key:

°F = Degrees Fahrenheit.
µS/cm = MicroSiemens per centimeter.
NTU = Nephelometric turbidity units.
s.u. = Standard units.

2.4.3 Permeability Testing

Rising-head slug tests were performed on each of the four wells to determine the hydraulic conductivity of the aquifer. First, a pressure transducer and a weighted cylinder of known volume (slug) were lowered into the water column. The water level in the well was allowed to equilibrate and the test was then started as the slug was removed. An assumed anisotropy ratio of 1 and saturated thickness of 10 feet were used for the upper weathered zone of the Lockport dolostone.

Based on the solution method of Bouwer and Rice and the measured recovery of the volume of water displaced by the slug, hydraulic conductivities were calculated for each of the four wells (see Appendix C). The hydraulic conductivities for these wells are shown below in Table 2-3.

Table 2-3 Hydraulic Conductivities for Wells, Tract II Site

Well Number	Hydraulic Conductivity (K)
MW-01	1.15 x 10^{-2} centimeters per second (cm/sec)
MW-02	3.47 x 10^{-3} cm/sec
MW-03	1.26 x 10^{-5} cm/sec
MW-04	1.07 x 10^{-2} cm/sec

This range of hydraulic conductivity provided sufficient recharge for purging and sampling purposes.

2.5 Underground Garage/Sump Inspection

A general inspection of the inside of the underground parking garage was initially performed to assess the condition of the structure and determine if oil, grease, or hazardous substances are present. In addition, a concrete pit located in the floor of a mechanical room in the northwest part of the garage was sampled. This pit apparently is used as a sump. A sludge sample from the 12-inch-thick sludge layer and a water sample from the 6-inch water depth were collected. These samples were analyzed for TCL VOCs, TCL SVOCs, TCL pesticide/PCBs, TAL metals, and cyanide. Figure 2-2 indicates the location of the concrete pit.

2.6 Asbestos Sampling at the Underground Parking Garage

During the initial inspection of the underground garage, three samples of suspected ACMs were collected. Each of these samples was collected from around or below pipes in the garage. A sample of a "mud" compound which had fallen from a pipe elbow on the east side of the garage was collected first. Next, a sample of a corrugated "cardboard" type of insulation was taken at the northeast part of the garage beneath a pipe from which it had fallen. Last, a sample of "air-cell"-type insulation was collected from around a fallen pipe on the west side of the garage. Each of these three samples was analyzed by a subcontracted laboratory for the presence of asbestos using polarized light microscopy (PLM). At the time of sample collection, general observations were made regarding the prevalence of the various types of suspected asbestos. Results of this inspection are discussed in Section 4.

At the requests of the City of Niagara Falls and NYSDEC, E & E conducted an asbestos survey of the underground parking garage to evaluate the volume and cost to remediate the asbestos-containing materials identified by the initial ACM analyses. A two-person investigation team consisting of a certified asbestos inspector and a health/safety officer conducted an asbestos survey on June 6, 2000. Findings are presented in Section 4.5.

Following asbestos analysis of the parking garage, the investigation team collected building materials samples at the dilapidated building located in the northeast corner of the site. Sample results are discussed in Section 3.7.

2.7 Dilapidated Building Inspection

The dilapidated building located at the northeast corner of the site was inspected for hazardous material presence and for asbestos-containing materials. An E & E field team consisting of a certified asbestos inspector and a health/safety officer investigated the building on June 6, 2000. The team collected seven samples of possible ACMs, inventoried possible hazardous materials, and collected three composite surface soil samples. Surface soil sampling activities were discussed in Section 2.2; surface soil sample results are discussed in Section 3.2. ACM analytical results are presented in Section 3.7, while results of the overall inspection are discussed in Section 4.5.

2.8 Sample Identification

All samples collected by E & E at the Tract II Site were identified using a specific sample identification number. The following sample identification system was used for this project.

Monitoring Well Numbers

MWT2-01OB

where:

MW = Monitoring well designation
T2 = Tract II
01 = Well number
OB = Well type: Overburden well.

Groundwater Sample Numbers

MWT2-01OB-WTmmddyy

where:

MWT2-01OB = Source (well number)
W = Water
T = Sample Type: O = Original
D = Duplicate
F = Filtered
B = Field Blank
T = Trip Blank
R = Rinsate

mmddyy = Date sampled.

Surface Soil Sample Number (Initial Investigation)

SST2-01-ST

where:

SS = Surface soil designation
T2 = Tract II
01 = Surface soil location number
S = Soil
T = Sample type, as above.

Second Investigation Effort

SST2-A

where:

SS = Surface soil designation
T2 = Tract II
A = Sample number.

Test Pit Soil Sample Numbers

TPT2-XX-HST

where:

TP = Test pit designation
T2 = Tract II
XX = Test pit number
H = Depth interval (if necessary): A = 0 - 2 feet
B = 2 - 4 feet
C = 4 - 6 feet, etc.
S = Soil
T = Sample type, as above.

Subsurface Soil Boring Samples

MWT2-A01ST

where:

MW = Monitoring well
T2 = Tract II

A = Depth: A = 0 - 2 feet
B = 2 - 4 feet
C = 4 - 6 feet
D = 6 - 8 feet
E = 8 - 10 feet, etc.
01 = Monitoring well number
S = Soil
T = Sample type, as above.

Asbestos Sample Numbers

Parking Garage Samples

AST-XX-SSAT

where:

AST = Asbestos testing
XX = Sample number
SS = Source: AC = Air cell insulation
EB = Elbow mud insulation
CB = Cardboard-type insulation
A = Surface collection
T = Type: O = Original
D = Duplicate
B = Field blank

Dilapidated Building Samples

T2-DBXX-AT

where:

T2 = Tract II site
DB = Dilapidated building
XX = Sample number
A = Surface collection
T = Type, as described above

3 Field Investigation Results

3.1 Introduction

Each of the soil and water samples collected at the Tract II Site during the first field effort, between November and December 1998, was submitted to E & E's Analytical Services Center (ASC) for the full TCL organic analysis suite, and TAL metals suite, plus cyanide. TCL analysis is comprised of three groups of organic compounds: VOCs, SVOCs, and PCB and pesticides. TAL analysis consists of testing for 23 metals and total cyanide. Soil samples collected during the second field effort in June 2000 were submitted for AL metals plus mercury analyses.

Sample analysis was performed according to the procedures established in New York State Analytical Services Protocol (ASP), October 1995 revisions. All resulting data were reviewed by quality assurance specialists. The laboratory Form I reports include United States Environmental Protection Agency (EPA) data qualifiers. In addition, outside data validation was performed by an outside subcontractor on 20% of the data. The EPA National Functional Guidelines for validation were used for this level of review.

Compounds and analytes that were not detected are listed as "ND" in the data summary tables which follow in this section (see Tables 3-1 to 3-6). Concentrations listed with no values are accepted as such values; however, some of the reported concentrations are qualified due to conditions associated with analysis of the sample. Qualifiers are listed along with reported values in the summary tables in this section.

Several samples contained compounds and analytes at concentrations greater than what could be accurately quantified without diluting the sample. In order to properly analyze such a sample, the sample is diluted. While this procedure allows for the proper

Table 3-1 Analytical Results Summary, First Round Surface Soil Samples, Tract II Site, Niagara Falls, New York

	SST2-01-SO Surface Soil	SST2-02-SO Surface Soil	SST2-03-SO Surface Soil	SST2-04-SO Surface Soil	SST2-05-SO Surface Soil	SST2-06-SO Surface Soil	SST2-06-SD Duplicate
Volatile Organics (µg/Kg)							
None detected.							
Semi-Volatile Organics (µg/Kg)							
Naphthalene	100 J	190 J	ND	54 J	ND	700 J	2000 J
2-methylnaphthalene	160 J	120 J	ND	50 J	ND	450 J	860 J
Acenaphthylene	500 J	490 J	170 J	700	310 J	1200 J	4000
Acenaphthene	140 J	340 J	47 J	63 J	ND	870 J	1200 J
Dibenzofuran	150 J	260 J	ND	140 J	ND	780 J	1500 J
Fluorene	240 J	430 J	65 J	110 J	ND	930 J	2000
Phenanthrene	1400	4200	750	3400	ND	9100	14000
Anthracene	780	1200	310 J	990	240 J	3000	4200
Carbazole	180 J	660 J	200 J	420	ND	1600 J	2000
Fluoranthene	3200	5800	1800	4300	ND	16000	18000
Pyrene	150 J	4200	290 J	2500	ND	7000	2900
Benzo(a)anthracene	1500	2500	860	1900	ND	7300	8100
Chrysene	920	2600	970	1800	ND	7300	7500
Benzo(b)Fluoranthene	830	1800	1000	1200	ND	7500	7100
Benzo(k)Fluoranthene	900	1700	740	1400	ND	6900	6700
Dibenz(a,h)anthracene	130 J	800 J	140 J	320 J	ND	1500 J	1400 J
bis(2-ethylhexyl)phthalate	ND	140 J	42 J	62 J	ND	260 J	ND
Benzo(a)pyrene	ND	2200	110 J	1400	ND	7300	1100 J
Indeno(1,2,3-cd)pyrene	ND	2100	95 J	810	ND	3400	980 J
Benzo(g,h,I)perylene	ND	2100	ND	590 J	ND	2300	ND
Butylbenzylphthalate	ND	ND	ND	200	ND	ND	ND
Di-n-butylphthalate	ND	ND	ND	ND	ND	ND	ND
Di-n-octylphthalate	ND	ND	ND	ND	ND	ND	ND

Table 3-1 Analytical Results Summary, First Round Surface Soil Samples, Tract II Site, Niagara Falls, New York

	SST2-01-SO Surface Soil	SST2-02-SO Surface Soil	SST2-03-SO Surface Soil	SST2-04-SO Surface Soil	SST2-05-SO Surface Soil	SST2-06-SO Surface Soil	SST2-06-SD Duplicate
n-Nitroso-diphenylamine	ND	ND	ND	ND	ND	ND	ND
Pesticides/PCBs (µg/Kg)							
Aldrin	5.6 J	22 DJ	4.1 J	9.2 J	ND	26 J	7.8 J
Heptachlor Epoxide	24 J	71 DJ	48 D	53 J	2.5 J	83 J	42 DJ
4,4'-DDT	23 J	14 J	ND	10 J	ND	84 J	ND
Methoxychlor	99	300 DJ	68	120	32	410 D	100
Endrin Ketone	19	48	13 J	31 J	8.0	58 J	22 J
gamma-Chlordane	9.2 J	ND	ND	ND	ND	ND	ND
Dieldrin	ND	8.4 J	ND	ND	ND	19	ND
4,4'-DDE	ND	17 J	ND	ND	ND	16 J	ND
Heptachlor	ND	4.1 J	ND	ND	ND	8.9	ND
Endrin	ND	10 J	ND	ND	ND	21 J	ND
delta-BHC	ND	ND	ND	ND	ND	2.6 J	ND
gamma-BHC (Lindane)	ND	ND	ND	ND	ND	7.3	ND
4,4'-DDD	ND	ND	ND	ND	ND	16	ND
Endrin Aldehyde	ND	ND	ND	ND	ND	8.0	ND
alpha-Chlordane	ND	ND	ND	ND	ND	ND	ND
Aroclor-1260	900	440 J	380 J	120 J	76	240	80 J
Inorganics (mg/Kg)							
Aluminum	9620	10000	7400	5520	6880	13000	11300
Antimony	6.3 B	12.1	1.9 B	9.9 B	49.5	41.3	64.1
Arsenic	12.5	6.5	5.7	7.6	10.3	11.0	11.1
Barium	111	140	90.5	95.5	151	996	3150
Beryllium	1.3	0.50 B	0.50 B	0.28 B	0.47 B	0.63 B	0.62 B
Cadmium	3.8	1.7	1.4	2.5	1.9	2.7	2.9
Calcium	83100	40900	55900	99300	36000	15700	18500

Table 3-1 Analytical Results Summary, First Round Surface Soil Samples, Tract II Site, Niagara Falls, New York

	SST2-01-SO Surface Soil	SST2-02-SO Surface Soil	SST2-03-SO Surface Soil	SST2-04-SO Surface Soil	SST2-05-SO Surface Soil	SST2-06-SO Surface Soil	SST2-06-SD Duplicate
Chromium	64.0	45.0	25.3	59.6	18.9	31.0	29.6
Cobalt	4.0 B	5.1 B	3.4 B	1.8 B	2.4 B	7.1 B	5.2 B
Copper	213	520	30.4	43.4	50.5	74.0	79.1
Iron	11300	23500	12900	20200	28300	26500	26300
Lead	186	210	120	295	2070	2060	4230
Magnesium	21700	9200	24500	50000	12500	6690	6100
Manganese	12600	750	510	1200	541	710	675
Mercury	ND	ND	0.34	0.45	7.4	1.6	7.9
Nickel	22.7	37.9	15.2	30.6	18.9	27.3	27.5
Potassium	807 B	1440	1180	789 B	967	1770	1600
Selenium	6.0	9.1	5.1	9.6	12.7	11.0	11
Silver	3.7	1.1 B	0.98 B	2.2	0.78 B	0.73 B	0.80 B
Sodium	ND	ND	ND	ND	ND	ND	ND
Thallium	16.1	ND	ND	1.9 B	ND	ND	ND
Vanadium	20.6	21.5	15.9	14.0	19.9	30.0	28.4
Zinc	162	409	444	555	305	839	2000
Cyanide	3.6	ND	ND	ND	ND	ND	ND

Table 3-1 Analytical Results Summary, First Round Surface Soil Samples, Tract II Site, Niagara Falls, New York

	SST2-07-SO Surface Soil	SST2-08-SO Surface Soil	SST2-09-SO Surface Soil	SST2-10-SO Surface Soil	SST2-11-SO Surface Soil	SST2-12-SO Surface Soil
Volatile Organics (µg/Kg)						
None detected						
Semi-Volatile Organics (µg/Kg)						
Naphthalene	94 J	240 J	51 J	190 J	4900 J	1100 J
2-methylnaphthalene	77 J	ND	43 J	89 J	2600 J	420 J
Acenaphthylene	220 J	2100	150 J	200 J	17000 J	370 J
Acenaphthene	140 J	ND	84 J	110 J	4400 J	240 J
Dibenzofuran	110 J	ND	58 J	91 J	6900 J	300 J
Fluorene	160 J	350 J	93 J	130 J	11000 J	260 J
Phenanthrene	1600	4000	1000	1400	72000	3000
Anthracene	440	2200	300 J	390 J	20000	830 J
Carbazole	240 J	440 J	120 J	180 J	11000 J	640 J
Fluoranthene	2200	14000	2000	2200	71000	8700
Pyrene	1300	7200	1100	1300	49000	4300
Benzo(a)anthracene	1000	6300	750	940	29000	3900
Chrysene	1100	6200	790	1100	29000	4400
Benzo(b)Fluoranthene	750	5500	720	870	20000	4800
Benzo(k)Fluoranthene	840	5200	640	820	21000	4500
Dibenz(a,h)anthracene	220 J	750 J	160 J	250 J	9800	650 J
bis(2-ethylhexyl)phthalate	530 J	ND	140 J	330 J	ND	130 J
Benzo(a)pyrene	920	5300	690	960	25000	3600
Indeno(1,2,3-cd)pyrene	540 J	1700 J	400	630	26000	1200 J
Benzo(g,h,I)perylene	370 J	980 J	170 J	550 J	20000	300 J
Butylbenzylphthalate	270 J	ND	ND	55 J	ND	ND
Di-n-butylphthalate	130 J	ND	ND	67 J	ND	ND

Table 3-1 Analytical Results Summary, First Round Surface Soil Samples, Tract II Site, Niagara Falls, New York

	SST2-07-SO Surface Soil	SST2-08-SO Surface Soil	SST2-09-SO Surface Soil	SST2-10-SO Surface Soil	SST2-11-SO Surface Soil	SST2-12-SO Surface Soil
Di-n-octylphthalate	ND	1200 J	ND	ND	ND	ND
n-Nitroso-diphenylamine	ND	ND	ND	ND	ND	140 J
Pesticides/PCBs (µg/Kg)						
Aldrin	3.2 J	8.7 J	ND	ND	ND	ND
Heptachlor Epoxide	8.8 J	53 J	12 J	7.2 J	190 J	ND
4,4'-DDT	46 D	40 J	61 J	15 J	ND	ND
Methoxychlor	30	270	ND	18 J	ND	ND
Endrin Ketone	7.7 J	23 J	ND	ND	ND	ND
gamma-Chlordane	16	ND	ND	2.4 J	ND	ND
Dieldrin	60 J	4.3	9.4	16	29 J	ND
4,4'-DDE	13 J	10 J	ND	11	ND	ND
Heptachlor	2.0 J	ND	ND	ND	ND	ND
Endrin	ND	ND	ND	4.7 J	ND	ND
delta-BHC	ND	2.4 J	ND	ND	ND	ND
gamma-BHC (Lindane)	ND	ND	ND	ND	ND	ND
4,4'-DDD	14 J	9.7 J	ND	ND	ND	ND
Endrin Aldehyde	ND	ND	ND	ND	ND	ND
alpha-Chlordane	13 J	ND	ND	ND	ND	ND
Aroclor-1260	170	110 J	ND	300	ND	ND
Inorganics (mg/Kg)						
Aluminum	6180	5840	9750	11100	7460	7480
Antimony	182	24.5	8.8 B	4.1 B	2.2 B	19.2
Arsenic	11.1	11.1	9.2	7.9	6.8	9.9
Barium	175	644	125	130	85.6	257
Beryllium	0.39 B	0.35 B	0.42 B	0.56 B	0.40 B	0.49 B

Table 3-1 Analytical Results Summary, First Round Surface Soil Samples, Tract II Site, Niagara Falls, New York

	SST2-07-SO Surface Soil	SST2-08-SO Surface Soil	SST2-09-SO Surface Soil	SST2-10-SO Surface Soil	SST2-11-SO Surface Soil	SST2-12-SO Surface Soil
Cadmium	0.98 B	2.6	0.67 B	0.69 B	0.47 B	1.2
Calcium	42400	51000	77300	26300	35300	65000
Chromium	18.0	27.4	21.4	24.9	20.2	22.4
Cobalt	2.9 B	3.4 B	5.1 B	6.3 B	5.4 B	4.5 B
Copper	72.6	55.2	45.6	43.2	26.6	54.1
Iron	17700	15300	23200	23200	19100	18200
Lead	8370	2420	345	240	127	1370
Magnesium	20600	11900	37600	10300	9310	14800
Manganese	516	575	541	611	538	530
Mercury	1.6	10.2	100	5.6	ND	1.2
Nickel	14.8	16.1	19.5	23.2	17.6	24.4
Potassium	1030 B	865 B	1370	1690	1050	1220
Selenium	8.0	7.2	9.1	9.6	7.8	8.5
Silver	1.4 B	1.3 B	1.3 B	0.46 B	0.59 B	1.3 B
Sodium	ND	ND	ND	ND	ND	ND
Thallium	ND	ND	ND	ND	ND	ND
Vanadium	18.8	19.2	20.9	24.2	19.2	19.3
Zinc	359	859	199	230	134	440
Cyanide	ND	ND	ND	ND	ND	ND

Table 3-2 Analytical Results Summary, Second Round Surface Soil Samples, Tract II Site, Niagara Falls, NY

Compound	NYSDEC TAGM 4046 [a]	SST2-A	SST2-B	SST2-B/D	SST2-C
Inorganics mg/kg					
Aluminum	128,000[b]	3,930	3,590	4,270	6,160
Antimony	4.5[c]	93.4 J	5.3 J	8.7 J	10.4 J
Arsenic	16[b]	67.1	7.5	7.5	31
Barium	867[b]	543 J	267 J	201 J	126 J
Beryllium	1.81[b]	0.44 B J	0.28 J	0.4 J	0.58 J
Cadmium	10[d]	195	7.5	8.6	4.2
Calcium	16,000[c]	36,800	6,140	7,780	20,100
Chromium	50[d]	136 J	15.8 J	25 J	29.2 J
Cobalt	30[e]	5.6 B J	3.6 J	4.8 J	12.8
Copper	48.7[b]	131 J	48.4 J	52.2 J	106 J
Iron	58,000[b]	17,100	13,900	17,200	36,700
Lead	128[c]	32,500	8,160	7,290	2,710
Magnesium	7,170[c]	14,600	1,940	2,420	5,280
Manganese	1,450[b]	468 J	317 J	366 J	737 J
Mercury	0.27[b]	2.4 J	0.44 J	0.52 J	0.56 J
Nickel	38.2[b]	35.7	24.1	27.8	36.9
Potassium	23,500[b]	440 B	934 J	1100 J	881 J
Selenium	4.5[c]	23.6 J	1.1 J	1.2 J	0.91 J
Silver	0.37[c]	2 J	1.7 J	2 J	0.65 J
Sodium	17,400[b]	188 J	176 J	186 J	133 J
Thallium	13.8[b]	0.69	0.61	0.67	0.53
Vanadium	150[d]	17.6	28.2	30.8	58
Zinc	130[c]	1,530 J	257 J	337 J	358 J
Cyanide	0.66[c]	ND	ND	ND	ND

[a] NYSDEC Technical and Administrative Guidance Memorandum (TAGM) 4046 (January 1994) Soil Cleanup Objectives.

[B] 90th percentile concentration in eastern U.S. soil (USGS 1984).

[C] concentration in local background sample.

[D] Concentration specified by NYSDEC Region 9 (Locey, 1998)

[e] Concentration specified by TAGM 4046.

Key:

J = Estimated value.
ND = Not detected.
mg/kg = Milligrams per kilogram.
NYSDEC = New York State Department of Environmental Conservation.
< = Less than.
– = No soil cleanup objectives available/applicable.
☐ = Reported value exceeds NYSDEC TAGM 4046 Soil Cleanup Objective.

Table 3-3 Analytical Results Summary, Test Pit Soil, Tract II Site, Niagara Falls, New York

	TPT2-01-CS0 Test Pit	TPT2-02-BS0 Test Pit	TPT2-03-ASO Test Pit	TPT2-04-ASO Test Pit	TPT2-05BSO Test Pit	TPT2-06-ASO Test Pit	TPT2-06-AS Duplicate
Volatile Organics (µg/kg)							
Trichloroethene	ND	ND	ND	2 J	ND	ND	ND
Acetone	ND	ND	ND	ND	90	ND	ND
Ethylbenzene	ND	ND	ND	ND	5 J	ND	ND
Xylene (Total)	ND	ND	ND	ND	55	ND	ND
Semi-Volatile Organics (µg/kg)							
Naphthalene	ND	ND	1300 J	99 J	300 J	ND	ND
2-methylnaphthalene	ND	ND	630 J	160 J	1700	ND	ND
Acenaphthylene	ND	ND	1200 J	70 J	ND	ND	ND
Acenaphthene	43 J	ND	4300 DJ	ND	ND	ND	ND
Dibenzofuran	ND	ND	4300 DJ	47 J	140 J	ND	ND
Fluorene	59 J	ND	8000 DJ	ND	230 J	ND	ND
Phenanthrene	460	ND	81000 D	280 J	460	120 J	ND
Anthracene	140 J	ND	25000 D	110 J	ND	ND	ND
Carbazole	67 J	ND	9300 DJ	42 J	ND	ND	ND
Fluoranthene	600	ND	120000 D	510	ND	170 J	53 J
Pyrene	500	ND	85000 D	390	ND	130 J	41 J
Benzo(a)anthracene	270 J	ND	59000 D	330 J	ND	92 J	ND
Chrysene	270 J	ND	60000 D	390	ND	110 J	ND
Benzo(b)Fluoranthene	180 J	ND	46000 D	300 J	ND	78 J	ND
Benzo(k)Fluoranthene	220 J	ND	38000 D	280 J	ND	79 J	ND
Dibenz(a,h)anthracene	43 J	ND	19000 DJ	95 J	ND	ND	ND
bis(2-ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	220 J	ND	53000 D	270 J	ND	95 J	ND
Indeno(1,2,3-cd)pyrene	130 J	ND	48000 D	200 J	ND	75 J	ND
Benzo(g,h,I)perylene	140 J	ND	38000 D	170 J	ND	59 J	ND
Butylbenzylphthalate	ND	ND	ND	ND	ND	ND	ND
Di-n-butylphthalate	ND	ND	ND	ND	ND	ND	ND

Table 3-3 Analytical Results Summary, Test Pit Soil, Tract II Site, Niagara Falls, New York

	TPT2-01-CS0 Test Pit	TPT2-02-BS0 Test Pit	TPT2-03-ASO Test Pit	TPT2-04-ASO Test Pit	TPT2-05BSO Test Pit	TPT2-06-ASO Test Pit	TPT2-06-AS Duplicate
Di-n-octylphthalate	ND	ND	ND	ND	ND	ND	ND
4-methylphenol	ND	ND	670 J	ND	ND	ND	ND
Di-ethylphthalate	ND	ND	ND	ND	ND	48 J	ND
Pesticides/PCBs (µg/kg)							
Aldrin	0.89 J	ND	14 J	ND	ND	ND	ND
Heptachlor Epoxide	10 J	ND	140 J	3.0 J	ND	ND	ND
4,4'-DDT	ND	ND	ND	ND	ND	ND	ND
Methoxychlor	11 J	ND	78 J	29 J	ND	ND	ND
Endrin Ketone	2.2 J	ND	65 J	8.4 J	ND	ND	ND
gamma-Chlordane	ND	ND	ND	ND	ND	ND	ND
Dieldrin	ND	ND	ND	ND	ND	ND	ND
4,4'-DDE	ND	ND	ND	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND	ND	ND	ND
Endrin	ND	ND	ND	ND	ND	ND	ND
delta-BHC	ND	ND	ND	ND	ND	ND	ND
gamma-BHC (Lindane)	ND	ND	ND	ND	ND	ND	ND
4,4'-DDD	ND	ND	ND	ND	ND	ND	ND
Endrin Aldehyde	1.7 J	ND	ND	2.1 J	ND	ND	ND
alpha-Chlordane	ND	ND	ND	ND	ND	ND	ND
Aroclor-1260	71 J	43	ND	ND	ND	ND	ND
Inorganics (mg/kg)							
Aluminum	7910	9740	5960	2070	16100	12800	14000
Antimony	3.3 B	1.6 B	6.6 B	67.5	2.8 B	6.5 B	4.3 B
Arsenic	5.7	5.3	24.4	7.1	5.5	6.1	6.6
Barium	77.8	63.0	264	105	133	83.9	101
Beryllium	0.33 B	0.42 B	0.37 B	0.19 B	0.74 B	0.68 B	0.72 B
Cadmium	ND	0.17 B	0.55 B	0.98	ND	ND	ND
Calcium	54100	50700	66600	6810	3670	4870	27100

Table 3-3 Analytical Results Summary, Test Pit Soil, Tract II Site, Niagara Falls, New York

	TPT2-01-CS0 Test Pit	TPT2-02-BS0 Test Pit	TPT2-03-ASO Test Pit	TPT2-04-ASO Test Pit	TPT2-05BSO Test Pit	TPT2-06-ASO Test Pit	TPT2-06-AS Duplicate
Chromium	12.2	14.3	27.7	5.5	21.0	16.6	17.9
Cobalt	5.5 B	6.2 B	3.5 B	0.72 B	11.5	8.0 B	8.3 B
Copper	18.7	15.5	69.8	64.0	19.1	16.0	19.4
Iron	18700	20500	18300	6660	29000	23500	24000
Lead	19.5	7.1	250	972	27.0	156	105
Magnesium	8300	8490	19600	3090	5190	3900	7000
Manganese	712	746	489	150	438	475	591
Mercury	ND	ND	0.18	0.19	ND	ND	0.49
Nickel	16.1	18.5	20.0	6.6 B	21.1	15.1	20.5
Potassium	815 B	1030	749 B	ND	1250	1030 B	1340
Selenium	7.5	8.4	8.6	3.2	11.5	9.4	10.2
Silver	0.76 B	0.75 B	1.5 B	ND	ND	ND	0.44 B
Sodium	ND	ND	ND	ND	ND	ND	ND
Thallium	ND	ND	ND	ND	ND	ND	ND
Vanadium	18.0	20.9	18.1	6.6 B	29.1	29.6	28.3
Zinc	53.9	53.0	497	159	84.4	63.8	64.9
Cyanide	ND	ND	ND	ND	ND	NR	ND

Table 3-3 Analytical Results Summary, Test Pit Soil, Tract II Site, Niagara Falls, New York

	TPT2-07-ASO Test Pit	TPT2-08-BSO Test Pit	TPT2-09-ASO Test Pit	TPT2-10-ASO Test Pit	TPT2-11-ASO Test Pit	TPT2-12-DSO Test Pit
Volatile Organics (µg/kg)						
Trichloroethene	ND	ND	ND	ND	ND	ND
Acetone	ND	18	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	ND	ND	ND
Xylene (Total)	ND	ND	ND	ND	ND	ND
Semi-Volatile Organics (µg/kg)						
Naphthalene	ND	ND	1700 J	2900 J	430 J	ND
2-methylnaphthalene	ND	ND	ND	1100 J	ND	ND
Acenaphthylene	140 J	ND	4000 J	1100 J	1600 J	ND
Acenaphthene	ND	ND	3000 J	2100 J	800 J	ND
Dibenzofuran	ND	ND	1900 J	2200 J	650 J	ND
Fluorene	ND	ND	3700 J	2400 J	1200 J	ND
Phenanthrene	440 J	230 J	37000	19000	9600	ND
Anthracene	170 J	ND	10000	5200	3300 J	ND
Carbazole	77 J	ND	3700 J	2400 J	920 J	ND
Fluoranthene	860	340 J	49000	19000	15000	ND
Pyrene	420 DJ	280 J	43000	15000	11000	ND
Benzo(a)anthracene	360 J	180 J	23000	8700	6800	ND
Chrysene	460 J	210 J	24000	8200	6700	ND
Benzo(b)Fluoranthene	480 J	190 J	13000	5100	4800	ND
Benzo(k)Fluoranthene	480 J	200 J	14000	5100	4400	ND
Dibenz(a,h)anthracene	82 J	76 J	5900 J	2400 J	1600 J	ND
bis(2-ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	420 J	220 J	19000	6600	5800	ND
Indeno(1,2,3-cd)pyrene	230 DJ	200 J	14000	6500	3500 J	ND

Table 3-3 Analytical Results Summary, Test Pit Soil, Tract II Site, Niagara Falls, New York

	TPT2-07-ASO Test Pit	TPT2-08-BSO Test Pit	TPT2-09-ASO Test Pit	TPT2-10-ASO Test Pit	TPT2-11-ASO Test Pit	TPT2-12-DSO Test Pit
Benzo(g,h,I)perylene	130 J	160 J	14000	7400	3200 J	ND
Butylbenzylphthalate	ND	65 J	ND	ND	ND	ND
Di-n-butylphthalate	ND	ND	ND	ND	ND	ND
Di-n-octylphthalate	ND	ND	ND	ND	ND	ND
4-methylphenol	ND	ND	ND	ND	ND	ND
Di-ethylphthalate	ND	ND	ND	ND	ND	ND
Pesticides/PCBs (µg/kg)						
Aldrin	ND	ND	16 J	18 J	72 J	ND
Heptachlor Epoxide	ND	ND	150 J	130 J	190 J	ND
4,4'-DDT	ND	ND	360	ND	37 J	ND
Methoxychlor	ND	ND	110	150	110	ND
Endrin Ketone	ND	ND	31 J	39 J	28 J	ND
gamma-Chlordane	ND	ND	ND	ND	ND	ND
Dieldrin	ND	ND	ND	ND	180 J	ND
4,4'-DDE	ND	ND	11 J	7.1 J	14 J	ND
Heptachlor	ND	ND	ND	ND	ND	ND
Endrin	ND	ND	9.1 J	ND	ND	2.9 J
delta-BHC	ND	ND	ND	ND	ND	ND
gamma-BHC (Lindane)	ND	ND	ND	ND	ND	ND
4,4'-DDD	ND	ND	ND	ND	ND	ND
Endrin Aldehyde	ND	ND	ND	ND	7.8 J	ND
alpha-Chlordane	ND	ND	ND	ND	ND	ND
Aroclor-1260	ND	ND	ND	ND	ND	140 J
Inorganics (mg/kg)						
Aluminum	7840	ND	6660	13500	8530	10200
Antimony	244	2.5 B	10.5 B	887	6.6 B	2.4 B

Table 3-3 Analytical Results Summary, Test Pit Soil, Tract II Site, Niagara Falls, New York

	TPT2-07-ASO Test Pit	TPT2-08-BSO Test Pit	TPT2-09-ASO Test Pit	TPT2-10-ASO Test Pit	TPT2-11-ASO Test Pit	TPT2-12-DSO Test Pit
Arsenic	8.4	2.6 B	9.5	74.2	8.4	7.7
Barium	117	3.8 B	371	254	208	59.5
Beryllium	0.35 B	1.4	0.22 B	1.0 B	0.46 B	0.46 B
Cadmium	1.0	ND	1.7	1.4	1.1 B	2.9
Calcium	60100	113000	73800	10500	51800	11200
Chromium	15.3	2.4 B	27.7	21.3	66.7	14.9
Cobalt	4.0 B	0.77 B	2.9 B	6.4 B	5.6 B	8.2 B
Copper	54.3	6.0 B	135	268	43.6	21.7
Iron	14600	1710	24900	26600	16200	19000
Lead	9950	109	779	9300	791	10.2
Magnesium	6200	584 B	18100	3310	16600	8170
Manganese	589	9.0	528	863	534	685
Mercury	0.13	ND	1.2	0.33	3.4	ND
Nickel	16.7	2.8 B	30.9	25.2	19.3	24.2
Potassium	940 B	ND	760 B	1110	1270	779 B
Selenium	6.1	ND	11.6	11.6	7.4	7.4
Silver	1.7 B	4.9	2.6	0.85 B	1.1 B	ND
Sodium	ND	ND	ND	ND	ND	ND
Thallium	ND	ND	ND	ND	ND	ND
Vanadium	17.9	2.3 B	13.7	25.6	20.5	21.4
Zinc	404	12.1	644	627	435	1860
Cyanide	ND	ND	3.1	ND	ND	ND

Table 3-4 Analytical Results Summary, Subsurface Boring, Sump, and Background Soil, Tract II Site, Niagara Falls, New York

	MWT2-A01-SO Soil Boring	MWT2-A01-SD Soil Boring	MWT2A02SO Soil Boring	MWT2-A03-SO Soil Boring	MWT2-A04-SO Soil Boring	SDT2-01SPSO Sump Soil	BGT201SO Background Soil
Volatile Organics (µg/kg)							
Methylene Chloride	ND	ND		ND	ND	21	ND
Toluene	ND	ND		ND	ND	5 J	ND
Chloroform	ND	ND		ND	ND	5 J	ND
Bromodichloromethane	ND	ND		ND	ND	23	ND
Dibromochloromethane	ND	ND		ND	ND	2400	ND
Acetone	ND	ND	ND	ND	ND	5 J	ND
Trichloroethene			ND			5 J	
Ethylbenzene			ND			14 J	
Xylene (Total)			ND				
Semi-Volatile Organics (µg/kg)							
Naphthalene	450 J	790 J	ND	1600 J	140 J	3800 J	ND
2-methylnaphthalene	330 J	430 J	ND	900 J	160 J	3000 J	ND
Acenaphthylene	570 J	ND	ND	2100 J	550	3700 J	ND
Acenaphthene	650 J	610 J	ND	1500 J	130 J	41000	65 J
Dibenzofuran	500 J	570 J	ND	1800 J	120 J	6600 J	ND
Fluorene	550 J	590 J	ND	2000 J	120 J	40000	ND
Phenanthrene	6400 DJ	6100 DJ	370 J	17000	1500	ND	450
Anthracene	2000	1700 J	84 J	4600	670	46000	100 J
Carbazole	1300 J	1100 J	56 J	2400 J	250 J	11000 J	71 J
Fluoranthene	14000	10000	490	18000	2800	ND	670
Pyrene	5600 DJ	6000 DJ	400	11000	1400	ND	630
Benzo(a)anthracene	6400	6800 DJ	240 J	7700	1300	140000	400 J
Chrysene	6900	7500 DJ	270 J	8100	1400	44000	480

Table 3-4 Analytical Results Summary, Subsurface Boring, Sump, and Background Soil, Tract II Site, Niagara Falls, New York

	MWT2-A01-SO Soil Boring	MWT2-A01-SD Soil Boring	MWT2A02SO Soil Boring	MWT2-A03-SO Soil Boring	MWT2-A04-SO Soil Boring	SDT2-01SPSO Sump Soil	BGT201SO Background Soil
Benzo(b)Fluoranthene	8100	6700	220 J	4600	1300	56000	350 J
Benzo(k)Fluoranthene	6500	6700	190 J	5700	1100	79000	360 J
Dibenz(a,h)anthracene	1500 DJ	2500 DJ	83 J	1700 J	290 J	7600 J	130 J
bis(2-ethylhexyl)phthalate	ND	ND	ND	780 J	170 J	ND	ND
Benzo(a)pyrene	6500	7100 DJ	210 J	6300	1200	73000	410 J
Indeno(1,2,3-cd)pyrene	3000 DJ	4000 DJ	210 J	4200	640	15000 J	290 J
Benzo(g,h,I)perylene	2900 DJ	3600 DJ	200 J	4000	560	12000 J	340 J
Butylbenzylphthalate	ND	ND	ND	ND	1100	ND	ND
Di-ethylphthalate		ND	ND	ND	ND	2000 J	ND
1,3-Dichlorobenzene		ND	ND	ND	ND	240000 E	ND
1,4-Dichlorobenzene		ND	ND	ND	ND	160000 E	ND
1,2-Dichlorobenzene		ND	ND	ND	ND	230000 E	ND
1,2,4-Trichlorobenzene	ND	ND	ND	ND	75 J	97000000	ND
Hexachlorobenzene	ND	ND	ND	ND	72 J	ND	ND
Pesticides/PCBs (µg/kg)							
Aldrin	ND	ND	ND	590	ND	ND	ND
Heptachlor Epoxide	ND	ND	ND	1700	ND	ND	2.5 J
4,4'-DDT	ND	ND	ND	ND	5.4	ND	ND
Methoxychlor	ND	ND	ND	1800 J	39	ND	ND
Endrin Ketone	ND	ND	ND	480	12	ND	ND
gamma-Chlordane	ND	ND	ND	54 J	ND	ND	ND
Dieldrin	ND	ND	ND	ND	11	ND	300 D
4,4'-DDE	ND	ND	ND	180 J	ND	ND	ND
Heptachlor	ND	ND	ND	ND	ND	ND	ND

Table 3-4 Analytical Results Summary, Subsurface Boring, Sump, and Background Soil, Tract II Site, Niagara Falls, New York

	MWT2-A01-SO Soil Boring	MWT2-A01-SD Soil Boring	MWT2A02SO Soil Boring	MWT2-A03-SO Soil Boring	MWT2-A04-SO Soil Boring	SDT2-01SPSO Sump Soil	BGT201SO Background Soil
Endrin	ND	ND	ND	ND	ND	ND	ND
delta-BHC	ND	ND	ND	ND	ND	ND	ND
gamma-BHC (Lindane)	ND	ND	ND	ND	ND	ND	ND
4,4'-DDD	ND	ND	ND	ND	ND	ND	ND
Endrin Aldehyde	ND	ND	ND	150 J	ND	ND	ND
alpha-Chlordane	ND	ND	ND	ND	ND	ND	ND
Aroclor-1260	ND	120	1400 J	ND	ND	31000000 PDC	ND
Inorganics (mg/kg)							
Aluminum	8780	7370	11800	8980	18500	2990	18700
Antimony	8.1 B	13.8	9.7 B	3.6 B	3.7 B	166	4.5 B
Arsenic	6.4	7.5	9.6	6.8	9.1	4.8	11.0
Barium	114	202	111	208	124	1870	120
Beryllium	0.49 B	0.35 B	0.64 B	0.45 B	0.85	ND	0.69 B
Cadmium	0.42 B	0.42 B	0.73 B	0.79 B	0.17 B	33.7	0.31 B
Calcium	8940	10800	69800	65100	8250	19900	16000
Chromium	19.9	25.7	33.6	38.6	26.8	89.7	36.3
Cobalt	5.5 B	5.3 B	6.1 B	4.5 B	8.4	8.5 B	9.3 B
Copper	34.2	53.1	23.7	44.6	37.1	382	35.3
Iron	18100	19200	20400	17600	33700	172000	30400
Lead	602	1060	208	249	30.4	7600	128
Magnesium	4230	4860	19600	20900	9140	3480	7170
Manganese	701	490	547	591	578	658	838
Mercury	7.3	0.63	0.22	ND	1.1	0.65	0.38
Nickel	26.5	31.7	22.1	17.6	31.9	87.8	32.4

Table 3-4 Analytical Results Summary, Subsurface Boring, Sump, and Background Soil, Tract II Site, Niagara Falls, New York

	MWT2-A01-SO Soil Boring	MWT2-A01-SD Soil Boring	MWT2A02SO Soil Boring	MWT2-A03-SO Soil Boring	MWT2-A04-SO Soil Boring	SDT2-01SPSO Sump Soil	BGT201SO Background Soil
Potassium	744 B	738 B	1260	1170	2240	213 B	2570
Selenium	8.2	8.7	8.6	8.2	12.6	13.9	11.5
Silver	0.44 U	0.51 B	1.1 B	1.1 B	ND	12.4	0.37 B
Sodium	233 U	ND	ND	ND	ND	ND	ND
Thallium	1.1 U	ND	ND	ND	ND	ND	2.0 B
Vanadium	26.5	29.8	22.8	23.6	34.9	ND	38.6
Zinc	184	271	176	245	100	2180	130
Cyanide	0.54 U	ND	ND	ND	ND	4.3	ND

Table 3-5 Analytical Results Summary, Groundwater, Tract II Site, Niagara Falls, New York

	MWT2-01WO Monitor Well	MWT2-01WR Rinsate	MWT2-02WO Monitor Well	MWT2-03WO Monitor Well	MWT2-04WO Monitor Well	MWT2-04WD Monitor Well
Volatile Organics (µg/L)						
Toluene	1 J	ND	ND	ND	2 J	3 J
Xylene (Total)	1 J	ND	ND	ND	2 J	3 J
Acetone	ND	ND	ND	9 J	ND	ND
Chloroform	ND	ND	ND	2 J	ND	ND
Methylene Chloride	ND	ND	ND	ND	28	29
Semi-Volatile Organics (µg/L)						
Naphthalene	ND	ND	ND	ND	ND	ND
2-methylnaphthalene	ND	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND	ND	ND
Dibenzofuran	ND	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND	ND
Carbazole	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND
Benzo(b)Fluoranthene	ND	ND	ND	ND	ND	ND
Benzo(k)Fluoranthene	ND	ND	ND	ND	ND	ND
Dibenz(a,h)anthracene	ND	ND	ND	ND	ND	ND
bis(2-ethylhexyl)phthalate	ND	ND	ND	ND	2 J	ND
Benzo(a)pyrene	ND	ND	ND	ND	ND	ND

Table 3-5 Analytical Results Summary, Groundwater, Tract II Site, Niagara Falls, New York

	MWT2-01WO Monitor Well	MWT2-01WR Rinsate	MWT2-02WO Monitor Well	MWT2-03WO Monitor Well	MWT2-04WO Monitor Well	MWT2-04WD Monitor Well
Indeno(1,2,3-cd)pyrene	ND	ND	ND	ND	ND	ND
Benzo(g,h,I)perylene	ND	ND	ND	ND	ND	ND
Butylbenzylphthalate	ND	ND	ND	ND	ND	ND
Di-n-butylphthalate	ND	ND	ND	ND	ND	ND
Di-n-octylphthalate	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND	ND	ND
Pesticides/PCBs (µg/L)						
Aldrin	ND	ND	ND	ND	ND	ND
Heptachlor Epoxide	ND	ND	ND	ND	ND	ND
4,4'-DDT	ND	ND	ND	ND	ND	ND
Methoxychlor	ND	ND	ND	ND	ND	ND
Endrin Ketone	ND	ND	ND	ND	ND	ND
gamma-Chlordane	ND	ND	ND	ND	ND	ND
Dieldrin	ND	ND	ND	ND	ND	ND
4,4'-DDE	ND	ND	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND	ND	ND
Endrin	ND	ND	ND	ND	ND	ND
delta-BHC	ND	ND	ND	ND	ND	ND
gamma-BHC (Lindane)	ND	ND	ND	ND	ND	ND
4,4'-DDD	ND	ND	ND	ND	ND	ND
Endrin Aldehyde	ND	ND	ND	ND	ND	ND
alpha-Chlordane	ND	ND	ND	ND	ND	ND
Aroclor-1260	ND	ND	ND	ND	ND	ND

Table 3-5 Analytical Results Summary, Groundwater, Tract II Site, Niagara Falls, New York

	MWT2-01WO Monitor Well	MWT2-01WR Rinsate	MWT2-02WO Monitor Well	MWT2-03WO Monitor Well	MWT2-04WO Monitor Well	MWT2-04WD Monitor Well
Inorganics (µg/L))						
Aluminum	151 B	ND	417	204	2740	110 B
Antimony	ND	ND	ND	ND	ND	ND
Arsenic	ND	ND	ND	11.3	ND	10.9
Barium	48.9 B	ND	76.9 B	74.7 B	94.0 B	72.8 B
Beryllium	ND	ND	ND	ND	ND	ND
Cadmium	ND	ND	1.1 B	ND	1.2 B	ND
Calcium	135000	ND	124000	68500	204000	67700
Chromium	8.3 B	ND	2.6 B	8.1 B	5.2 B	4.0 B
Cobalt	1.1 B	ND	1.6 B	ND	2.7 B	ND
Copper	ND	ND	ND	ND	ND	ND
Iron	353	ND	1030	409	3790	254
Lead	6.0	ND	8.5	3.4	35.5	4.6
Magnesium	53600	ND	49300	44800	64300	44200
Manganese	161	ND	302	55.7	244	51.6
Mercury	ND	ND	ND	ND	ND	ND
Nickel	9.1 B	ND	4.4 B	6.4 B	7.8 B	4.1 B
Potassium	4080 B	ND	5120	4320 B	6580	4310 B
Selenium	ND	ND	ND	ND	ND	ND
Silver	2.7 B	ND	2.1 B	ND	3.5 B	ND
Sodium	22400	ND	50500	12600	58600	12600
Thallium	ND	ND	ND	ND	ND	ND
Vanadium	ND	ND	ND	ND	4.5 B	ND
Zinc	ND	ND	81.0	24.8	327	21.5
Cyanide	ND	ND	43.0	ND	ND	ND

Table 3-6 Analytical Results Summary, Sump and Drilling Water, Tract II Site, Niagara Falls, New York

	SWT2-01SPWO Sump Water		DWT2-01-WO Drill Water	
Volatile Organics (µg/L)				
Chloroform	ND		12	
Bromodichloromethane	ND		8	J
Dibromodichloromethane	ND		4	J
Semi-Volatile Organics (µg/L)				
bis(2-ethylhexyl)phthalate	ND		11	
Di-n-butylphthalate	1	J	2	J
2,4-Dichlorophenol	3	J	ND	
Pesticides/PCBs (µg/L)				
Aroclor-1260	30	D	ND	
Inorganics (µg/L))				
Aluminum	49.6	B	194	B
Antimony	1.71	B	3.9	U
Arsenic	3.5	U	4.6	U
Barium	62.5	B	23.8	B
Beryllium	0.20	U	1.0	U
Cadmium	0.94	B	1.0	U
Calcium	75900		36300	
Chromium	159		1.4	B
Cobalt	0.40	U	1.0	U
Copper	7.5	B	15.5	B
Iron	1110		82.9	B
Lead	12.7		6.0	
Magnesium	14600		8300	
Manganese	25.1		7.8	B
Mercury	0.20	U	0.20	U
Nickel	0.79	B	2.0	U
Potassium	4200	B	1440	B
Selenium	4.5	B	4.3	U
Silver	1.8	B	2.1	U
Sodium	13300		10400	

Table 3-6 Analytical Results Summary, Sump and Drilling Water, Tract II Site, Niagara Falls, New York

	SWT2-01SPWO Sump Water		DWT2-01-WO Drill Water	
Thallium	3.7	U	5.3	U
Vanadium	0.7	U	1.7	U
Zinc	108		423	
Cyanide	10.0	U	10.0	U

analysis of chemicals at high concentration, it also raises the detection limit.

In those cases in which an analyte concentration value can only be estimated, it is qualified with a "J." Similarly, when an elevated detection limit results from a dilution, and the detection limit itself is estimated, the value is qualified as "UJ."

Quality control samples including trip blanks and laboratory blanks were included in the analysis of the field samples. Blanks are used to determine whether other sources of an analyte besides the sample matrix exist. Analytes qualified with a "B" were present at a concentration less than ten times the concentration detected in the blank for common laboratory contaminants (acetone, MEK, methylene chloride, toluene, and phthalate esters). For all other analytes, a factor of five was used in application of the "B" flag. For the purposes of this report, analytes qualified with a "B" are not considered present at significant quantities and, therefore, are not discussed. Trip blanks did not show contamination unless associated with laboratory contamination. The results are flagged as "U" and considered not-detect.

3.2 Surface Soil Investigation Results

As discussed in Section 2, a total of 12 surface soil composite samples (plus one field duplicate) were initially collected at the site. The results of the organic and inorganic analysis of these samples are presented in Table 3-1. The results for the 12 surface soil samples and field duplicate indicate that VOCs are not present. Several SVOCs, comprised mostly of PAHs and some phthalates were found at elevated levels in 12 of these samples. Elevated levels of the pesticide compound heptachlor epoxide were found in eight of these samples. The pesticide dieldrin was found at an elevated level in one of the surface soil samples. There were no elevated concentrations of PCBs present in the surface soil samples, although the PCB Aroclor-1260 was just below the level of concern. Lead was found at high concentrations in six surface soil samples collected on the east side of the site. Slightly elevated levels antimony, arsenic, barium, chromium, copper, iron, magnesium, manganese, mercury, nickel, selenium, silver, thallium, and zinc were found in some of the surface soil samples. In addition, a low level of cyanide was detected in one of these samples. These results are discussed with respect to regulatory screening criteria and the level of risk posed to human health and the environment in Section 5.2.1.

The second set of surface soil samples, collected around the dilapidated building in the northeast corner of the site, were submitted for TAL inorganics and mercury analyses. Data show 12 of the 24 analytes were present at concentrations exceeding TAGM 4046 levels in at least one of the samples. Cyanide was not detected in any of the samples. Compared to the other samples collected around the dilapidated building, the composite sample collected at the southwest corner of the building (sample SST2-A-ASO) contains significantly higher concentrations of many inorganic analytes.

3.3 Test Pit Investigation Results

A total of 12 subsurface soil samples (plus one field duplicate) were collected from the 12 test pits excavated at the site. The results of the organic and inorganic analyses of these samples are presented in Table 3-3. A description of the contents of the test pits is provided in Section 4. The results for the 12 subsurface soil samples and field duplicate from the test pits show the presence of six VOCs, but at minimal concentrations. The SVOC analysis indicates that PAHs are prevalent at elevated concentrations at several of the test pit locations on the east and west sides of the site. The highest levels of PAHs were found at Test Pit TP-03 which was excavated in the berm at the northwest side of the site. The pesticides aldrin, heptachlor epoxide, and dieldrin were found at elevated levels in test pit soils. Heptachlor epoxide was found in one soil sample at a high estimated concentration. There were no elevated levels of PCBs found in the test pit soil samples. Lead was found at elevated or high concentrations in the majority of the test pit samples. Elevated levels of antimony, arsenic, chromium, copper, magnesium, mercury, selenium, silver, and zinc were found in some of the samples. In addition, a low concentration of cyanide was detected in one of these samples. These results are discussed with respect to regulatory screening criteria and the level of risk posed to human health and the environment in Section 5.2.1.

3.4 Subsurface Boring, Sump Sludge, and Background Soil Results

A total of four subsurface soil samples (plus one field duplicate) were collected from the four subsurface borings at the site. A sludge sample was also collected from the sump in the underground garage. In addition, a background soil sample was taken northeast of the site in an undeveloped area north of 17th Street. This background sample was collected from 0 to 2 feet BGS. The results of the organic and inorganic analyses of these samples are presented in Table 3-4. The results for the four subsurface soil samples and field duplicate from the well borings indicates that no VOCs were present. The SVOC analysis shows that elevated levels of PAHs are present. The pesticides aldrin and heptachlor epoxide were found in the MW-03 well boring at elevated levels and dieldrin was found in the MW-04 well boring at an elevated level. The PCB Aroclor-1260 was present at an elevated level in the MW-02 well boring. The sludge sample collected from the bottom of the sump contained low concentrations (some estimated) of eight VOCs, including the solvent compound chlorobenzene. Analysis for SVOCs indicated that a total of 23 such compounds were present. There were no pesticides present in the sludge; however, the PCB Aroclor-1260 was found at a high level. Twelve metals were detected at elevated levels and lead was found at a high level in the sample. Twelve metals were detected at elevated levels and lead was found at a high level in this sample. In addition, cyanide was found at an elevated concentration in the sump sludge. The background soil sample contained no VOCs and low estimated concentrations of 10 SVOCs, mainly PAHs. Two pesticides, heptachlor epoxide and dieldrin were also detected. Metals concentrations were not elevated in the background soil sample. These results are discussed with respect to regulatory screening criteria and the level of risk posed to human health and the environment in Section 5.2.1 and 5.2.2.

3.5 Groundwater Sample Results

A total of four groundwater samples (plus one field duplicate) were collected from the four wells installed at the site. The results of the organic and inorganic analyses of these samples are presented in Table 3-5. The results for the four groundwater samples and field duplicate from the new wells indicates that the VOCs toluene, xylene, acetone, chloroform, and methylene chloride were detected in certain samples. The concentrations (estimated values) of these VOCs were very low, with the exception of methylene chloride. This solvent compound was found at an elevated level in both the original and duplicate samples collected at MW-04. The SVOC analysis showed the presence of a low concentration (estimated) of bis(2-ethylhexyl)phthalate, a common laboratory contaminant associated the use of with latex gloves both in the field and laboratory. There were no pesticides or PCBs detected in any of the groundwater samples. Iron, manganese and iron (combined), magnesium manganese, and sodium were the only elevated metals detected in any of the four wells. These results are discussed with respect to regulatory screening criteria and the level of risk posed to human health and the environment in Section 5.2.3.

When compared to NYSDEC groundwater quality standards, the data collected indicate site groundwater quality is questionable at the southeast corner of the site. Various inorganic analytes are present at concentrations that may be considered elevated in comparison to concentrations of these same analytes in other site groundwater wells. Based on the few groundwater monitoring wells currently on site and existing groundwater flow data, the source of this degraded water is not immediately identifiable as a site source. The limited groundwater contour data available for this site indicates groundwater flow is south southwest (see Section 4). Thus the contaminant source for this area is quite possibly off site.

As discussed in Section 5.2.3, site groundwater is currently not used as a drinking water supply, nor is it likely to be used as such in the future. Thus, there are currently no plausible pathways for human exposure to site contaminants in groundwater.

3.6 Sump and Drilling Water Sample Results

A sample of the water standing in the sump in the underground parking garage was collected. In addition, a water sample was collected from the tank of the drilling rig to verify that this source of water was free of contaminants. The results of the organic and inorganic analyses of these samples are presented in Table 3-6. VOCs were not detected in the sump water sample. Low concentrations (estimated) of the SVOCs di-n-butylpthalate and 2,4-dichlorophenol were detected. No pesticides were detected in this water sample; however, the PCB Aroclor-1260 was detected at a low level. Elevated concentrations of chromium and iron were also found in this sump water sample. These results are discussed further in Section 5.2.2.

Based on the site groundwater data collected, this sump does not appear to be releasing contaminants to the surrounding site groundwater. Groundwater monitoring well MW03 is the nearest downgradient well to this sump. Although not directly downgradient of the sump, if the sump were to be severely degrading groundwater quality, one would expect to find degraded groundwater in MW03. Groundwater data from MW03 does not show degradation in comparison to groundwater samples from wells MW01 and MW02. While groundwater from MW04 does appear to show some signs of degradation, the contaminant source for MW04 can not be this sump due to the prevailing groundwater flow pattern at the site. Based on the high contaminant concentrations in the sump and the absence of several of the same contaminants in downgradient groundwater, it is reasonable to suspect that the sump is not currently contributing to groundwater degradation.

Also supporting the theory that the sump is not contaminating the surrounding groundwater is the presence of water in the sump. If the sump were dry, one might assume its contents had leaked out. However, the sump contained substantial water, indicating a positive structural integrity of the sump walls. The investigation team did not note any physical indications of the sump leaking. Note that any piping connected to the sump possibly contains similar contaminants as those found in the sump.

Results for the sample of water used for decontamination and general drilling purposes indicates that a slightly elevated level of chloroform and low levels (estimated) of bromodichloromethane and dibromochloromethane were present. A low level of the common lab artifact bis(2-ethyl-hexyl)phthalate and a low concentration (estimated) of di-n-butylpthalate were also present. There were no pesticides, PCBs, or elevated concentrations of metals in this sample.

3.7 Asbestos Sampling Results

As described in Section 2, asbestos analysis was conducted on samples collected from both the underground parking garage and the dilapidated building at the site. Three samples of pipe insulation suspected of containing asbestos were collected from the parking garage. Each of these samples were positively identified as containing asbestos through PLM analysis. Seven samples of suspected ACM were collected at the dilapidated building. Four of the samples were positively identified as ACM. The specific type of asbestos and its respective concentration in each of the samples is summarized in Tables 3-7 and 3-8. The laboratory report associated with the asbestos analysis is provided as Appendix D.

Table 3-7 Asbestos Analysis Results for Samples Collected At the Parking Garage, Tract II Site, Niagara Falls, New York

Sample Identification	Material Description	Asbestos Content	Other Content
AST2-01-ACAO	"air-cell" type pipe insulation	68% Chrysotile	32% non-fibrous material
AST2-02-EBAO	"mud" type pipe elbow insulation	44% Chrysotile	29% mineral wool and 27% non-fibrous material
AST2-03-CBAO	"cardboard" type pipe insulation	10% Chrysotile	66% cellulose and 24% non-fibrous material

Table 3-8 Asbestos Analysis Results for Samples Collected At the Dilapidated Building, Tract II Site, Niagara Falls, New York

Sample Identification	Material Description	Asbestos Content	Other Content
T2DB-01	Fire door insulation	<1% chrysotile	30% Cellulose; 70% matrix. 5 doors present
T2DB-02	Pipe insulation	80% chrysotile	20% matrix
T2DB-03	Mortar between bricks	18% chrysotile	82% non-fibrous material
T2DB-04	Boiler insulation	NAD	
T2DB-05	Pipe lagging	67% chrysotile	33% matrix
T2DB-06	Transite Panel	17% chrysotile	83% matrix
T2DB-07	Fireproof Brick	NAD	

NAD = No asbestos detected.

4

Physical Characteristics of the Site

The description of the physical characteristics of the site, including a description of the geology, and the presentation of the geotechnical and aquifer slug testing results are included in this section. Information regarding the underground parking garage, including the associated asbestos and sump, and the dilapidated building at the northeast part of the site are also provided. Last, a description of the site ecology is presented at the end of this section.

4.1 Site Geology

The surface soils at the site are not classified by the U.S. Soil Conservation Service; however, soils in nearby areas east of the site are classified as Odessa or Schoharie (United States Department of Agriculture [USDA] 1972). These soils are silty clays, remnant of glacial Lake Warren III.

Appendix A presents the well bore logs and well construction information. Table 4-1 summarizes the subsurface conditions observed in the test pits. Geotechnical testing to determine moisture content, grain size, and Atterberg Limits was performed on soil samples from two of the well borings (see Appendix B). Sample MWT2-B04S was collected from 2 to 4 feet BGS at the boring for MW-04. The geotechnical results indicate that this sample is classified as a Lean Clay (CL). Sample MWT2-G03S was collected from 12 to 14 feet BGS at the boring for well MW-03. Test results indicate this soil sample is classified as a Silty Clay (CL-ML).

Due to the low hydraulic conductivity expected in the clay-rich soils found beneath the site, bedrock interface wells were installed. The depth to bedrock in the well borings ranged from 12.5 to 23.5 feet BGS (see Table 2-1). The bedrock beneath the site is the Lockport dolostone formation of the Middle Silurian-age Lockport Group. Bedrock coring was not part of the scope of this investigation; however, there is abundant information available regarding

Table 4-1 Test Trench Summary, Tract II Site

Test Pit Number	Sample Number	Sample Depth (feet BGS)	OVA Response (ppm)	Depth of Fill (feet BGS)	Depth of Test Pit (feet BGS)	Observations
TP-01	TPT2-01-CSO	4 - 6	0	2.8	0 - 8	0 -0.6': Dry, red-brown, sand and silt cover material. 0.6-2.8': C&D debris, including brick, pipe, sheet metal, and concrete. 2.8-8.0': Moist, red-brown clay with minor silt.
TP-02	TPT2-02-BSO	2 - 4	0	1.9	0 - 8	0-0.7': Moist, medium brown silty clay cover material. 0.7-1.9': Moist, black, charred wood, and brick. 1.9-8.0': Moist, medium brown clay with minor silt.
TP-03	TPT2-03-ASO		$\leq 180^a$	4.4	0 - 8	0-0.3': Dry, medium brown silty clay cover material and concrete blocks. 0.3-4.4': Moist-wet C&D debris; mainly brick and refuse including burnt cardboard.
TP-04	TPT2-04-ASO	0 - 2	0	0.9	0 - 4	0-0.9': Dry, black cinder/coarse grained ash, silt and sand. 0.9-4.0': Moist, yellow-red brown clay with minor silt.
TP-05	TPT2-05-BSO	2 - 4	$\leq 300^b$	5.4	0 - 8	0-0.5': Dry, grey silt, sand, and fine gravel cover soil. 0.5-5.4': Strong organic odor, moist black soil mixed with tar-like substance, old timbers, brick, and mica from old windows. 5.4-8.0': Moist, yellow-brown silty clay.
TP-06	TPT2-06-ASO/D	0 - 2	0	3.5	0 - 8	0-0.5': Dry, medium brown sand and silt cover soil with roots. 0.5-3.5': Black cinder/ash covering C&D debris such as wood and brick with mortar. 3.5-8.0': Moist, yellow-brown clay with minor silt-compact.
TP-07	TPT2-07-ASO	0 - 2	0	4.7	0 - 8	0-0.5': Dry, medium brown sand and silt cover with roots. 0.5-4.7': C&D debris such as brick, cinder block, and wood. 4.7-8.0': Moist, yellow-brown clay with minor silt.

Table 4-1 Test Trench Summary, Tract II Site

Test Pit Number	Sample Number	Sample Depth (feet BGS)	OVA Response (ppm)	Depth of Fill (feet BGS)	Depth of Test Pit (feet BGS)	Observations
TP-08	TPT2-08-ASO	0 - 2	0	4.0	0 - 8	0-0.5': Dry to moist dark brown sandy silt cover with rootlets. 0.5-1.0': Dry, black cinder/coarse ash. 1.0-4.0': Moist, white paste-like substance, consistent texture and moisture; rusty metal strapping and scrap. 4.0-8.0': Moist, yellow-brown clay with silt.
TP-09	TPT2-09-ASO	0 - 2	0	7.8	0 - 8	0-0.5': Dry , light brown sandy silt cover with roots. 05.-7.8': C&D debris, including 3' x 3' x 3' concrete block, brick, sand, and metal scrap. 7.8-8.0': Moist, yellow-brown clay with silt.
TP-10	TPT2-10-ASO	0 - 2	0	7.3	0 - 8	0-0.2': Dry, medium brown sand with silt. 0.2-7.3': C&D debris, including electrical conduit, brick, cinder block, ceramic tile, single battery casing found at ~3'; see photolog in Appendix E. 7.3-8.0': Moist, yellow-brown clay with silt.
TP-11	TPT2-11-ASO	0 - 2	0	4.6	0 - 8	0-4.6': Moist, dark brown clay, silt, and fine sand with C&D debris and refuse, including brick, concrete, car tire, bottles, and plastic. 4.6-8.0': Moist, yellow-brown clay with minor silt.
TP-12	TPT2-12-DSO	7.5 - 8	0	7.4	0 - 8	0-0.7': Dry, dark brown silt and sand cover with roots. 0.7-1.7': Moist, red-brown clay with minor silt. 1.7-7.4': C&D debris, mainly brick and broken battery casings; see photolog in Appendix E. 7.4-8.0': Moist, yellow-brown clay with minor silt.

[a] Methane.

[b] Sample collected of black, tar-like substance.

Key:

BGS = Below ground surface.

the Lockport formation. It consists of a fine-to-coarse crystalline, thin-to-massive bedded dolostone, limestone, and shaley dolostone with vugs containing gypsum and calcite. The upper 18 feet of the formation is the most permeable zone, containing bedding planes, and vertical joints and cavities enlarged by the dissolution of dolostone gypsum. The bedding planes generally dip to the south-southwest at approximately 30 feet per mile (United States Geological Survey [USGS] 1987).

4.2 Subsurface Conditions in Test Pits

General observations made during the excavation of 12 test pits indicate that the 1.9 to 7.8 feet BGS at the site consists of fill which is primarily C & D debris (see Table 4-1). The origin of this material is not known, but it appears to be from the demolition of the buildings which formerly occupied the site. The main component of the fill was brick, although concrete, wood, and other scrap building materials were also observed. To a lesser extent, battery casings, tires, and other industrial materials were found in the test pits.

A black, tar-like substance with a strong organic odor was found in a Test Pit TP-05 sample in front of the dilapidated building located on the northeast side of the site. Laboratory analysis of sample SST2-05-BSO, collected from 4 to 6 feet BGS in this test pit, indicates that naphthalene and 2-methyl-naphthalene are present in tar substance at concentrations below respective screening criteria. In Test Pit TP-08 located at the west-central part of the site, a white, paste-like substance was observed. Laboratory analysis of sample SST2-08-BSO, collected from 4 to 6 feet BGS in this test pit, indicates that PAH compounds are present at concentrations exceeding in-screening criteria.

Elevated concentrations of lead were found in five test pit soils samples at levels exceeding the OSWER screening criterion. Four of these test pits were located on the east side of the site. Old battery casings were also observed on the east side of the site in Test Pits TP-10 and TP-12.

4.3 Site Hydrogeology and Slug Test Results

The depth to groundwater beneath the site was measured at between 12.56 and 16.08 feet BGS during groundwater sampling (see Table 4-2). Based on the respective groundwater elevations in the four monitoring wells, the direction of groundwater flow is to the southwest (see Figure 4-1). A fairly flat hydraulic gradient of

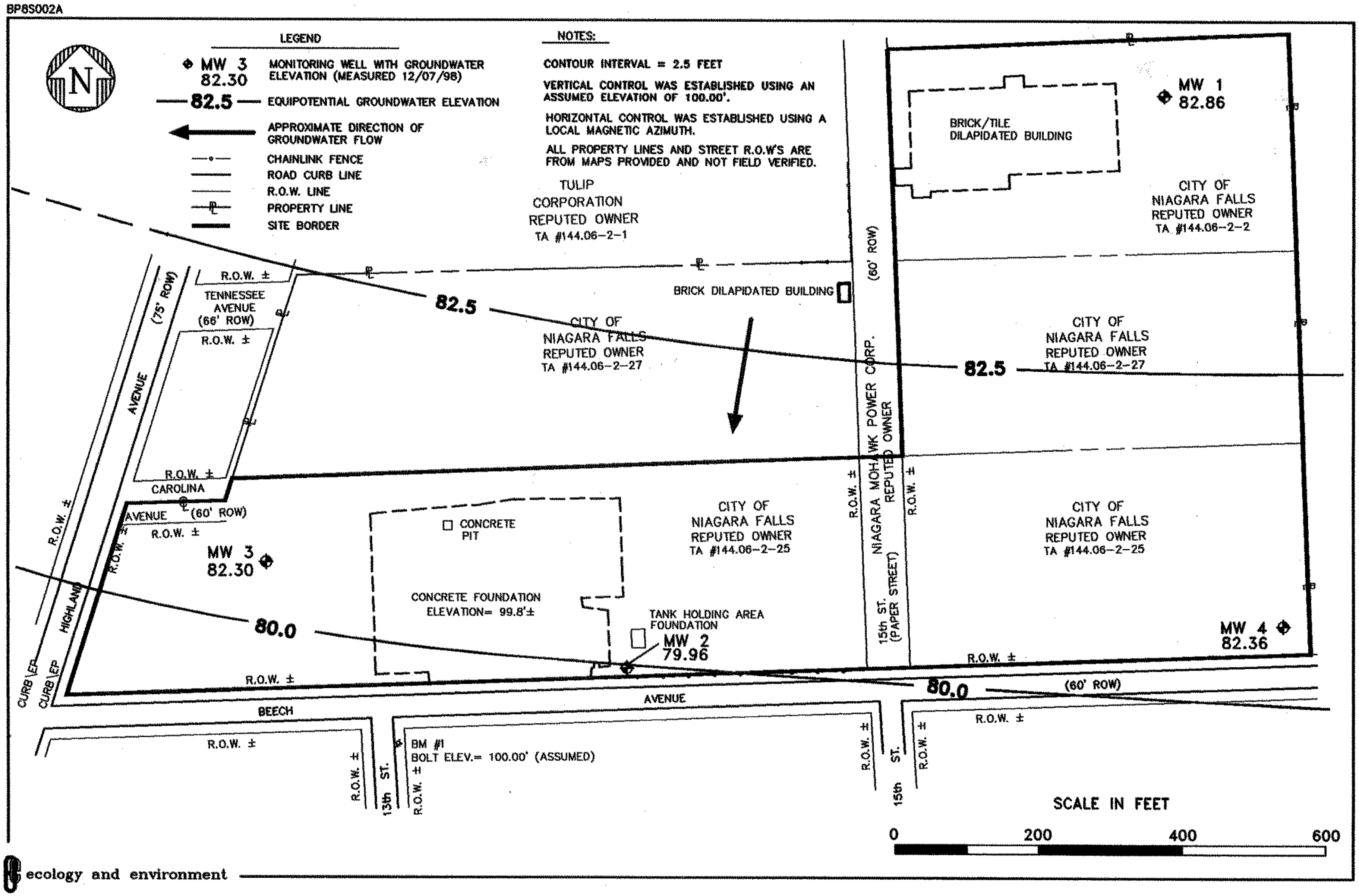

FIGURE 4-1 POTENTIOMETRIC SURFACE MAP SHOWING GROUNDWATER-FLOW DIRECTION BELOW TRACT II SITE, NIAGARA FALLS, NEW YORK

Table 4-2 Groundwater Elevation Data, Tract II Site

Well Number	Water Level Measurement Date	Depth to Groundwater (feet BGS)	Groundwater Elevation[a] (feet)
MW-01	12/7/98	12.82	82.86
MW-02	12/7/98	16.08	79.96
MW-03	12/7/98	12.84	82.30
MW-04	12/7/98	12.56	82.36

a Reference datum used for site is 100 feet at the northeast corner of 13th Street.

Key:

BGS = Below Ground Surface.
PVC = Polyvinyl chloride.

0.003 is measured across the site. Analysis of the rising head slug test results was performed using AQTESOLV v.2.13. This software uses the method of Bouwer and Rice (1976) to determine hydraulic conductivity (K) unconfined aquifers. A correction factor was applied to the solution to account for the porosity of the sand pack because the water table elevations in the wells were screened across the water table. The results of the aquifer testing indicate that (K) in the four wells ranges from 1.3 x 10^{-5} cm/sec (MW-01) to 1.6 x 10^{-2} cm/sec (MW-04). Such a range can be expected in fractured bedrock, depending on the prevalence and condition of the fractures at a given location.

4.4 Site Topography

The Tract II Site is almost entirely flat-lying and graded, and is located at a latitude of 79° 02' 33" and a longitude of 43° 06' 56. The elevation of the site is approximately 585 feet above the National Geodetic Vertical Datum (NGVD) of 1929 (USGS 1980). Based on relative ground elevations at the site, surface drainage is expected to be toward the south and east.

Except at the locations of the concrete foundation and dilapidated building, infiltration of precipitation at the site is high probably because of the permeable nature of the thin layer of silt and sand covering most of the site. There are no drainage swales or culverts present at the site; however, a storm water sewer runs beneath the center of the Niagara Mohawk Power Corporation ROW.

The west side of the site is generally flat, except for a prominent mound approximately 4 feet high, 30 feet wide, and 330 feet long which borders the northeast property line. A test pit excavated in this berm indicates that it is composed primarily of C & D material including concrete and brick, and refuse such as partially burned cardboard and paper. There are some irregularities in the ground surface on the east side of the site where large pieces of concrete are not covered completely. Numerous depressions and small openings exist in the ground surface due to the inconsistent density of the fill which is prevalent beneath this area. In addition, there are several physical hazards in this area such as protruding pipe, wire, scrap metal, etc.

4.5 Existing Structures and Presence of Asbestos

Two structures currently exist at the Tract II Site: a concrete parking garage located at the central part of the site and a dilapidated building at the northeast corner of the site.

A concrete foundation covers an abandoned underground parking garage. The calculated area of the foundation is 81,442 square feet. While a structural survey of the parking garage was not within the scope of work for this project, the field team noted that the condition of the concrete foundation is poor and the structure of the underground garage appears to be unsound. The concrete is crumbling in many locations. Water has seeped into the garage through openings and cracks and small, cylindrical mineral deposits hang from the ceiling and drip to the floor. Several hazards exist in the garage including, asbestos, a sump containing PCBs, fallen pipes, and other debris. The ceilings are approximately 10 feet in height. Although cars have been restricted from access to the foundation top, trespassers can enter at other locations within the building. The field team noted indications of trespassers inside the garage, including benches, bottles, and car parts.

Three samples of pipe insulation were collected within the garage and each was confirmed to contain asbestos (see Section 3.7). A general inspection of suspected ACM was conducted during the initial sampling effort to provide preliminary information regarding the prevalence of suspected ACM. The asbestos survey of the underground parking garage conducted by a certified asbestos inspector on June 6, 2000, revealed there to be approximately 2,563 linear feet of 3-inch diameter pipe covered by "air-cell" type insulation; 2,195 linear feet of 4-inch diameter pipe covered by "air-cell" insulation; and approximately 25 9-inch square floor tiles. The tiles are considered "presumed "ACM" due to the age of the parking garage and the tile size. (Nine-inch-square floor tiles are nearly always ACM.) Although some of the asbestos pipe insulation has fallen to the floor, for ACM volume estimating purposes, it is assumed that all pipes are covered by ACM as the volume doesn't change, regardless of whether or not the ACM is still attached to the pipes. The inspector did not identify any potential ACMs that had not already been sampled during the initial site investigation activities in December 1998. However, the inspector did note that the ceiling in one room of the underground parking garage had collapsed, preventing entry into the area. The room appeared to be a boiler room, measuring 10 feet by 20 feet. A total of 10 4-inch pipes and 14 2-inch pipes traversing the length of this room were counted. The 4-inch pipe was covered by "air-cell" insulation, while the 2-inch pipe was covered by "cardboard" type insulation. ACM 'mud" was noted at all pipe elbows throughout the building. However, a separate calculation of this type of material was not made as the mud quantities are included with the estimates of linear pipe insulation to be removed.

A concrete pit apparently used as a sump is located in a small electrical maintenance room on the west side of the north wall of the garage. The sump has dimensions of approximately 2.5 feet by 3 feet and a depth of about 2 feet. The water level in the sump was approximately 6 inches below the top, which is flush with the floor of the room. The sump contains no pump. There were no signs of pipes leading to or from the sump, although it was not possible to see below the water level. Approximately 10 inches of sludge material consisting of oily, brown-black solids and pieces of rusted metal were present in the bottom of the sump. The water depth was approximately ½ foot As discussed in Section 3.4, in addition to several VOCs and SVOCs, the sludge sample from the bottom of the sump contained high levels of the PCB Aroclor-1260 (31,000 mg/kg) and lead (7,600 mg/kg). As discussed in Section 3.6, the water sample collected from the sump also contained Aroclor-1260 (30 7D µg/L).

The dilapidated building at the northeast part of the site is not currently in use. Historical maps of the site indicate that this 39,370 square foot building was once associated with the nearby battery manufacturing operation on the adjacent parcel to the west. Most of the building is in poor condition. Walls are crumbling and the roof over much of the building's west end has collapsed. A portion of the building west of the loading dock area was inaccessible as the doorway had been sealed by a brick wall. Also, some of the building contents could not be reviewed due to a fallen roof blocking visibility to some building rooms.

During the June 2000 site investigation activities, the field team noted much refuse had been placed on the north side (back) of the building. This refuse consisted of a 4-foot by 4-foot pile of television sets; numerous shopping carts, and segments of electrical cable. Within the building, the team noted the potentially hazardous materials listed in Table 4-3.

Table 4-3 Potentially Hazardous Materials* Stored in the Dilapidated Building, Tract II Site, Niagara Falls, New York

Material	Volume	Comments
Hydraulic Oil	4 5-gallon pails	2 pails full; 2 pails approx 3/4 full
Stain Remover	1 5-gallon pail	Labeled as "Corrosive"
Liquid dishwashing detergent	1 5-gallon pail	Possibly corrosive
Joint compound	2 5-gallon pails	Possible ACM
Rubbing alcohol	1 5-gallon pail	poison
Unknown contents	4 containers ranging from 1- to 5-gallons	labels are illegible, but containers no leaking
Unknown contents	5 5-gallon pails	bottoms of containers appear rotted; contents leaked onto building floor
Fluorescent light ballasts	40	Possibly contain PCBs. Catalogue number SMZE5S

* Other than ACMs

As discussed in Section 3.7, asbestos analysis of the seven building materials sampled showed only four materials to be ACMs: the brick mortar, pipe insulation, pipe lagging, and transite panels stored in the building. Four transite panels measuring 4 feet by 8 feet were identified within the building.

4.6 Site Ecology

Vegetation at the Tract II Site is patterned with a relatively open area west of the Niagara Mohawk ROW and sparse groupings of trees and thick shrub and herbaceous layers on the east side. The softwood deciduous trees on the east side of the site are early successional *Populus* sp. Smaller reproductions of these trees, in addition to sumac and dogwood, characterize the shrub layer. The herbaceous vegetation at the east area of the site is typical of land which has been disturbed. Primarily, this vegetation consists of Japanese knotweed and other non-native, intrusive species. The majority of the west side of the site contains native and non-native grasses and forbs. Small depressions in the ground at areas on the west side of the site are poorly drained and are inhabited by groupings of cattails (*Typha* sp.).

Because of the diversity and density of the vegetation, the east side of the site has a moderate potential to provide value to many different wildlife species. However, because of the overall urban setting of the property, the actual presence of wildlife is limited. A red-tailed hawk was observed in one of the larger trees on site, and typical species such as American tree sparrows, black capped chickadees, and European starlings were seen in small numbers. The shallow ground depressions and small holes in the fill are conducive to small mammals (e.g., rats, mice, and rabbits) as well as reptiles (e.g., garter snakes); however, none of these species were observed on site in the early winter.

5

Human Health Risk Evaluation

This preliminary human health risk evaluation for the Tract II Site is a screening level assessment. Its purpose is to determine which contaminants detected in environmental media at the site potentially pose significant risks to human health under current or expected future site conditions, and to qualitatively discuss these potential risks. Contaminants detected in site soils include SVOCs (primarily polynuclear aromatic hydrocarbons [PAHs]), PCBs, pesticides, and metals. Possible sources of soil contamination include past site operations, releases from adjacent industrial properties, and disposal of materials at the site. Some of the PAH contamination detected in soils may have resulted from emissions from various fossil fuel sources (such as automobile emissions). Contaminants detected in site groundwater include VOCs, one PAH, and metals.

5.1 Exposure Setting and Potential Exposure Pathways

The Tract II Site is a 24.5-acre parcel located on Highland Avenue in the City of Niagara Falls, New York. The site is located in a mixed land use setting, with areas of former and current industrial use positioned intermittently with light commercial and residential areas. A park, school, and churches also are located in the areas south and east of the site. A Conrail ROW is located south and west of the site, and industrial property is directly north of the site.

Currently, the site is vacant except for a concrete foundation in the central part of the property (formerly the Moore Business Form Manufacturing Company). There is an underground parking garage below the foundation, and a dilapidated cinder block building in the northeast corner of the site. The underground parking garage is in a state of disrepair. A sump pit in the northeast part of the garage contains sediment and surface water that appears to be surface runoff from the floor. Currently, an abundance of surface debris and refuse is present at the site.

A large abandoned brick building located directly north of the site at 3123 Highland Avenue was the location of a former lead-acid battery manufacturing operation. The facility produced batteries for automobiles, trucks, and tractors. Facility operations shifted in the 1960s to the manufacturing of hard rubber cases, filling of batteries with sulfuric acid, and charging of batteries. Battery operations ceased in the mid-1970s. Following the cessation of battery manufacturing, the building was subsequently used as an automotive body shop and also as a warehouse by Power City Distribution Company.

Discarded battery casings are present in the northeast corner of the Tract II Site. Other areas of possible concern at the Tract II Site include an area where a warehouse was destroyed by fire, a berm south of the former battery manufacturing building, a former aboveground storage tank area, and a former railroad siding area between the concrete foundation and the brick factory building north of the site. Various depressions were also noted in the ground surface on the southeast part of the site.

The site is currently inactive, although there are signs of dumping (debris, refuse, and construction and demolition debris on site). Access is unrestricted along the west side of the site, and limited along the south and east sides of the site. A short berm containing concrete and other fill traverses short segments of the east and southeast edges of the site. Both are overgrown with brush. Area residents who enter the site may potentially be exposed to contaminants in surface soils by dermal contact and incidental ingestion via hand-to-mouth transfer. If the site is redeveloped in its current condition as an industrial or commercial facility, a future site worker could be exposed to contaminants via these pathways. Because redevelopment of the site may involve excavation and disturbance of site soils, future construction workers may potentially be exposed to contamination in present subsurface soils.

5.2 Risk-Based Screening

5.2.1 Soil

The goal of New York State's brownfields program effort is to develop currently unused properties into available real estate. NYSDEC requires soil remediation alternatives at brownfield sites to be evaluated using the recommended soil cleanup objectives presented in a Technical and Administrative Guidance Memorandum (TAGM), referred to as TAGM 4046 (NYSDEC 1994). TAGM 4046 is considered a set of cleanup standards which, if implemented, would eliminate all significant threats to health and the environment. Tables 5-1 through 5-4 list those analytes exceeding TAGM 4046 criteria. Note that many of the more stringent values listed as Recommended Soil Cleanup Objectives are based on protection of groundwater, while some are based on potential cancer risks from incidental soil ingestion. Appendix F lists the sample analytes that were screened against TAGM 4046 criteria.

For metals, TAGM 4046 provides the option of using site-specific background concentrations, or an alternative value (typically published background concentrations), as a recommended cleanup objective. Because only a single local background sample was collected for the site, data on Eastern U.S. soils presented by Shacklette and Boerngen (USGS 1984) also was considered in selecting a background level.

In addition, risk-based concentrations (RBCs) for industrial soils developed by EPA Region III (EPA 1996) were adopted as screening criteria for contaminants in site soil. The RBCs, which are not officially endorsed by New York State regulatory agencies, are based on potential worker exposures by incidental ingestion. They are not intended as recommendations for cleanup, but merely as points of reference for purposes of discussing commercial/ industrial use. The RBCs are based on an acceptable level of risk; however, they are generally more stringent than TAGM 4046 criteria. RBCs are also listed in Table 5-1 through 5-4 and in Appendix F.

RBCs are based on the default reasonable maximum exposure assumption that a worker ingests 50 milligrams (mg) of site soil each day, 250 days per year, for a period of 25 years. The RBCs were calculated to correspond to one of two target risk levels: an upper-bound excess lifetime cancer risk of 1×10^{-6}, or a noncancer hazard quotient of 1.0. A cancer risk of 1×10^{-6} is equal to a one-in-a-million probability, which is the lower end of the 10^{-6} to 10^{-4} range regarded as acceptable by EPA. A noncancer hazard quotient is EPA's method for quantifying noncancer effects. The resulting RBCs are adequately protective for site visitors whose potential exposures are likely far less than that of a site worker. An RBC has not been calculated for lead in soil because there are no EPA-approved toxicity values for lead. In lieu of an RBC, EPA's recommended screening level for lead in residential soils (400 milligrams per kilogram [mg/kg]) was used (EPA 1994c).

Table 5-1 Summary of Analytical Results for Surface Soil, Tract II Site, Niagara Falls, New York

Compound	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Local Background Concentration	EPA Region III Industrial Soil RBC	Frequency of Exceeding RBC	NYSDEC TAGM 4046 Level	Frequency of Exceeding TAGM 4046
Volatile Organics (mg/Kg)								
None Detected								
Semi-Volatile Organics (mg/Kg)								
Dibenzofuran	9/12	0.058	6.9	ND	8,200	0/12	6.2[e]	1/12
Phenanthrene	11/12	0.75	72	0.45	41,000[b]	0/12	50[f]	1/12
Fluoranthene	11/12	1.8	71	0.67	82,000	0/12	50[f]	1/12
Benzo(a)anthracene	11/12	0.75	29	0.4 J	7.8[a]	1/12	0.224[g]	11/12
Chrysene	11/12	0.79	29	0.48	780[a]	0/12	0.4[e]	11/12
Benzo(b)Fluoranthene	11/12	0.72	20	0.35 J	7.8[a]	1/12	1.1[e]	6/12
Benzo(k)Fluoranthene	11/12	0.64	21	0.36 J	78[a]	0/12	1.1[e]	6/12
Dibenz(a,h)anthracene	11/12	0.13	9.8	0.13 J	0.78[a]	3/12	0.014[g]	11/12
Benzo(a)pyrene	10/12	0.11	25	0.41 J	0.78[a]	8/12	0.061[g]	10/12
Indeno(1,2,3-cd)pyrene	10/12	0.095	26	0.29 J	7.8[a]	1/12	3.2[e]	1/12
Pesticides/PCBs (mg/Kg)								
Heptachlor Epoxide	11/12	0.0025 J	0.19 J	0.0025 J	0.63	0/12	0.02[e]	7/12
Endrin Ketone	8/12	0.0077 J	0.048	ND	610[c]	0/12	—	NA
Dieldrin	7/12	0.0043	0.06	0.3 D	0.36[a]	0/12	0.044[g]	1/12
Endrin Aldehyde	1/12	—	0.008*	ND	—	NA	—	NA
Inorganics (mg/Kg)								
Antimony	15/15	1.9 B	182	4.5 B	820	0/15	4.5[j]	12/15
Arsenic	15/15	5.7	31	11	3.8[a]	15/15	16[i]	1/15
Barium	15/15	85.6	2073*	120	140,000	0/15	867[i]	1/15
Cadmium	15/15	0.47	3.8	0.31 B	1,000	0/15	10[k]	1/15

Table 5-1 Summary of Analytical Results for Surface Soil, Tract II Site, Niagara Falls, New York

Compound	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Local Background Concentration	EPA Region III Industrial Soil RBC	Frequency of Exceeding RBC	NYSDEC TAGM 4046 Level	Frequency of Exceeding TAGM 4046
Calcium	15/15	614	99300	16000	—	NA	16,000[j]	13/15
Chromium	15/15	18	136	36.3	6,100	0/15	50[k]	3/15
Copper	15/15	26.6	520	35.3	82,000	0/15	48.7[i]	10/15
Lead	15/15	120	32500	128	400[d]	0/15	128[j]	13/15
Magnesium	15/15	1940*	50000	7170	—	NA	7,170[j]	12/15
Manganese	15/15	317	12600	838	41,000	0/15	1450[i]	1/15
Mercury	12/15	0.34	100	0.38	610	0/15	0.27[i]	12/15
Nickel	15/15	14.8	54.8*	32.4	41,000	0/15	38.2[i]	1/15
Selenium	15/15	1.1	12.7	11.5	10,000	0/15	11.5[j]	1/15
Silver	15/15	0.46	3.7	0.37 B	10,000	0/15	0.37[j]	15/15
Vanadium	15/15	14	30.8*	38.6	14,000	0/12	150[k]	15/15
Zinc	15/15	134	1530*	130	610,000	0/12	130[j]	1/15

Table 5-1 Summary of Analytical Results for Surface Soil, Tract II Site, Niagara Falls, New York

Compound	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Local Background Concentration	EPA Region III Industrial Soil RBC	Frequency of Exceeding RBC	NYSDEC TAGM 4046 Level	Frequency of Exceeding TAGM 4046
Cyanide	1/12	—	3.6	0.66 U	41,000	0/12	0.66[j]	1/12

[a] Corresponds to an upper-bound cancer risk of 1 x 10^{-6}.
[b] RBC for naphthalene.
[c] RBC for endrin.
[d] EPA screening level for lead in soil in residential setting.
[e] Soil cleanup objective to protect groundwater quality.
[f] Objective for individual SVOCs is <50 ppm.
[g] Objective based on potential cancer risk for soil.
[h] Objective for total pesticides is <10 ppm.
[i] 90th percentile concentration in eastern U.S. soil (USGS 1984).
[j] Concentration reported in the local background sample.
[k] Concentration specified by NYSDEC Region 9 (Locey 1998).
[l] Concentration specified in TAGM 4046.

Key:

* = Average for duplicates.
J = The associated numerical value is an estimated quantity.
B = Indicates analyte result is between instrument detection limit and contract required detection limit (inorganics).
ND = Not detected at or above the Contract Required Detection Limit (CRDL).
— = No value or not applicable.

Table 5-2 Summary of Analytical Results for Subsurface Soil, Tract II Site, Niagara Falls, New York

Compound	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Local Background Concentration	EPA Region III Industrial Soil RBC	Frequency of Exceeding RBC	NYSDEC TAGM 4046 Level	Frequency of Exceeding TAGM 4046
Volatile Organics (mg/Kg)								
None detected								
Semi-Volatile Organics (mg/Kg)								
Phenanthrene	12/16	0.12	81 D	0.45	41,000^b	0/16	50^f	1/16
Fluoranthene	13/16	0.1115	120	0.67	82,000	0/16	50^f	1/16
Pyrene	13/16	0.0855	85	0.63	61,000	0/16	50^f	1/16
Benzo(a)anthracene	13/16	0.092	59	0.4 J	7.8^a	3/16	0.224^g	11/16
Chrysene	13/16	0.11	60	0.48	780^a	0/16	0.4^e	8/16
Benzo(b)Fluoranthene	13/16	0.078	46	0.35 J	7.8^a	2/16	1.1^e	7/16
Benzo(k)Fluoranthene	13/16	0.079	38	0.36 J	78^a	0/16	1.1^e	7/16
Dibenz(a,h)anthracene	12/16	0.043	19	0.13 J	0.78^a	6/16	0.014^g	12/16
Benzo(a)pyrene	13/16	0.095	53	0.41 J	0.78^a	7/16	0.061^g	13/16
Indeno(1,2,3-cd)pyrene	13/16	0.075	48	0.29 J	7.8^a	3/16	3.2^e	6/16
Pesticides/PCBs (mg/Kg)								
Aldrin	6/16	0.00089 J	0.59	ND	0.34^a	1/16	0.041^g	2/16
Heptachlor Epoxide	7/16	0.003 J	1.7	0.0025 J	0.63^a	1/16	0.02^e	5/16
Dieldrin	2/16	0.011	0.18 J	0.3 D	0.36^a	0/16	0.044^g	1/16
Aroclor-1260	5/16	0.043	1.4 J	ND	2.9^a	0/16	1^h	1/16
Inorganics (mg/Kg)								
Antimony	16/16	1.6	887	4.5 B	820	1/16	4.5^j	9/16
Arsenic	16/16	2.6	74.2	11	3.8^a	15/16	16^i	2/16
Calcium	16/16	3670	113000	16000	—	—	16,000^j	9/16
Chromium	16/16	2.4 B	66.7	36.3	6,100	0/16	50^k	1/16

Table 5-2 Summary of Analytical Results for Subsurface Soil, Tract II Site, Niagara Falls, New York

Compound	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Local Background Concentration	EPA Region III Industrial Soil RBC	Frequency of Exceeding RBC	NYSDEC TAGM 4046 Level	Frequency of Exceeding TAGM 4046
Copper	16/16	6 B	268	35.3	82,000	0/16	48.7^{i}	5/16
Lead	16/16	7.1	9950	128	400^{d}	6/16	128^{j}	10/16
Magnesium	16/16	584	20900	7170	—	—	7,170^{j}	9/16
Mercury	11/16	0.13	3.97	0.38	610	0/16	0.27^{i}	6/16
Selenium	15/16	3.2	12.6	11.5	10,000	0/16	11.5^{j}	4/16
Silver	12/16	0.37*	4.9	0.37 B	10,000	0/16	0.37^{j}	12/16
Zinc	16/16	12.1	1860	130	610,000	0/16	130^{j}	10/16
Cyanide	1/16	—	3.1	0.66 U	41,000	0/16	0.66^{j}	1/16

[a] Corresponds to an upper-bound cancer risk of 1 x 10^{-6}.
[b] RBC for naphthalene.
[c] RBC for endrin.
[d] EPA screening level for lead in soil in residential setting.
[e] Soil cleanup objective to protect groundwater quality.
[f] Objective for individual SVOCs is <50 ppm.
[g] Objective based on potential cancer risk for soil.
[h] Objective for total pesticides is <10 ppm.
[i] 90th percentile concentration in eastern U.S. soil (USGS 1984).
[j] Concentration reported in the local background sample.
[k] Concentration specified by NYSDEC Region 9 (Locey 1998).
[l] Concentration specified in TAGM 4046.

Key:

*	=	Average for duplicates.
J	=	The associated numerical value is an estimated quantity.
B	=	Indicates analyte result is between instrument detection limit and contract required detection limit (inorganics).
ND	=	Not detected at or above the Contract Required Detection Limit (CRDL).
—	=	No value or not applicable.

Table 5-1 lists site surface soil sample analytes present at concentrations that exceed TAGM 4046 soil screening criteria. Table 5-2 lists subsurface (borings and test pit) soil sample analytes present at concentrations exceeding TAGM 4046 soil criteria. In addition, the tables list the results of the local background sample collected for the site. Because metals occur naturally in soil and other non-site-related sources of contamination may exist in the area, it is important to consider how site soil concentrations compare to local background concentrations, in addition to other screening criteria. Note that a single soil sample provides a rough indication of background levels only and does not reflect the range of concentrations that may be present in local soils. Most of the organic and inorganic chemical concentrations reported in the background sample were below the TAGM 4046 criteria. The exceptions were benzo(a)anthracene, chrysene, dibenz(a,h)anthracene, benzo(a)pyrene, dieldrin, lead, mercury, selenium, and zinc.

Aroclor 1260 was detected in nine of the 12 surface soil composite samples, but at concentrations below the TAGM 4046 recommended soil cleanup objective of 1 mg/kg for surface soils. Aroclor 1260 was detected in one subsurface sample (MWT2A02SO) above the TAGM 4046 criterion, but below the RBC. Heptachlor epoxide, a pesticide, was detected in seven of the 12 samples at a concentration exceeding the TAGM 4046 criterion. Dieldrin, another pesticide, was detected in one sample at a concentration exceeding the TAGM 4046 criterion. The PAH contamination was more widespread. Benzo(a)anthracene, chrysene, and dibenz(a,h)anthracene were detected in 11 of the 12 samples above TAGM 4046 criteria. Benzo(a)pyrene was detected in 10 out of 12 samples at concentrations above TAGM 4046 objectives. Other TAGM 4046 criteria include exceedances. Phenanthrene (1 out of 12), fluoranthene (1 out of 12), indeno(1,2,3-cd)pyrene (1 out of 12), benzo(b)fluoranthene (6 out of 12), and benzo(k)fluoranthene (6 out of 12).

The organic compounds detected were at concentrations well below their respective RBCs, with the exception of five PAHs which are considered to be carcinogenic. Benzo(a)anthracene, benzo(b)fluoranthene, dibenz(a,h)anthracene, benzo(a)pyrene, and indeno(1,2,3-cd)pyrene were all detected at concentrations exceeding their respective RBC, which are associated with a target cancer risk of 1×10^{-6}. Benzo(a)pyrene (detected in eight of the 12 at concentrations exceeding its RBC) was the PAH compound detected most frequently above the respective RBC. The maximum concentration of benzo(a)pyrene (25 mg/kg) was found at the southeast area of the site in surface soil sample SS-11. This concentration is 32 times greater than the RBC. Certain PAH compounds are classified by EPA as probable human carcinogens (Group B2), based on carcinogenicity in animals. PAHs can cause cancer at the point of exposure; oral exposures are associated with stomach cancer.

Generally, the higher PAH concentrations were detected in the eastern part of the site in samples SS-06, SS-08, SS-11, and SS-12. Elevated PAHs also were found in the upper subsurface samples (0 to 2 feet) collected from test pits TP-03, TP-09, TP-10, and TP-11. Based on the maximum concentrations of carcinogenic PAHs detected in surface soils, the estimated total upper-bound cancer risk for future site workers is approximately 5.4 x 10^{-5}, which is within EPA's acceptable range of 10^{-6} to 10^{-4}.

Lead was detected at concentrations exceeding TAGM 4046 criterion (the local background) in 13 of 15 samples. Five of the samples exceeded the 400 mg/kg concentration for residential soils (EPA OSWER) as well as the New York State Department of Health's (NYSDOH) guidance value of 1,000 mg/kg for properties evaluated under a commercial/industrial future-use scenario. The highest lead concentrations were detected in samples SS-05, SS-06, SS-07, SS-08, SS-12, SS-T2A, SS-T2B, and SS-T2C. The first five of these samples were collected in the eastern portion of the site, while the last three were collected around the dilapidated building. These concentrations of lead currently pose an unacceptable level of risk to children who may repeatedly enter this unrestricted site. In addition, repeated exposure to these high lead concentrations could pose adverse health effects to future site workers.

Arsenic concentrations in all of the surface soil samples and most of the subsurface samples exceeded the RBC, which is based on potential cancer risk. However, with the exception of two test pit soil samples, the arsenic concentrations were similar to the background concentration. The highest arsenic concentration detected (74.2 mg/kg collected in Test Pit 10) was nearly seven times the background concentration, but the estimated excess cancer risk for a site worker from exposure to arsenic based on the maximum detected value would be approximately 2 x 10^{-5}, which is within EPA's acceptable range.

The concentrations detected for 15 inorganic analytes (including lead and arsenic) exceeded their respective TAGM 4046 criteria in at least one surface soil sample (see Table 5-1). For six of the metals, the local background concentration was used as the criterion. Only lead and arsenic were detected at concentrations above their respective RBCs for the industrial worker scenario. Generally, antimony, copper, and zinc concentrations were elevated at the same locations where lead concentrations were high.

Based on the prevalence and nature of contamination, potential adverse health effects may occur to future site workers from chronic exposure to soils. Remedial alternatives to reduce exposure to contaminated soils (i.e., soil removal or capping in place) should be considered as described in Sections 6 and 7, when the site is redeveloped.

5.2.2 Sump Sludge and Water

One sludge sample was collected from a concrete sump pit located inside the underground parking garage at the site. The pit did not appear to have any discharge lines, and apparently had accumulated surface runoff from the floor of the mechanical room of the garage. Concentrations of 14 organic compounds and 15 inorganic analytes were detected in the sediment sample at concentrations exceeding their respective TAGM 4046 criteria (see Table 5-3). In addition, concentrations of eight PAHs, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, 1,2,4-trichlorobenzene, PCB Aroclor 1260, arsenic, and lead also exceeded industrial RBCs.

The concentration of Aroclor 1260 detected in the sludge sample is approximately 3.1%. The water in the sump contained low levels of Aroclor 1260, di-n-butylphthalate, and 2-4, dichlorophenol. The levels of contaminants detected clearly warrant removal of the sediments and accumulated water in the concrete sump pit and further investigation of the area for possible migration pathways from the pit such as possible future cracks in the sump walls.

5.2.3 Groundwater

Based on the lack of plausible exposure pathways, it is unlikely that contamination in site groundwater poses any significant human health risks. Although groundwater is not a current or likely future drinking water supply source in the area, NYSDEC policy regards all groundwater as a potential drinking water source.

Table 5-3 Summary of Analytical Results for Sump Sediment and Water, Tract II Site, Niagara Falls, New York

Compound	Sample Number	
	SDT2-01SPSO (Sediment)	SWT2-01SPWO (Water)
Volatile Organics (mg/Kg)		
Acetone	0.021	ND
2-Butanone	0.005 J	ND
Benzene	0.005 J	ND
Toluene	0.023	ND
Chlorobenzene	2.4	ND
Ethylbenzene	0.005 J	ND
Styrene	0.005 J	ND
Xylene (Total)	0.014 J	ND
Semi-Volatile Organics (mg/Kg)		
Naphthalene	3.8 J	ND
2-methylnaphthalene	3 J	ND
Acenaphthylene	3.7 J	ND
Acenaphthene	41	ND
Dibenzofuran	6.6 J	ND
Fluorene	40	ND
Anthracene	46	ND
Carbazole	11 J	ND
Benzo(a)anthracene	140	ND
Chrysene	44	ND
Benzo(b)Fluoranthene	56	ND
Benzo(k)Fluoranthene	79	ND
Dibenz(a,h)anthracene	7.6 J	ND
Benzo(a)pyrene	73	ND
Indeno(1,2,3-cd)pyrene	15 J	ND
Benzo(g,h,i)perylene	12 J	ND
Di-n-butylphthalate	ND	1 J
2,4-Dichlorophenol	ND	3 J
Diethylphthalate	2 J	ND
1,3-Dichlorobenzene	240 E	ND
1,4-Dichlorobenzene	160 E	ND
1,2-Dichlorobenzene	230 E	ND
1,2,4-Trichlorobenzene	97,000	ND

Table 5-3 Summary of Analytical Results for Sump Sediment and Water, Tract II Site, Niagara Falls, New York

Compound	Sample Number	
	SDT2-01SPSO (Sediment)	SWT2-01SPWO (Water)
Pesticides/PCBs (mg/Kg)		
Aroclor-1260	31,000 JDC	30 D
Inorganics (mg/Kg)		
Aluminum	2,990	49.6 B
Antimony	166	17.1 B
Arsenic	4.8	3.5 U
Barium	1870	62.5 B
Cadmium	33.7	0.94 B
Calcium	19,900	75,900
Chromium	89.7	159
Cobalt	8.5 B	0.4 U
Copper	382	7.5 B
Iron	172,000	1110
Lead	7,600	12.7
Magnesium	3,480	14,600
Manganese	658	25.1
Mercury	0.65	0.2 U
Nickel	87.8	0.79 B
Potassium	213 B	4,200 B
Selenium	13.9	4.5 B
Silver	12.4	1.8 U
Sodium	243 U	13,300
Zinc	2,180	108
Cyanide	4.3	10 U

Key:

B = Result is between instrument detection limit and Contract Required Detection Limit (CRDL).
C = Identification confirmed by GC/MS.
D = Reported result taken from diluted sample analysis.
E = Value is estimated due to quantitation above calibration range.
J = Value is estimated.
ND = Compound was analyzed for, but not detected at or above CRDL.
U = Compound was analyzed for, but not detected at or above CRDL.

Table 5-4 Groundwater Analytes Exceeding Class GA Groundwater Standards, Tract II Site, Niagara Falls, New York

	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Class GA Groundwater Standard	Frequency of Exceeding Standard
Volatile Organics (µg/L)					
Methylene Chloride	1/4	—	28.5 *	5	1/4
Semi-Volatile Organics (µg/L)					
None Detected					
Pesticides/PCBs (µg/L)					
None Detected					
Inorganics (µg/L)					
Iron	4/4	353	2022*	300	4/4
Iron & Manganese[a]	4/4	464.7	2169.8*	500	3/4
Magnesium	4/4	44800	54250*	35000	4/4
Manganese	4/4	51.6	302	300	1/4
Sodium	4/4	12600	50500	20000	3/4

[a] Iron and Manganese combined cannot exceed 500 µg/L.

Key:

* = Average of duplicates.
J = The associated numerical value is an estimated quantity.
B = Indicates analyte result is between instrument detection limit and contract required detection limit.
ND = Not detected at or above the Contract Required Detection Limit (CRDL).
— = No value or not applicable.

Consequently, contaminant concentrations detected in groundwater were compared to the New York State Class GA groundwater standards (NYSDEC 1998). Table 5-4 summarizes the analytical results of site groundwater samples exceeding NYSDEC Class GA groundwater standards.

Methylene chloride was detected at levels above the Class GA groundwater standard in the original and duplicate groundwater samples from monitoring well MW-04. The averaged concentration of the two samples is nearly six times greater than the Class GA groundwater standard. Methylene chloride was not reported in the associated trip blank sample, so it is assumed to be present in the groundwater. Methylene chloride is widely used as an industrial solvent and as a paint stripper.

Absorption of methylene chloride into the body occurs readily following exposure by breathing vapors or accidental ingestion. Based on results from animal studies, methylene chloride is classified as a Group B2 probable human carcinogen. Uncertainties remain regarding the pharmacokinetics, pharmacodynamics, and mechanisms of carcinogenicity for methylene chloride.

Iron, magnesium, manganese, and sodium also were detected in groundwater above Class GA standards. All of these analytes occur naturally in soils and groundwater, and cannot be attributed with certainty to the observed contamination at the site.

Under the current and likely future site conditions, there are no plausible pathways for human exposure to contamination in site groundwater. The site area is served by a municipal water system and groundwater is not a source of potable water, nor is it likely to become one in the future.

6

Identification and Development of Remedial Alternatives

6.1 Introduction

This section presents the methodology and rationale used to develop remedial action alternatives for the Tract II Site. Note a debris pile containing abandoned televisions, grocery carts, and other debris is located north of the dilapidated building. Removal and disposal costs of this debris pile are not included in the remedial alternative evaluations; these costs are to be addressed by the site owner at the time of development.

6.2 Remedial Action Objective

As stated in Section 5.2.1, the objective of the Brownfields Program is to return a given project site to unrestricted use, or restricted use conditions where feasible. Appropriate cleanup goals to achieve unrestricted conditions were developed and are discussed in the following section. It is not always practical and feasible, however, to return a given project site to unrestricted conditions given current site conditions. Therefore, a second set of site cleanup goals was developed to achieve typical restricted use conditions and make the site suitable for possible future commercial/industrial use. These cleanup goals are also discussed below.

Appropriate remedial action alternatives have been developed and evaluated based on compliance with both of these remedial cleanup goals. Based on the designated future use of the site, the final remedy for the site will be selected from these alternatives.

6.2.1 Unrestricted Conditions

Unrestricted conditions correspond to cleanup goals that are considered to be the most protective of human health and the environment and would be appropriate for a residential (or equivalent) future use of the site. NYSDOH has established the following guidance values for PAH and lead contamination that are to be used as cleanup goals to achieve unrestricted conditions:

- A maximum concentration of 1 ppm total carcinogenic PAHs or 10 ppm total PAHs in top two feet of soil (O'Connor 1997); and

- A maximum concentration of 500 ppm lead in top two feet of soil (O'Connor 1997).

6.2.2 Restricted Use Conditions

The cleanup goals for achieving restricted use conditions on site are less protective than the cleanup levels established for achieving unrestricted use conditions as a result of different exposure scenarios and potential human health risks. In general, restricted use condition levels would correspond to a commercial/industrial future use of the site or equivalent. NYSDOH uses a screening level of 1,000 ppm of lead to assess properties for potential future commercial use (O'Connor 1997). In addition, TAGM 4046 establishes a limit on the concentration of total SVOCs, of which PAHs are a subset, in the surface soils (0 to 2 inches) to $\leq$500 ppm, and on each individual SVOC concentration to $\leq$50 ppm. These values have been established as the cleanup goals for restricted use conditions. In cases in which contaminant concentrations in the subsurface soil exceed these levels, individual TAGM values were reviewed to determine the potential impact on groundwater quality from a given contaminant.

6.2.3 Regulatory Implications of Contaminant Concentrations

In general, the contaminants detected in the soils at the Tract II Site include PAHs, PCBs, pesticides, and metals. Of the PAHs detected, the following carcinogenic PAHs are present: benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. All contaminants detected at concentrations exceeding TAGM 4046 levels are shown on Table 5-1. The unrestricted cleanup goal for c-PAHs of 1 ppm was exceeded in 11 of the 12 surface soil samples and 8 of the 13 subsurface soil samples (those soil samples collected from soil borings and test pits). There was one exceedance of the restricted use cleanup goal of 500 ppm total semivolatiles in subsurface soil sample TPT2-03-ASO. Several compounds were detected in this sample at concentrations which exceeded the 50 ppm limit established for individual SVOCs. Additionally, the compounds phenanthrene and fluoranthene were detected in surface soil sample SST2-11-SO at concentrations greater than 50 ppm.

Lead was detected in 13 of the surface soil samples and in seven of the subsurface soil samples at concentrations exceeding the TAGM 4046 level, which is the site background concentration of 128 ppm. The highest surface soil and subsurface soil concentrations also exceeded the NYSDOH site cleanup goal of 500 ppm (unrestricted use level). In addition, eight surface soil samples and two of the subsurface soil samples exceeded the site cleanup goal of 1,000 ppm (restricted use level).

PCBs were detected in approximately half of the soil samples collected on site; however, the TAGM 4046 level of 1 ppm was exceeded in only one sample, MWT2A-02-SO. The concentration of PCBs detected in this sample was 1.4 ppm. Disposal of PCB-contaminated soil is regulated in accordance with the provisions of the Toxic Substances Control Act (TSCA), 40 CFR Part 761.

Groundwater at the Tract II Site was determined to pose no risks to human health because it is not a current or likely future source of drinking water. Because the entire area is adequately supplied by a public water source, no remedial alternatives were developed for groundwater.

6.3 General Response Actions

General response actions are implemented at a site in order to meet the remedial action objective. These actions may include treatment, containment, excavation, extraction, disposal, institutional controls, or a combination thereof. The following general response actions were identified for the soils at the Tract II Site:

- Containment,
- Removal (partial or complete),
- Off-site Disposal,
- Institutional Controls, and
- No Action.

6.4 Development of Alternatives

The general response actions identified in Section 6.3 are combined as appropriate into remedial action alternatives that address the contamination concerns at the site as a whole. As discussed in Section 6.2, two sets of cleanup goals were identified for the Tract II Site on the basis of returning the site to either unrestricted conditions or restricted use conditions. The following remedial action alternatives were developed for this site to address both possible future site conditions:

- Alternative 1 - Containment and Institutional Controls;
- Alternative 2 - Excavation and Off-site Disposal;
- Alternative 3 - Institutional Controls; and
- Alternative 4 - No Action.

These alternatives are evaluated in detail in Section 7. Note that several treatment technologies exist for PAH- and lead-contaminated soils. However, due to the limited amount of contaminated soil at the Tract II site, not all technologies would be cost effective. Only economically feasible technologies have been included in this analysis of alternatives.

7

Detailed Analysis of Alternatives

7.1 Introduction

A detailed analysis of the remedial action alternatives developed for the Tract II Site consists of the presentation of information necessary to select an appropriate remedial action. The proposed alternatives were analyzed in this report using the following seven evaluation criteria, as defined in Regulation 6 NYCRR Part 375:

1. Overall protection of human health and the environment;
2. Compliance with remedial action objectives;
3. Short-term effectiveness;
4. Reduction of toxicity, mobility, and volume;
5. Long-term effectiveness and permanence;
6. Implementability; and
7. Cost.

The criterion of community acceptance will be evaluated by NYSDEC following issuance of the proposed plan.

7.2 Individual Analysis of Alternatives

Each alternative is further defined in the following paragraphs with regard to: volumes or areas of contaminated media to be addressed; the technologies to be used; and any performance requirements associated with those technologies. Cost estimates are based on a variety of sources, including the 1999 and 2000 editions of *R.S. Means Site Work and Landscape Cost Data and Environmental Remediation Cost Data-Assemblies*; local vendors; previous project experience; and sound engineering judgment. Note that present-worth calculations were not performed. Annual operation and maintenance (O & M) costs are expected with some of the proposed alternatives; however, it is assumed that these expenses will be the responsibility of the future site owner.

The remedial alternatives presented below are discussed in terms of site-specific areas. The "buildings" refer to both the parking garage and the dilapidated buildings. Two small areas of contamination (referred to as "hot spots") were identified on the western portion of the site, one near Test Pit 3 and one at monitoring well MW2, southeast of the parking garage. Also, the "eastern portion of the site" consists of the area extending from approximately the 15th Street right-of-way east to the eastern site border, and to within approximately 150 feet of Beech Street. Figure 7-1 depicts the positions of the site buildings, the two hot spots, and the eastern portion of the site.

7.2.1 Alternative 1 - Containment and Institutional Controls

Description of Alternative 1

Under this alternative, direct contact with soil contaminated at concentrations exceeding NYSDOH and TAGM 4046 cleanup goals would be minimized through the installation of a site cap. Installation of a properly constructed cap could also reduce infiltration of contaminants into the subsurface soils and the potential for contaminant migration. The main components of this containment alternative include site preparation, cap construction, and long-term deed restrictions. These components are the same regardless of whether unrestricted or restricted use cleanup goals are assumed. Results of the site investigation indicate that the entire site (excluding that parking garage and dilapidated building) would require capping under unrestricted use conditions. Under restricted use conditions, capping would be necessary only in the eastern portion of the site. However, the two localized "hot spots" would also require remedial action. Since it is not practical to cap small, discrete areas of the site where contaminant concentrations exceed selected cleanup goals, a limited amount of excavation in these two locations would be required to achieve restricted use conditions. A minimum 15-foot-by-5-foot area of PAH-contaminated soil in the area of Test Pit 3 and 5-foot-by-5-foot area of PCB-contaminated soil in the area of MW 2 would be excavated and disposed of off site. Excavation would be to a depth of at least 2 feet, generating approximately 7.5 cubic yards of soil for disposal. The excavated areas would be filled with clean soil and graded. Depending on its contents, there is a potential that the remainder of the berm located in the northwest portion of the site should be removed at a later date.

Capping would consist of installing a single-layered topsoil cap, having an average thickness of 2 feet, suitable for maintaining native vegetative growth or grasses. In order to establish unrestricted use conditions, it is assumed that the entire site, except the areas covered by buildings (encompassing approximately 74,000 square yards) would be covered by the soil cap. This would require an estimated 49,400 cubic yards of soil. An area of approximately 40,000 square yards in the eastern portion of the site would be capped to achieve an objective of establishing unrestricted use conditions. This would require an estimated 26,800 cubic yards of additional soil.

Both restricted and unrestricted use would require grading of the soil cap to promote natural drainage. Maintenance of the soil cap to prevent erosion would be necessary. Institutional controls consisting of deed restrictions on the disturbance of subsurface soils below 2 feet, as well as a requirement to maintain the vegetative cover on the soil cap, would be necessary to reduce possible exposure to contaminated soil left on site.

Section 7.3 discusses building and asbestos removal costs. It is recommended that both buildings be removed prior to implementation of Alternative 1.

A general remedial scope of work outline for Alternative 1 is as follows:

- Preconstruction meeting;
- Mobilization;
- Land surveying;
- Erosion control;
- Site preparation, including clearing and grubbing;
- Excavation and backfill of hot spots (restricted use only);
- PAH- and PCB-contaminated soils disposal (restricted use only);
- Installation 2-foot-thick soil layer, including hauling and spreading;
- Grading;
- Compaction, including watering;
- Vegetative cover;
- Demobilization;
- Vegetative cover maintenance;

- Deed restrictions.

An option to the homogeneous soil cap recommended under this alternative consists of containment by a variety of construction materials that may be an integral part of the site redevelopment plans, including asphalt, concrete, and soil. Assuming the future use of the site will require construction of one or more buildings that would occupy the majority of the property, any new building foundation(s) installed would function as a large portion of the containment system. An asphalt parking lot, concrete sidewalks and/or driveways, and vegetated green space would also be expected to be present in conjunction with the building(s) and would occupy the remaining areas. It is assumed that each portion of the site would be covered by one of these materials. The actual surface areas to be covered by each of these material types would be contingent on the redevelopment plans. Use of this containment option would be more cost effective than a soil cap because the cost for construction would be covered under site redevelopment.

Assessment of Alternative 1

An assessment of Alternative 1 based on the seven evaluation criteria is provided in Tables 7-1 to 7-3. Capital costs associated with Alternative 1 are provided in Tables 7-2 and 7-3. The cost of maintaining the vegetative cover on the 2-foot cap would become the responsibility of the future site owner. These costs are not included in the remedial cost estimate provided in Tables 7-2 and 7-3.

7.2.2 Alternative 2 - Excavation and Off-site Disposal

Description of Alternative 2

Components of this alternative include excavation, transportation, and off-site disposal of contaminated soil from the Tract II Site. These basic components are the same regardless of whether unrestricted or restricted use cleanup goals are assumed. However, because the unrestricted use cleanup goals are more stringent than the restricted use goals in both contaminant concentrations and depth restrictions, larger quantities of soil would require excavation to meet unrestricted use conditions.

To meet the NYSDOH cleanup levels for c-PAHs and lead under unrestricted use conditions, the entire site area except the parking garage and dilapidated building sites would be excavated to a depth of 2 feet. The total volume of soil to be excavated would be approximately 49,400 cubic yards. Under restricted use conditions, excavation of PAH- and lead-contaminated soil would be conducted mainly on the eastern portion of the site. Excavation in this

Table 7-1 Detailed Analysis of Alternatives, Tract II Site

Remedial Alternative	Protection of Human Health and Environment	Compliance with Remedial Action Objective	Short-term Effectiveness	Reduction of Toxicity, Mobility, Volume	Long-term Effectiveness and Permanence	Implementability
Alternative 1: Containment and Institutional Controls	Would minimize direct contact hazards.	Does not comply with remedial goals of removing surface and subsurface contamination.	Short-term construction-related impacts due to dust generation, noise disturbance, and increased vehicular traffic.	No reduction in toxicity, mobility, or volume of contaminants.	Direct contact hazards would be eliminated as long as cap is maintained. Long-term deed restrictions necessary.	Construction of alternative relatively simple and straightforward.
Alternative 2: Partial Excavation and Off-Site Disposal	Virtually eliminates direct contact hazards and subsurface hazards.	Complies with remedial goals.	Short-term construction-related impacts due to dust generation, noise disturbance, and increased vehicular traffic.	No reduction in toxicity, mobility, or volume of contaminants.	Virtually eliminates all direct contact hazards. Long-term deed restrictions may be necessary on use of subsurface soils.	Construction of alternative relatively simple and straightforward. Availability of adequate landfill space must be determined.
Alternative 3: Institutional Controls	No reduction in risk of existing contaminants. Restricts site access and possible exposure to site contaminants.	Does not comply with remedial goals of removing surface and subsurface contamination and providing for site redevelopment.	Some short-term construction-related impacts due to dust generation, noise disturbance, and increased traffic volume.	No reduction in toxicity, mobility, or volume of contaminants.	Direct contact hazard remains.	Implementation of alternative simple and straightforward.
Alternative 4: No Action	No reduction in risk.	Does not comply with remedial goals of removing surface and subsurface contamination and providing for site redevelopment.	No short-term impacts.	No reduction in toxicity, mobility, or volume of contaminants.	Direct contact hazards remain.	No construction or operation associated with alternative.

Table 7-2 Capital Costs for Alternative 1, Unrestricted Use Conditions, Tract II Site

Remedial Alternative Item	Units	Unit Cost ($)	Quantity	Total Cost ($)
Surveying	LS	3,000	1	3,000
Site preparation/clearing/grubbing	LS	20,000	1	20,000
Soil layer (2 foot)	CY	7	49,400	345,800
Filling and compaction	CY	3	49,400	148,200
Site grading	SY	1	74,000	74,000
Vegetative cover	acre	1,750	15	26,250
Subtotal				**$617,250**
Contingency (20%)				$123,450
Subtotal				**$740,700**
Engineering (15%)				$111,105
Total Cost				**$851,805**

Key:

LS = Lump sum.
SY = Square yard.
CY = Cubic yard.

area would be to a depth of 6 inches. Excavation of the small areas around Test Pit 3 and MW 2 will remain the same as discussed in Section 7.2.1. Therefore, the total volume of soil exceeding restricted use cleanup goals is estimated at 6,490 cubic yards.

Implementation of this alternative would require site clearing and grubbing prior to excavation of the selected areas. Site excavation would be performed using traditional earth-moving equipment such as backhoes and bulldozers. Excavated material would then be covered and transported in lined dump trucks or trailers to the nearest permitted solid/hazardous waste landfill approved to accept these waste materials. PCB-contaminated soil would need to be segregated and disposed of in accordance with TSCA requirements. In addition, measures would be taken during excavation to control the generation of contaminated dust. Excavated areas would be backfilled with clean soil and graded upon completion. Deed restrictions on the disturbance of soils below the depth of excavation would be necessary on the future use of this site to prevent contact with subsurface soils not removed during remediation.

Table 7-3 Capital Costs for Alternative 1, Restricted Use Conditions, Tract II Site

Remedial Alternative Item	Units	Unit Cost ($)	Quantity	Total Cost ($)
Surveying	LS	3,000	1	3,000
Site preparation/clearing/grubbing	LS	12,000	1	12,000
Soil layer (2 foot)	CY	7	26,800	187,600
Filling and compaction	CY	3	26,800	80,400
Site grading	SY	1	40,000	40,000
Vegetative cover	acre	1,750	8.3	14,525
Soil excavation	LS	1	1,000	1,000
Provide and placement of backfill	CY	10	7.5	75
Transportation and off-site disposal				
PAH-contaminated soil	TN[a]	70	8.8	616
PCB-contaminated soil	TN[a]	150	3.2	480
Subtotal				**$339,696**
Contingency (20%)				$67,939
Subtotal				**$407,635**
Engineering (15%)				$61,145
Total Cost				**$468,780**

[a] Assume soil density of 1.6 tons/cy.

Key:

CY = Cubic yard.
LS = Lump sum.
SY = Square yard.
TN = Ton.

Section 7.3 discusses building and asbestos removal costs. It is recommended that they be removed prior to implementation of Alternative 2.

A general remedial scope of work outline for Alternative 2 is as follows:

- Preconstruction meeting;
- Mobilization;
- Land surveying;
- Erosion control;
- Dust control;

- Site preparation, including clearing and grubbing;
- Soil excavation, including hauling;
- Soil disposal;
- Backfill;
- Grading;
- Compaction;
- Demobilization; and
- Deed restrictions.

Assessment of Alternative 2

A complete assessment of Alternative 2 based on the seven criteria is provided in Tables 7-1, 7-4, and 7-5. Capital costs associated with Alternative 2 are provided in Tables 7-4 and 7-5, which list the costs associated with both unrestricted and restricted use conditions, respectively.

Table 7-4 Capital Costs for Alternative 2, Unrestricted Conditions, Tract II Site

Remedial Alternative Item	Units	Unit Cost ($)	Quantity	Total Cost ($)
Surveying	LS	3,000	1	3,000
Site preparation/clearing/grubbing	LS	20,000	1	20,000
Soil excavation	CY	7.00	49,400	345,800
Dust control	LS	5,000	1	5,000
Provide backfill	CY	7.00	49,400	345,800
Filling/compaction	CY	3.00	49,400	148,200
Site grading	SY	1.00	74,000	74,000
Transportation and off-site disposal[a]	TN[b]	70	79,040	5,532,800
Subtotal				**$6,474,600**
Contingency (20%)				$1,294,920
Subtotal				**$7,769,520**
Engineering (15%)				$1,165,428
Total Cost				**$8,934,948**

[a] The cost for disposal of PCB-contaminated soil is approximately $150/TN; however, due to the very small volume of PCB-contaminated soil as compared to the total volume of soil to be excavated, a separate cost for disposal was not included in the cost estimate for this alternative.

[b] Assume soil density of 1.6 tons/cy.

Key:

CY = Cubic yard.
LS = Lump sum.
SY = Square yard.
TN = Ton.

Table 7-5 Capital Costs for Alternative 2, Restricted Use Conditions, Tract II Site

Remedial Alternative Item	Units	Unit Cost ($)	Quantity	Total Cost ($)
Surveying	LS	3,000	1	3,000
Site preparation/clearing/grubbing	LS	12,000	1	12,000
Soil excavation	CY	7.00	6,490	45,430
Dust control	LS	5,000	1	5,000
Provide backfill	CY	7.00	6,490	45,430
Filling/compaction	CY	3.00	6,490	19,470
Site grading	SY	1.00	40,000	40,000
Transportation and off-site disposal[a]	TN[b]	70	10,384	726,880
Subtotal				**$897,210**
Contingency (20%)				$179,442
Subtotal				**$1,076,652**
Engineering (15%)				$161,498
Total Cost				**$1,238,150**

[a] The cost for disposal of PCB-contaminated soil is approximately $150/TN; however, due to the very small volume of PCB-contaminated soil as compared to the total volume of soil to be excavated, a separate cost for disposal was not included in the cost estimate for this alternative.

[b] Assume soil density of 1.6 tons/cy.

Key:

CY = Cubic yard.
LS = Lump sum.
SY = Square yard.
TN = Ton.

7.2.3 Alternative 3 - Institutional Controls

Description of Alternative 3

Under this alternative, no remedial activities would take place to remove, contain, or treat contaminated soils. Soils would remain on site in their present state. However, institutional controls in the form of fencing, signs, and deed restrictions would be implemented to restrict the use of site soils and to restrict vehicular and human traffic on site. The components of this alternative are the same regardless of whether unrestricted or restricted use level cleanup goals are assumed.

A general remedial scope of work outline for Alternative 3 is as follows:

- Preconstruction meeting;
- Mobilization;
- Land surveying;
- Site preparation, including clearing;
- Fence installation;
- Sign installation;
- Demobilization; and
- Deed Restrictions

Assessment of Alternative 3

A complete assessment of Alternative 3 based on the seven criteria is provided in Tables 7-1 and 7-6. Capital costs associated with Alternative 3 are provided in Table 7-6.

Table 7-6 Capital Costs for Alternative 3, Tract II Site

Remedial Alternative Item	Units	Unit Cost ($)	Quantity	Total Cost ($)
6-foot chain-link fence	LF	20	5,123	102,460
Signs	EA	100	8	800
Subtotal				**$103,260**
Contingency (20%)				$20,652
Subtotal				**$123,912**
Engineering (15%)				$18,587
Total Cost				**$142,499**

Key:

EA = Each.
LF = Linear feet.

7.2.4 Alternative 4 - No Action

Description of Alternative 4

Under this alternative, no remedial activities would take place on site to remove, contain, or treat contaminated soils. Soils would remain on site in their present state. In addition, no institutional controls would be implemented to restrict the use of site soils or site access. The components of this alternative are the same regardless of whether unrestricted or restricted use level cleanup goals are assumed.

Assessment of Alternative 4

A complete assessment of Alternative 4 based on the seven criteria is provided in Table 7-1. There are no capital costs associated with this alternative.

7.3 Building Removal and Asbestos Abatement

Both the dilapidated building and parking garage are in poor structural condition and should be removed for safety purposes. Facility inspections have indicated that there is asbestos in both facilities. Before the buildings are demolished, the asbestos must be removed. Costs for asbestos and building removal have been included in tables 7-7 and 7-8, respectively.

7.3.1 Asbestos Abatement

Asbestos removal is necessary for commercial or residential land use. Removal of asbestos from the parking garage includes mobilization, pre-cleaning, remote decontamination, removal of asbestos containing thermal insulation and floor tiles, air monitoring, waste disposal, and demobilization. Removal of asbestos from the dilapidated building includes mobilization, remote decontamination, removal of asbestos-containing thermal insulation and transite panels, demolition of the facility's brick-and-mortar exterior walls, air monitoring, waste disposal, and demobilization. Removal of asbestos from the Old Boiler Room will require a slightly different approach due to the structurally unsound conditions of the room. Removal will require that the concrete ceiling be taken off to reduce the structural hazards to abatement employees. Access will be performed through the top of the room, and deteriorated thermal insulation will be bagged for disposal. Intact asbestos debris will be cut and bagged and disposed of as insulated piping. The asbestos abatement and disposal costs are summarized Table 7-7. These costs are based on several assumptions, including:

- The project will be governed by New York State Department of Labor (NYSDOL) industrial code rule (ICR) 56 Regulations and project fees.
- Asbestos removal from the parking garage, dilapidated building, and Old Boiler Room will be performed under one contract to reduce NYSDOL fees and mobilization/demobilization costs.
- Mobilization will occur once for all three areas.
- All asbestos is chrysotile.

Table 7-7 Costs for Asbestos Removal and Disposal, Tract II Site

Item Description	Units	Unit Cost ($)	Quantity	Total Cost ($)
Dilapidated Building				
Mobilization (includes permits and fees)	EA	4,000	1	4,000
Remote Decontamination unit and setup	EA	1,500	1	1,500
Removal of thermal insulation	LF	4.25	40	170
Removal of Transite Panels	SF	3.00	128	384
Demolition of Building Brick and Mortar	SF	2.10	11,100	23,310
Air Monitoring (pre, abate, post)	EA	15	63	945
Air Monitoring (Personals)	EA	15	6	90
Waste Disposal	TN	40	175	7,000
Demobilization	EA	2,000	1	2,000
Subtotal Dilapidated Building				39,400
Parking Garage				
Mobilization (includes permits & fees)	EA	0	1	0
Pre-Cleaning Areas	SF	0.20	9,000	1,800
Remote Decontamination unit and setup	EA	1,500	2	3,000
Removal of thermal insulation	LF	4.25	4,800	20,400
Removal of Floor Tile	SF	3	15	45
Air Monitoring (pre, abate, post)	EA	15	90	1,350
Air Monitoring (Personals)	EA	15	20	300
Waste Disposal	TN	40	25	1,000
Demobilization	EA	0	1	0
Old Boiler Room				
Mobilization (includes permits and fees)	EA	0	1	0
Improve access and structural hazards	EA	2,000	1	2,000
Remote decon unit setup	EA	1,500	1	1,500
Removal of TSI	LF	5.00	260	1,300
Removal of TSI debris	EA	4,000	1	4,000
Air monitoring (pre, abate, post)	EA	15	35	525
Air monitoring (personals)	EA	15	5	75
Waste disposal	TN	40	10	400
Demobilization	EA	0	1	0
Subtotal Parking Garage				27,900

Table 7-7 Costs for Asbestos Removal and Disposal, Tract II Site

Item Description	Units	Unit Cost ($)	Quantity	Total Cost ($)
Subtotal Dilapidated Building				39,400
Subtotal				77,100
Engineering and Legal (15%)				11,570
Oversight & Monitoring (30%)				23,130
Subtotal				111,800
Contingencies (25%)				27,950
Total Cost				139,750

Key:

EA = Each.
LF = Linear feet.
SF = Square feet.
TN = Ton

- Applicable variances will be utilized for floor tile removal.
- Applicable variances will be utilized for glove bag removal of pipe lagging and double wrapping on transite paneling.
- Secondary tenting will be used along with the use of a glove bag for removal of pipe insulation and pipe lagging.
- Remote decontamination units will be set up to perform all abatement.
- The garage is an underground parking facility with two primary parking areas for remediation.
- The dilapidated building is structurally unsound and does not warrant abatement, with the exception of the thermal systems insulation (TSI) and transite panel removal.
- Work on the Old Boiler Room will require the area to be structurally sound. The concrete roof will be removed with a backhoe. Access to the room will be from the top by ladder.
- Asbestos debris is to be bagged and intact thermal insulation is to be cut and wrapped.

Table 7-8 Costs for Building and Parking Garage Demolition, Tract II Site

Item Description	Units	Unit Cost ($)	Quantity	Total Cost ($)
Dilapidated Building				
Mobilization (includes permits & fees)	EA	6,000	1	6,000
Building Demolition	CF	.32	70,000	22,400
Hauling	CY	3.49	2,000	6,980
Grading	CY	1.38	1,500	2070
Demobilization	EA	4,000	1	4,000
Subtotal Dilapidated Building				41,450
Parking Garage				
Mobilization (includes permits & fees)	EA	1	1	0
Concrete Demolition	SF	5.64	7,020	39,592
Roofing Demolition	SF	.70	91,000	63,700
Borrow	CY	7.70	15,000	115,500
Grading	CY	1.38	3,370	4,651
Sump cleaning and disposal of PCB-containing waste	EA	3,000	1	3,000
Demobilization	EA	0	1	0
Subtotal Parking Garage				226,443
Subtotal Parking Garage (rounded)				226,400
Subtotal Dilapidated Building (rounded)				41,500
Subtotal				**267,900**
Engineering and Legal (15%)				40,200
Oversight & Monitoring (30%)				80,400
Subtotal				**388,500**
Contingencies (25%)				97,100
Total Cost				**485,600**

Key:

CF = Cubic feet.
CY = Cubic yard.
EA = Each.
LF = Linear feet.
SF = Square feet.

- All debris is to be removed from the Old Boiler Room, and air clearance will be performed in accordance with CR 56.
- The Oil Boiler Room is approximately 10 feet wide, 20 feet long, and 14 feet deep.
- Approximately 560 LF of TSI is located in the room, either in poor condition or fallen to the floor below. Assume 300 LF is debris.
- It will take 5 days to remove ACM from the area.
- Water and power are assumed to be available for use during the abatement process.
- Area and personal air monitoring will be required during the abatement process.
- The TSI and vinyl asbestos tile (VAT) removal is estimated to require approximately 18 days for the parking garage.
- The TSI and transite removal is estimated to require approximately 2 days for the dilapidated building.
- The demolition of the building for brick and mortar removal is expected to require 4 days.
- The dilapidated brick wall demolition will be performed using wet methods.
- All demolition debris from the dilapidated building will be transported and disposed as construction/demolition (C/D) debris.
- The parking garage floor tile removal does not include adhesive mastic removal.
- Pre-cleaning of the areas will be needed because insulation on pipes has deteriorated in several areas.
- The areas of precleaning are based on the deteriorated areas directly below damaged insulated piping.
- Replacement of insulation or tile will not be required as the structures will be demolished.

A general remedial scope of work outline for asbestos removal is as follows:

- Preconstruction meeting,
- Mobilization,
- Remote decontamination set up,
- Pre-cleaning areas,
- Asbestos removal-panels, floor tiles, and insulation,
- Demolition of brick and mortar,
- Air monitoring,
- Waste disposal,
- Decontamination, and
- Demobilization.

7.3.2 Building Removal

After completion of asbestos removal, the buildings can be removed. The parking garage is a one story concrete building made up of two large rooms and one small boiler room. The foundation extends a maximum of 6 feet aboveground, and the rest of the building is below ground. The walls consist of 12-inch-thick concrete. Removal of the underground parking garage includes site mobilization/demobilization, and removal of any interior contents that are salvageable or unsuitable for burial. Part of the roof has collapsed rendering a portion of the building unsafe for inspection, however, except for the sump area, no contaminants other than asbestos, were found in the structurally sound areas. Sump cleaning must take place prior to building demolition. As the parking garage is underground, the aboveground portion can be demolished and backfilled into the below-ground portion. The underground garage should be backfilled with fill, and graded for drainage. Prior to demolition, holes must be punched in the building floors to allow for proper drainage.

The dilapidated brick building is one story. Demolition and disposal of the exterior walls of the brick building is included with the asbestos removal work due the presence of asbestos in the mortar. The remainder of the facility should be emptied of potentially hazardous materials found inside the building during the site inspection (these materials are not ACMs and are listed in Table 4-3) and any other materials that are salvageable or unsuitable for burial. Removal of the dilapidated building includes mobilization/demobilization, demolition, excavation, hauling and disposal. The costs to demolish the dilapidated building and parking garage are shown in Table 7-8. The building removal costs are based on assumptions including:

- Mobilization will occur one time for the two areas.
- Both buildings will be demolished to grade.
- No contaminants, other than asbestos, exist inside the buildings.
- No items with salvage value or unsuitable items remain in the buildings.
- At or below grade footings and slabs will not be demolished.
- The boiler and appurtenances have been removed from the parking garage.
- All construction debris will be buried in the underground portion of the parking garage.
- The exterior walls of the dilapidated building were removed and disposed during the asbestos removal portion.
- No seeding or revegetation is required.
- The dilapidated building rests of a slab footing.
- PCB waste disposal from the concrete sump consists of two drums of sludge and one drum of water.

A general remedial scope of work outline for building removals is as follows:

- Preconstruction meeting,
- Mobilization to dilapidated building,
- Erosion control,
- Dust control,
- Building demolition,
- Hauling,
- Mobilization to parking garage,
- Erosion control,
- Dust control,
- PCB-containing waste disposal,
- Concrete and roofing demolition,
- Crushing and disposal of building materials,
- Hauling,

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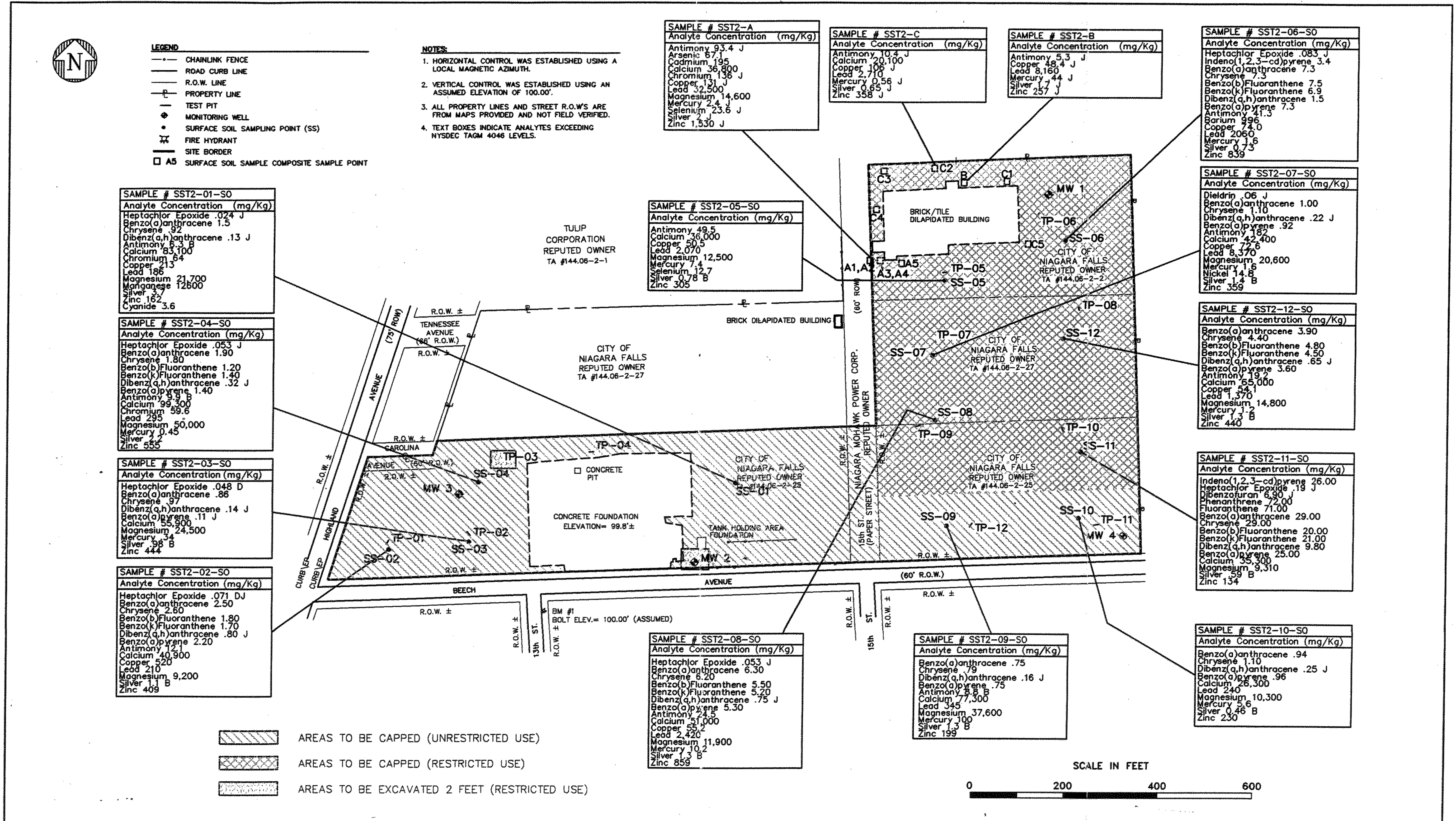

LEGEND

—•—	CHAINLINK FENCE
——	ROAD CURB LINE
——	R.O.W. LINE
—℄—	PROPERTY LINE
—	TEST PIT
⊕	MONITORING WELL
•	SURFACE SOIL SAMPLING POINT (SS)
⛯	FIRE HYDRANT
━━	SITE BORDER
☐ A5	SURFACE SOIL SAMPLE COMPOSITE SAMPLE POINT

NOTES:

1. HORIZONTAL CONTROL WAS ESTABLISHED USING A LOCAL MAGNETIC AZIMUTH.
2. VERTICAL CONTROL WAS ESTABLISHED USING AN ASSUMED ELEVATION OF 100.00'.
3. ALL PROPERTY LINES AND STREET R.O.W'S ARE FROM MAPS PROVIDED AND NOT FIELD VERIFIED.
4. TEXT BOXES INDICATE ANALYTES EXCEEDING NYSDEC TAGM 4046 LEVELS.

SAMPLE # SST2-01-SO

Analyte	Concentration (mg/Kg)
Heptachlor Epoxide	.024 J
Benzo(a)anthracene	1.5
Chrysene	.92
Dibenz(a,h)anthracene	.13 J
Antimony	6.3 B
Calcium	83,100
Chromium	64
Copper	213
Lead	186
Magnesium	21,700
Manganese	12600
Silver	3.7
Zinc	162
Cyanide	3.6

SAMPLE # SST2-04-SO

Analyte	Concentration (mg/Kg)
Heptachlor Epoxide	.053 J
Benzo(a)anthracene	1.90
Chrysene	1.80
Benzo(b)Fluoranthene	1.20
Benzo(k)Fluoranthene	1.40
Dibenz(a,h)anthracene	.32 J
Benzo(a)pyrene	1.40
Antimony	9.9 B
Calcium	99,300
Chromium	59.6
Lead	295
Magnesium	50,000
Mercury	0.45
Silver	2.2
Zinc	555

SAMPLE # SST2-03-SO

Analyte	Concentration (mg/Kg)
Heptachlor Epoxide	.048 D
Benzo(a)anthracene	.86
Chrysene	.97
Dibenz(a,h)anthracene	.14 J
Benzo(a)pyrene	.11 J
Calcium	55,900
Magnesium	24,500
Mercury	.34
Silver	.98 B
Zinc	444

SAMPLE # SST2-02-SO

Analyte	Concentration (mg/Kg)
Heptachlor Epoxide	.071 DJ
Benzo(a)anthracene	2.50
Chrysene	2.60
Benzo(b)Fluoranthene	1.80
Benzo(k)Fluoranthene	1.70
Dibenz(a,h)anthracene	.80 J
Benzo(a)pyrene	2.20
Antimony	12.1
Calcium	40,900
Copper	520
Lead	210
Magnesium	9,200
Silver	1.1 B
Zinc	409

SAMPLE # SST2-A

Analyte	Concentration (mg/Kg)
Antimony	93.4 J
Arsenic	67.1
Cadmium	195
Calcium	36,800
Chromium	136 J
Copper	131 J
Lead	32,500
Magnesium	14,600
Mercury	2.4 J
Selenium	23.6 J
Silver	2 J
Zinc	1,530 J

SAMPLE # SST2-C

Analyte	Concentration (mg/Kg)
Antimony	10.4 J
Calcium	20,100
Copper	106 J
Lead	2,710
Mercury	0.56 J
Silver	0.65 J
Zinc	358 J

SAMPLE # SST2-B

Analyte	Concentration (mg/Kg)
Antimony	5.3 J
Copper	48.4 J
Lead	8,160
Mercury	.44 J
Silver	1.7 J
Zinc	257 J

SAMPLE # SST2-05-SO

Analyte	Concentration (mg/Kg)
Antimony	49.5
Calcium	36,000
Copper	50.5
Lead	2,070
Magnesium	12,500
Mercury	7.4
Selenium	12.7
Silver	0.78 B
Zinc	305

SAMPLE # SST2-06-SO

Analyte	Concentration (mg/Kg)
Heptachlor Epoxide	.083 J
Indeno(1,2,3-cd)pyrene	3.4
Benzo(a)anthracene	7.3
Chrysene	7.3
Benzo(b)Fluoranthene	7.5
Benzo(k)Fluoranthene	6.9
Dibenz(a,h)anthracene	1.5
Benzo(a)pyrene	7.3
Antimony	41.3
Barium	996
Copper	74.0
Lead	2060
Mercury	1.6
Silver	0.73
Zinc	839

SAMPLE # SST2-07-SO

Analyte	Concentration (mg/Kg)
Dieldrin	.06 J
Benzo(a)anthracene	1.00
Chrysene	1.10
Dibenz(a,h)anthracene	.22 J
Benzo(a)pyrene	.92
Antimony	182
Calcium	42,400
Copper	72.6
Lead	8,370
Magnesium	20,600
Mercury	1.6
Nickel	14.8
Silver	1.4 B
Zinc	359

SAMPLE # SST2-12-SO

Analyte	Concentration (mg/Kg)
Benzo(a)anthracene	3.90
Chrysene	4.40
Benzo(b)Fluoranthene	4.80
Benzo(k)Fluoranthene	4.50
Dibenz(a,h)anthracene	.65 J
Benzo(a)pyrene	3.60
Antimony	19.2
Calcium	65,000
Copper	54.1
Lead	1,370
Magnesium	14,800
Mercury	1.2
Silver	1.3 B
Zinc	440

SAMPLE # SST2-11-SO

Analyte	Concentration (mg/Kg)
Indeno(1,2,3-cd)pyrene	26.00
Heptachlor Epoxide	.19 J
Dibenzofuran	6.90 J
Phenanthrene	72.00
Fluoranthene	71.00
Benzo(a)anthracene	29.00
Chrysene	29.00
Benzo(b)Fluoranthene	20.00
Benzo(k)Fluoranthene	21.00
Dibenz(a,h)anthracene	9.80
Benzo(a)pyrene	25.00
Calcium	35,300
Magnesium	9,310
Silver	.59 B
Zinc	134

SAMPLE # SST2-10-SO

Analyte	Concentration (mg/Kg)
Benzo(a)anthracene	.94
Chrysene	1.10
Dibenz(a,h)anthracene	.25 J
Benzo(a)pyrene	.96
Calcium	26,300
Lead	240
Magnesium	10,300
Mercury	5.6
Silver	0.46 B
Zinc	230

SAMPLE # SST2-08-SO

Analyte	Concentration (mg/Kg)
Heptachlor Epoxide	.053 J
Benzo(a)anthracene	6.30
Chrysene	6.20
Benzo(b)Fluoranthene	5.50
Benzo(k)Fluoranthene	5.20
Dibenz(a,h)anthracene	.75 J
Benzo(a)pyrene	5.30
Antimony	24.5
Calcium	51,000
Copper	55.2
Lead	2,420
Magnesium	11,900
Mercury	10.2
Silver	1.3 B
Zinc	859

SAMPLE # SST2-09-SO

Analyte	Concentration (mg/Kg)
Benzo(a)anthracene	.75
Chrysene	.79
Dibenz(a,h)anthracene	.16 J
Benzo(a)pyrene	.75
Antimony	8.8 B
Calcium	77,300
Lead	345
Magnesium	37,600
Mercury	100
Silver	1.3 B
Zinc	199

▧	AREAS TO BE CAPPED (UNRESTRICTED USE)
▩	AREAS TO BE CAPPED (RESTRICTED USE)
░	AREAS TO BE EXCAVATED 2 FEET (RESTRICTED USE)

ecology and environment

FIGURE 7-1 ALTERNATIVE 1 – AREAS TO BE CAPPED TRACT II SITE, NIAGARA FALLS, NEW YORK

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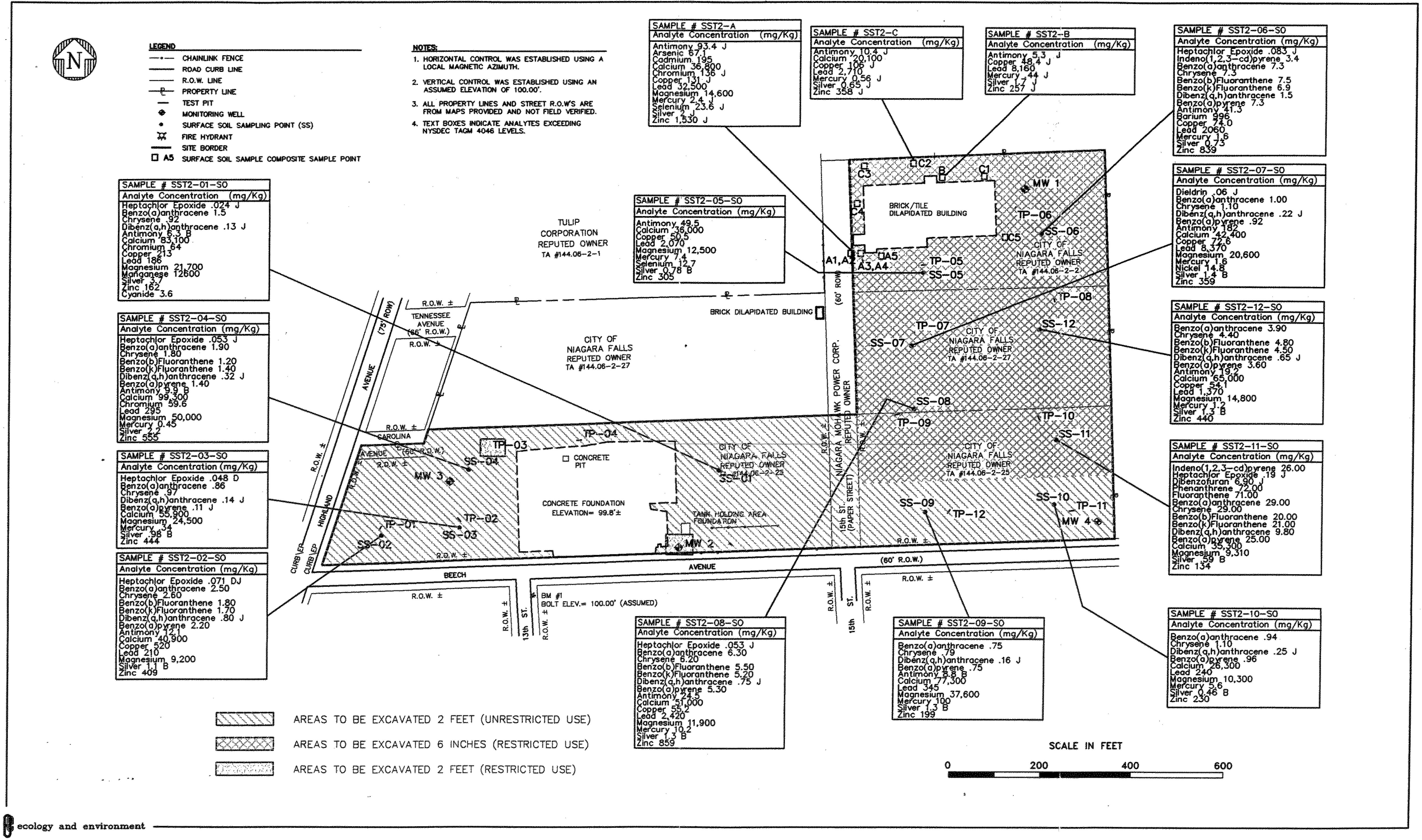

NOTES:

1. HORIZONTAL CONTROL WAS ESTABLISHED USING A LOCAL MAGNETIC AZIMUTH.
2. VERTICAL CONTROL WAS ESTABLISHED USING AN ASSUMED ELEVATION OF 100.00'.
3. ALL PROPERTY LINES AND STREET R.O.W'S ARE FROM MAPS PROVIDED AND NOT FIELD VERIFIED.
4. TEXT BOXES INDICATE ANALYTES EXCEEDING NYSDEC TAGM 4046 LEVELS.

SAMPLE # SST2-01-SO
Analyte Concentration (mg/Kg)
Heptachlor Epoxide .024 J
Benzo(a)anthracene 1.5
Chrysene .92
Dibenz(a,h)anthracene .13 J
Antimony 6.3 B
Calcium 83,100
Chromium 64
Copper 213
Lead 186
Magnesium 21,700
Manganese 12600
Silver 3.7
Zinc 162
Cyanide 3.6

SAMPLE # SST2-04-SO
Analyte Concentration (mg/Kg)
Heptachlor Epoxide .053 J
Benzo(a)anthracene 1.90
Chrysene 1.80
Benzo(b)Fluoranthene 1.20
Benzo(k)Fluoranthene 1.40
Dibenz(a,h)anthracene .32 J
Benzo(a)pyrene 1.40
Antimony 9.9 B
Calcium 99,300
Chromium 59.6
Lead 295
Magnesium 50,000
Mercury 0.45
Silver 2.2
Zinc 555

SAMPLE # SST2-03-SO
Analyte Concentration (mg/Kg)
Heptachlor Epoxide .048 D
Benzo(a)anthracene .86
Chrysene .97
Dibenz(a,h)anthracene .14 J
Benzo(a)pyrene .11 J
Calcium 55,900
Magnesium 24,500
Mercury .34
Silver .98 B
Zinc 444

SAMPLE # SST2-02-SO
Analyte Concentration (mg/Kg)
Heptachlor Epoxide .071 DJ
Benzo(a)anthracene 2.50
Chrysene 2.60
Benzo(b)Fluoranthene 1.80
Benzo(k)Fluoranthene 1.70
Dibenz(a,h)anthracene .80 J
Benzo(a)pyrene 2.20
Antimony 12.1
Calcium 40,900
Copper 520
Lead 210
Magnesium 9,200
Silver 1.1 B
Zinc 409

SAMPLE # SST2-A
Analyte Concentration (mg/Kg)
Antimony 93.4 J
Arsenic 67.1
Cadmium 195
Calcium 36,800
Chromium 136 J
Copper 131 J
Lead 32,500
Magnesium 14,600
Mercury 2.4 J
Selenium 23.6 J
Silver 2 J
Zinc 1,530 J

SAMPLE # SST2-C
Analyte Concentration (mg/Kg)
Antimony 10.4 J
Calcium 20,100
Copper 106 J
Lead 2,710
Mercury 0.56 J
Silver 0.65 J
Zinc 358 J

SAMPLE # SST2-B
Analyte Concentration (mg/Kg)
Antimony 5.3 J
Copper 48.4 J
Lead 8,160
Mercury .44 J
Silver 1.7 J
Zinc 257 J

SAMPLE # SST2-05-SO
Analyte Concentration (mg/Kg)
Antimony 49.5
Calcium 36,000
Copper 50.5
Lead 2,070
Magnesium 12,500
Mercury 7.4
Selenium 12.7
Silver 0.78 B
Zinc 305

SAMPLE # SST2-06-SO
Analyte Concentration (mg/Kg)
Heptachlor Epoxide .083 J
Indeno(1,2,3-cd)pyrene 3.4
Benzo(a)anthracene 7.3
Chrysene 7.3
Benzo(b)Fluoranthene 7.5
Benzo(k)Fluoranthene 6.9
Dibenz(a,h)anthracene 1.5
Benzo(a)pyrene 7.3
Antimony 41.3
Barium 996
Copper 74.0
Lead 2060
Mercury 1.6
Silver 0.73
Zinc 839

SAMPLE # SST2-07-SO
Analyte Concentration (mg/Kg)
Dieldrin .06 J
Benzo(a)anthracene 1.00
Chrysene 1.10
Dibenz(a,h)anthracene .22 J
Benzo(a)pyrene .92
Antimony 182
Calcium 42,400
Copper 72.6
Lead 8,370
Magnesium 20,600
Mercury 1.6
Nickel 14.8
Silver 1.4 B
Zinc 359

SAMPLE # SST2-12-SO
Analyte Concentration (mg/Kg)
Benzo(a)anthracene 3.90
Chrysene 4.40
Benzo(b)Fluoranthene 4.80
Benzo(k)Fluoranthene 4.50
Dibenz(a,h)anthracene .65 J
Benzo(a)pyrene 3.60
Antimony 19.2
Calcium 65,000
Copper 54.1
Lead 1,370
Magnesium 14,800
Mercury 1.2
Silver 1.3 B
Zinc 440

SAMPLE # SST2-11-SO
Analyte Concentration (mg/Kg)
Indeno(1,2,3-cd)pyrene 26.00
Heptachlor Epoxide .19 J
Dibenzofuran 6.90 J
Phenanthrene 72.00
Fluoranthene 71.00
Benzo(a)anthracene 29.00
Chrysene 29.00
Benzo(b)Fluoranthene 20.00
Benzo(k)Fluoranthene 21.00
Dibenz(a,h)anthracene 9.80
Benzo(a)pyrene 25.00
Calcium 35,300
Magnesium 9,310
Silver .59 B
Zinc 134

SAMPLE # SST2-08-SO
Analyte Concentration (mg/Kg)
Heptachlor Epoxide .053 J
Benzo(a)anthracene 6.30
Chrysene 6.20
Benzo(b)Fluoranthene 5.50
Benzo(k)Fluoranthene 5.20
Dibenz(a,h)anthracene .75 J
Benzo(a)pyrene 5.30
Antimony 24.5
Calcium 51,000
Copper 55.2
Lead 2,420
Magnesium 11,900
Mercury 10.2
Silver 1.3 B
Zinc 859

SAMPLE # SST2-09-SO
Analyte Concentration (mg/Kg)
Benzo(a)anthracene .75
Chrysene .79
Dibenz(a,h)anthracene .16 J
Benzo(a)pyrene .75
Antimony 8.8 B
Calcium 77,300
Lead 345
Magnesium 37,600
Mercury 100
Silver 1.3 B
Zinc 199

SAMPLE # SST2-10-SO
Analyte Concentration (mg/Kg)
Benzo(a)anthracene .94
Chrysene 1.10
Dibenz(a,h)anthracene .25 J
Benzo(a)pyrene .96
Calcium 26,300
Lead 240
Magnesium 10,300
Mercury 5.6
Silver 0.46 B
Zinc 230

▨ AREAS TO BE EXCAVATED 2 FEET (UNRESTRICTED USE)
▩ AREAS TO BE EXCAVATED 6 INCHES (RESTRICTED USE)
░ AREAS TO BE EXCAVATED 2 FEET (RESTRICTED USE)

FIGURE 7-2 ALTERNATIVE 2 – AREAS TO BE EXCAVATED TRACT II SITE, NIAGARA FALLS, NEW YORK

8

Summary and Conclusions

8.1 Project Summary

8.1.1 Summary of Site Investigation

The site investigation at the Tract II Site consisted of two main field efforts. Initially, the 24.5-acre site was divided into three large areas (Areas 1, 2, and 3) that were collectively subdivided into a total of 12 cells (see Figure 2-1). One composite surface soil sample was collected in each of the 12 cells. The intended depth of these surface soil samples was 0 to 2 feet BGS; however, the majority of these samples terminated at a depth of 6 inches because of prevalent C & D debris at this depth beneath the site. Twelve test pits (one per cell) were excavated at the site. These excavations were 8 feet deep, 2 feet wide, and 10 feet long. One soil sample was collected from each of the test pits either at a depth where contamination was visible or from the 0- to 2-foot BGS depth interval. Four soil borings were drilled to bedrock and one subsurface soil sample was collected from each of these borings. In addition, one subsurface soil sample was collected from each of two of these borings and submitted for geotechnical analysis. Subsequently, bedrock interface wells were installed in the subsurface borings. Groundwater samples were collected from each of the four wells (including a field duplicate). In addition, one sludge and one water sample were collected from a sump in the underground garage. Three samples of suspected asbestos-containing materials also were collected in this garage. During the second field effort, three surface soil samples were collected around the dilapidated building. An inventory of the dilapidated building potentially hazardous materials was made, followed by an investigation of possible ACMs. An asbestos survey of the parking garage was also completed during this second field effort.

Each of the soil (and sludge) and water samples collected at the site was analyzed for TCL VOCs, SVOCs, pesticide/PCBs, and TAL metals including cyanide (see Tables 3-1 through 3-5). The samples of suspected asbestos were analyzed for positive identification using permissible exposure limit (PEL) methods (see Section 3.7).

Rising-head slug tests were performed at each of the wells to determine the hydraulic conductivity of the Lockport dolostone aquifer at these locations. Finally, the wells and other sampling locations were surveyed. Based on the surveyed elevations of the wells and water levels measured in them, the direction of groundwater flow beneath the site was estimated (see Figure 4-1).

8.1.2 Summary of Remedial Alternatives Review Process

A risk evaluation consisting of a screening-level assessment was conducted to determine which site contaminants pose significant threats to human health and the environment. In order to address contaminants posing these significant threats, several remedial alternatives were considered on a feasibility and cost basis, and soil cleanup goals were developed for two site conditions: unrestricted and restricted uses.

A remedial alternative review was also conducted to address site contaminants and soil cleanup objectives were developed for a commercial/light industrial future use scenario. Based on the Highland Avenue redevelopment plan currently being devised, this reuse seems likely. The proximity of the site to existing industry and prevalence of C & D fill material at the site will likely preclude it from being redeveloped as residential property.

Six general response actions, as defined by the Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA), were considered based on a commercial/light industrial future use, and four remedial alternatives were developed and analyzed based on these response actions.

8.2 Nature and Extent of Contamination

8.2.1 Dilapidated Building and Parking Garage

Two site inspections revealed the presence of asbestos in both buildings onsite. Asbestos-containing pipe insulation and transite panels were found in the dilapidated building. Also, asbestos was found in the building mortar. Asbestos in the parking garage was found in floor tiles and in pipe insulation.

8.2.2 Surface Soils

Analysis of the 15 surface soil samples and field duplicate indicates that VOCs are not present (see Table 5-1). Several SVOCs, comprised mostly of PAHs and some phthalates were found at elevated levels in 12 of these samples. Elevated levels of the pesticide compound heptachlor epoxide were found in eight of these samples. The pesticide dieldrin was found at an elevated level in one of the surface soil samples. There were no elevated concentrations of PCBs present in the surface soil samples, although the PCB Aroclor-1260 was just below the level of concern. Lead was found at high concentrations in nine surface soil samples collected on the east side of the site. Slightly elevated levels antimony, arsenic, barium, chromium, copper, iron, magnesium, manganese, mercury, nickel, selenium, silver, thallium, and zinc were found in some of the surface soil samples. In addition, a low level of cyanide was detected in one of these samples.

8.2.3 Subsurface Soils

Analysis of the 12 subsurface soil samples and field duplicate from the test pits show the presence of six VOCs, but at minimal concentrations (see Table 5-2). The SVOC analysis indicates that PAHs are prevalent at elevated concentrations at several of the test pit locations on the east and west sides of the site. The highest levels of PAHs were found at Test Pit TP-03 which was excavated in the berm at the northwest side of the site. Partially burned cardboard and paper were observed there. Elevated concentrations of PAHs, which are a product of incomplete combustion were found in the test pit soil sample collected at this location. The pesticides aldrin, heptachlor epoxide, and dieldrin were found at elevated levels in test pit soils. These occurrences were confined mainly to the southeast corner of the site, with one exception. Heptachlor epoxide was found in the soil sample taken from the aforementioned berm at a high estimated concentration. There were no elevated levels of PCBs found in the test pit soil samples. Lead was found at elevated or high concentrations in the majority of the test pit samples, particularly the east side of the site. Elevated levels of antimony, arsenic, chromium, copper, magnesium, mercury, selenium, silver, and zinc were found in some of the samples. In addition, a low concentration of cyanide was detected in one of these samples.

Analysis of the four subsurface soil samples and field duplicate from the well borings indicates that no VOCs were present (see Table 5-2). The SVOC analysis shows that elevated levels of PAHs are present. The pesticides aldrin and heptachlor epoxide were found in the MW-03 well boring at elevated levels and dieldrin was found in the MW-04 well boring at an elevated level. It should be noted that the concentration of dieldrin was elevated in the diluted soil sample from the background location northeast of the site. In addition, the PCB Aroclor-1260 was present at an elevated level in the MW-02 well boring on the west side of the site near the former aboveground storage tank area.

8.2.4 Groundwater

Analysis of the four groundwater samples and field duplicate from the new wells indicates that the VOCs toluene, xylene, acetone, chloroform, and methylene chloride were detected in certain samples (see Table 3-4). The concentrations (estimated values) of these VOCs were very low, with the exception of methylene chloride. This solvent compound was found at an elevated level in both the original and duplicate samples collected at MW-04 at the southeast corner of the site. The SVOC analysis showed the presence of a low concentration (estimated) of bis(2-ethylhexyl)phthalate, a common laboratory artifact associated with latex gloves. There were no pesticides or PCBs detected in any of the groundwater samples. Iron, manganese and iron (combined), magnesium manganese, and sodium were the only elevated metals detected in any of the four wells.

8.2.5 Sump Water and Sludge

Analysis of the water sample from the concrete sump in the underground garage shows that there were no VOCs present (see Table 3-5). Low concentrations (estimated) of the SVOCs di-n-butylphthalate and 2,4-dichlorophenol were detected. No pesticides were detected in this water sample; however, the PCB Aroclor-1260 was detected at a low level. Elevated concentrations of chromium and iron were also found in this sump water sample.

The sludge sample collected from the bottom of the sump contained low concentrations (some estimated) of eight VOCs, including the solvent compound chlorobenzene. Analysis for SVOCs indicated that a total of 23 such compounds were present. There were no pesticides present in the sludge; however, the PCB Aroclor-1260 was found at a high concentration. Twelve metals were detected at elevated levels and lead was found at a high level in this sample. In addition, cyanide was found at an elevated concentration in the sump sludge.

8.2.6 Drill Water

Analysis of the sample of water used for decontamination and general drilling purposes indicates that a slightly elevated level of chloroform and low levels (estimated) of bromodichloromethane and dibromochloromethane were present. A low level of the common lab artifact bis(2-ethyl-hexyl)phthalate and a low concentration (estimated) of di-n-butylphthalate was also present. There were no pesticides, PCBs, or elevated concentrations of metals in this sample.

8.3 Comparison to Regulatory Criteria

As shown on analytical screening Table 5-1, concentrations of SVOCs, one pesticide, and several metals exceeded TAGM 4046 criteria at the majority of the 15 surface soil sampling locations at the site. Specifically, the SVOC dibenzofuran was found at 6.9 mg/kg, above the TAGM criterion of 6.2 mg/kg in the SS-02 sample (0 to 6 inches BGS) collected at the southeast corner of the site. Respective TAGM criteria for PAH compounds (including carcinogens) were exceeded at 11 of the 12 surface soil sampling locations from which surface soils were collected and submitted for SVOC analysis. The pesticide heptachlor epoxide was found at concentrations exceeding the TAGM criterion of 0.02 mg/kg in seven surface soil samples. Lead was found at concentrations exceeding the EPA OSWER criterion of 400 mg/kg in 13 of the 15 surface soil samples submitted for metals analysis. The highest levels of lead (32,500 mg/kg) in the surface soil, were found adjacent to the dilapidated building. Concentrations of 13 other metals exceeded TAGM criteria in one or more of the surface soil samples. With only one exception, these surface soil samples were collected from 0 to 6 inches BGS because of the presence of dense C & D fill beneath this depth. At SS-04 on the northwest part of the site, penetration from 0 to 2 feet BGS was achieved.

Review of Table 5-2 shows that concentrations of PAHs, pesticides, PCBs, and metals exceeded TAGM 4046 criteria in certain subsurface soil samples. Several PAHs (including carcinogens) were present at levels above respective TAGM criteria in as many as 13 of 16 subsurface soil locations. The pesticides aldrin, heptachlor epoxide, and dieldrin were found at concentrations (estimated) above respective TAGM criteria. Levels of heptachlor epoxide exceeded the criterion of 0.02 mg/kg in five of the subsurface soils. Four of these soil samples were collected from 0 to 2 feet BGS at the southeast corner of the site. The fifth was collected from 0 to 2 feet BGS in the berm at the northwest side of the site. The PCB Aroclor-1260 was detected at a concentration of 1.4 mg/kg in the subsurface soil sample collected from 0 to 2 feet BGS in the boring for well MW-02. The TAGM value for total PCBs in surface soil is 1 mg/kg and 10 mg/kg for subsurface soil, although the respective depths are not specified in the guidance document. Concentrations of 10 metals plus cyanide exceeded TAGM criteria in one or more of the subsurface soil samples.

NYSDEC standards and guidance values are not directly applicable for the results for the water and sludge samples collected from the sump in the underground garage. The sump is lined with concrete and does not appear to be impacting soil or groundwater. However, a thorough inspection of the sump has not been performed. Because groundwater is at least a potential receptor, it should be noted that levels of chromium, iron, and the PCB Aroclor-1260 in the sump water are above NYSDEC Class GA groundwater standards. It should also be noted that concentrations of 10 SVOCs (including seven carcinogenic PAHs), the PCB Aroclor-1260, and 12 metals (including lead and cyanide) were found at concentrations above TAGM 4046 criteria. Although the concrete sump may fully contain these contaminants, it is located in a building without restricted access.

As shown on analytical screening Table 5-4, the VOC methylene chloride was detected at an average concentration of 28.5 µg/L in the original and duplicate groundwater samples collected from monitoring well MW-04. The concentrations in the original and duplicate sample, 28 µg/L and 29 µg/L, respectively, exceed the NYSDEC Class GA groundwater standard of 5 µg/L. There were no SVOCs detected above screening criteria and no pesticides or PCBs detected in the groundwater samples. Concentrations of iron, magnesium, manganese, and sodium exceeded NYSDEC Class GA standards in one or more of the groundwater samples.

8.4 Risk Evaluation Findings

In the absence of site remediation, the presence of elevated concentrations of lead and other metals in surface soils poses an unacceptable risk to children and potential future workers at the Tract II Site. In addition, the level of lead and PCBs in the sump sludge presents an unacceptable risk.

Lead was found at concentrations exceeding the EPA OSWER guidance value of 400 mg/kg for residential soils and the NYSDOH guidance value of 1,000 mg/kg for properties evaluated under a commercial/industrial future-use scenario in eight surface soil sampling locations on the east side of the site. The highest concentration of lead found in these samples was 32,500 mg/kg. These levels of lead currently pose an unacceptable level of risk to children who may repeatedly enter the unrestricted site. Also, repeated exposure to these high concentrations of lead could pose adverse health effects to future site workers. Generally, antimony, copper, and zinc concentrations were elevated at the same locations where lead concentrations were high.

Lead was found at 7,600 mg/kg in the sump sludge sample and the PCB Aroclor-1260 was found at 31,000 mg/kg (PDC) or 3.1 percent. The RBC for Aroclor -1260 is 2.9 mg/kg. The sump is located in an underground parking garage with unrestricted access. Clearly, the contaminated sump sludge poses an unacceptable level of risk until it is removed or restricted.

PAHs were detected in most site surface soils at levels above TAGM 4046 criteria and in many cases above industrial RBCs. Based on the maximum concentrations of carcinogenic PAHs detected in surface soils, the estimated upper-bound cancer risk for future site workers is approximately 5.4×10^{-5}, which is within EPA's acceptable range of 10^{-6} to 10^{-4}. Most arsenic concentrations were above the industrial RBC, which is based on a potential cancer risk. However, with the exception of two test pit samples, they were similar to the background concentration. The estimated cancer risk posed to a site worker based on the maximum level of arsenic found at the site would be 2×10^{-5}, within the acceptable range.

Methylene chloride and four inorganic analytes were found at levels above the NYSDEC Class GS standards. Methylene chloride is classified as a Group 2 human carcinogen. However, under the current and likely future site conditions, there are no plausible pathways for human exposure through contamination in site groundwater. The site area is served by a municipal water system and groundwater is not a source of potable water, nor is it likely to become one in the future.

8.5 Conclusions

8.5.1 Data Limitations and Recommendations for Future Work

Site sampling locations were selected to be representative of overall site conditions. Specific spill or release areas were not seen, although a white, paste-like substance that appeared to be of industrial origin was observed in Test Pit TP-08 near the northeast corner of the site. A total of three asbestos samples were collected from the underground garage and seven asbestos samples were collected from the dilapidated building. There were no bedrock cores taken because it is a historical site and the presence of low permeability overburden soils did not suggest that contamination of the bedrock was likely. Therefore, this investigation was limited only to surface and subsurface soils, the shallow bedrock aquifer, and asbestos sampling.

Review of the remedial alternatives showed that to return the site to unrestricted use cleanup goals by containing the site with a vegetated cap, performing excavation in two localized "hot spots," and establishing long-term deed restrictions (Alternative 1) would cost approximately $851,800. Using the same methods but returning the site to restricted use cleanup goals would entail containing a smaller area and very limited excavation at a cost of approximately $468,800. The building and asbestos would also need to be removed from the site, costing $485,000 and $117,000, respectively.

Excavation and off-site disposal of contaminated soil (Alternative 2) to return the site to unrestricted use cleanup goals would cost approximately $8,935,000. Using the same methods, but returning the site to restricted use cleanup goals would cost approximately $1,238,200. Building demolition and asbestos removal would cost approximately $485,000 and $117,000, respectively.

Implementation of institutional controls (Alternative 3) such as installation of fencing, warning signs, and deed restrictions would cost approximately $142,500. This alternative does not involve returning the site to pre-disposal or urban conditions.

No action (alternative 4) at the site would involve no remediation or use of institutional controls. This alternative does not involve returning the site to pre-disposal or urban conditions. There are no capital costs associated with this alternative.

8.5.2 Indications of Contaminant Sources

Most of the contaminants found at the site appear to be associated with the surface cover and other non-native fill which is prevalent over much of the site. Most of the cover soil is sandy containing small pieces of manmade material. Much of this cover may have been brought from elsewhere to the site to cover the large volume of C & D fill underlying the surface cover. In many locations, particularly on the northwest and northeast parts of the site, this cover soil has the appearance of foundry sand. This would explain the high incidence of elevated metals and PAHs in surface soils at the site.

Historical records indicate the dilapidated building on the northeast part of the site was formerly associated with lead-acid battery manufacturing. Surface soil samples collected in this area show the highest concentrations of lead at the site. Discarded battery casings were also observed in two test pits on the southeast side of the site. The source of low levels of PCBs in some of the surface soils at the site is not known. They may have been present initially in the cover soil used at the site or the results of small spills or releases.

The source of the methylene chloride seen in the groundwater at monitoring well MW-04 is unknown. Because it is not present in the upgradient well MW-01, it is probable that it is the result of a small spill of waste material containing the solvent on the east side of the site. The four inorganic analytes found at elevated levels in the groundwater at MW-02 are naturally occurring and are not believed to be the result of site activities.

The source of the high concentrations of PCBs, PAHs, lead, and other metals in the concrete sump in the underground garage is unknown. The room in which the sump is located appears to be an old electrical/mechanical room. It is possible that a spill from a transformer or other electrical equipment containing PCB dielectric fluids occurred. Asbestos-containing pipe insulation is present throughout much of the building. In some cases, the asbestos has fallen from the pipes to the floor directly below.

8.5.3 Recommended Remedial Alternatives

The recommended remedial approach for the Tract II Site is Alternative 1, elimination of direct contact with contaminated soils through the installation of a cap with the objective of returning the site to urban cleanup goals. Installation of a properly constructed cap would reduce both infiltration into subsurface soils and the potential for groundwater contamination. Given the proximity of the site to existing industry and the likelihood that it will be redeveloped for commercial/light industrial future use, remediating the site to restricted use conditions is appropriate. Therefore, only the east side of the site would be covered and a limited amount of excavation would be needed at two areas on the west side of the site. The excavated areas would be backfilled with clean fill and graded. The approximate cost of this remedial alternative is $468,800.

The capped portion of the site would be vegetated to prevent erosion. Maintenance of the cover vegetation and deed restrictions on disturbance of the subsurface soils below two feet would be necessary. It should be noted that certain redevelopment scenarios may include partial or complete covering of the contaminated areas with infrastructure such as buildings, parking areas, or roads.

Thus, the need for capping an extensive area may be greatly reduced.

In addition, the removal of the asbestos and disposal of the material in the sump in the underground garage is recommended to eliminate public health risks. The cost to remove the asbestos from both buildings is approximately $139,750, including engineering, contractor oversight, and contingencies.

If site remediation is delayed or is not the selected alternative, the use of Alternative 3, the implementation of institutional controls in the form of fencing, warning signs, and deed restrictions is recommended. These measures will restrict public exposure to site contamination which currently poses an unacceptable risk to human health. They can serve as a cost effective interim measure, or as a final alternative if the site is not redeveloped.

Finally, demolition of the garage and dilapidated building at the site are recommended as portions of these structures are beginning to collapse. The approximate cost to demolish the concrete garage and dilapidated building are is approximately $485,000, including engineering, contractor oversight, and contingencies.

9

References

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A

Drilling Log Sheets

DRILLING LOG FOR MW1

Project Name Tract II

Site Location Beech St
Niagara Falls, NY

Date Started/Finished 12/2/98 - 12/4/98

Drilling Company Marion Technologies

Driller's Name Ron Brown / Mike Keller

Geologist's Name V. Angelaki

Geologist's Signature

Rig Type (s) CME-75

Drilling Method (s) HSA & Tricone Roller Bit

Bit Size (s) 3 7/8" Auger Size (s) 4 1/4" ID

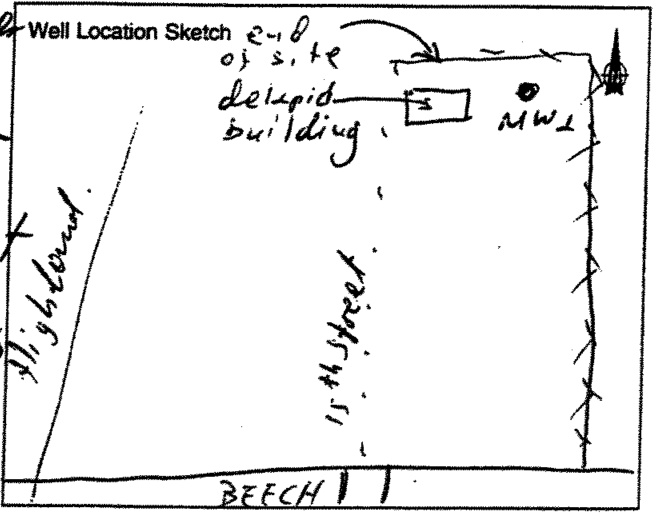
Auger/Split Spoon Refusal SS at 23.5' BGS

Total Depth of Borehole Is

Total Depth of Corehole Is

Water Level (TOIC)		
Date	Time	Level(Feet)

Well Location Sketch



Depth(Feet)	Split spoon Sample Number	Blows on Sampler		Soil Components: Rock Profile CL SL S GR	Penetration Times	Run Number	Core Recovery	RQD	Fracture Sketch	HNu/OVA (ppm)	Comments
1	1	6 10	7 10		1438		24"				Took Photo Took Sample MWT2-A01308 SD
2 3	2	10 8	15 8		1440		20"				
4 5	3	5 10	7 13		1449		23"			0	
6 7	4	9 13	12 14		1454		24"				
8 9	5	2 11	6 8		1515		23"			0ppm	
10 11	6	3 9	6 8		1520		24"			0ZEL	
12 13	7	5 8	6 8		1524		24"			0ppm	
14 15	<	3 4	4 9		1531					0ppm in SS 0.5 ppm in Aug 0 LEZ	

MW-1

SCREENED WELL

Stick-up ________ ft

Top of Grout ________ ft

Top of Seal at 12 ft

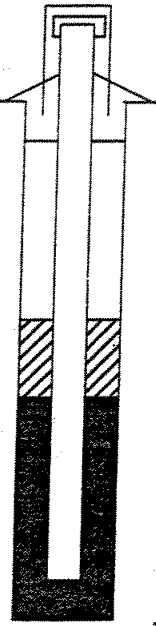
Top of Sand Pack 13.8 ft

Top of Screen at 15.5 ft

Bottom of Screen at 25.5 ft

Bottom of Hole at 25.9 ft

Bottom of Sandpack at 25.9



Lock Number 3220

Inner Casing Material PVC

Inner Casing Inside Diameter 2 inches

GROUND SURFACE

Quantity of Material Used:

Bentonite [✓ Pellets] ________

Cement ________

Borehole Diameter 8 inches

Cement/ Bentonite ________

Grout ________

Screen Slot Size .010

Screen Type

☒ PVC Sch. 40

☐ Stainless Steel ________

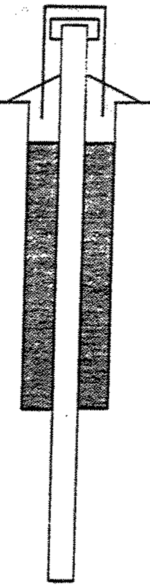
Pack Type/Size: #1

☒ Sand Granusil 2 1/2 lbs sand

☐ Gravel ________

☐ Natural ________

OPEN-HOLE WELL



Stick-up ________ ft

Inner Casing Material ________

Inner Casing Inside Diameter ________ inches

Outer Casing Diameter ________ inches

Borehole Diameter ________ ft

Bedrock ________ ft

Bottom of Rock Socket/ Outer Casing ________ ft

Bottom of Inner Casing ________ ft

Corehole Diameter ________

Bottom of Corehole ________ ft

NOTE: See pages 136 and 137 for well construction diagrams

Depth-ft.	NARRATIVE LITHOLOGIC DESCRIPTION	Moisture Content Dry	Moist	Wet
	0-~~40~~ Topsoil: grass silt clay sand	☒	○	○
10"-20"	~~40-17~~" Coal/ash	☒	○	○
2 20.1-24"	Sand silt w/ clay orange dry brittle	☒	○	○
3 2-4	Orange clay w/ some silt/sand dry	☒	○	○
4-6	Orange clay w/ some silt dry brittle, cohesive (med)	☒	○	○
5	some plastic when wet	☒	○	○
6	1" of coal/ash on top	○	○	○
7'				
6-8' 8	Same as above (orange clay w/ silt dry)	○	○	○
9	the bottom 1' more clay less silt less dry	○	○	○
10	(not moist though)	○	○	○
11 8-10'	Same as above: dry plastic clay w/ some-little silt	○	○	○
12 10-12'	upper part (≈1') more moist than bottom whole spoon	☒	☒	○
13	more ~~wet~~ moist than before			
14 12-14	Same as above little sand in upper 1/2 ft	☒	○	○
15	no sand in bottom 1/2 foot - more red orange this part	☒	○	○
	~~A bit of ash at 13"~~			

MW-1

Depth(feet)	Sample Number	Blows on Sampler	Soil Components CL SL S GR	Rock Profile	Penetration Times	Run Number	Core Recovery	RQD	Fracture Sketch	HNu/OVA (ppm)	Comments
	8										
16											
17	9	4 4 4 4			1536		24			0	
18											
19	10	2 3 3 3			1543		24				
20											
21	11	2 3 5 9			1549		18			0	
22											
23	12	10 12 16 50/0			1553						SS refusal 23.5 BGS
21. 24											
25				BOTTOM OF HOLE AT 25.9 BGS							
26											
27											
28											
29											
30											
31											
32											
33											
34											
35											
36											
37											
38											
39											
40											
41											
42											
43											
44											
45											

Depth(feet).	NARRATIVE LITHOLOGIC DESCRIPTION	Moisture Content Dry	 Moist	 Wet
16	14'-16' Orange/red clay v. little silt plastic soft	○	☒	○
17	16-18 More moist than before top 1½" more moist/wet	○	☒	☒
18	than bottom which is less red	○	○	○
19	Clay plastic, soft v. little silt	○	☒	☒
20	18'-20' same as above.	○	○	○
21	At 18'8 7" gravel in w/ the clay 1/4 of inch	○	☒	☒
22	some broken pieces of gravel also - gravel is	○	○	○
23	gray subrounded	○	○	○
24	20'-22' 20→20+13 same as above →with v. little sand } moist	○	☒	○
25	20+13→20+18 no gravel	○	☒	○
26	*S.S. Refused at 23.5' BGS	○	○	○
27	22-23.5 Same as above. larger pieces of gravel	○	○	○
28	(≃ 1/2 - 2/4") & gravel fragments. Gravel is	○	○	○
29	gray subrounded	○	○	○
30	12/3/98	○	○	○
31	Auger 20-23.5 ≃200gals.	○	○	○
32	Roller bit	○	○	○
33	All rock - lots of cuttings - Loosing water.	○	○	○
34	09:35 2' BGS (2 ft in 20 minutes)	○	○	○
35	10:02 Drillers cleaned the hole	○	○	○
36	Bottom of hole at 25.9.	○	○	○
37		○	○	○
38		○	○	○
39		○	○	○
40		○	○	○
41		○	○	○
42		○	○	○
43		○	○	○
44		○	○	○
45		○	○	○

12/3/98

DRILLING LOG FOR MW-2

Project Name TRACT II

Site Location Beech st.
Nia. Falls N.Y.

Date Started/Finished 12-1-98 - 12/3/98

Drilling Company Maxim Technologies

Driller's Name Ron Brown / mike Keller

Geologist's Name Robert Meyers

Geologist's Signature Robert Meyers

Rig Type (s) CME-75

Drilling Method (s) HSA, Tricone Rollerbit

Bit Size (s) 3 7/8" Auger Size (s) 4 1/4" ID

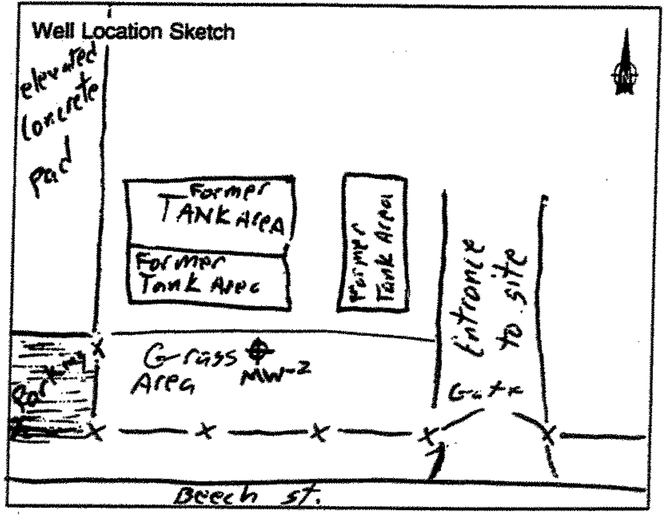
Auger/Split Spoon Refusal SS @ 15', Auger @ 14.8'

Total Depth of Borehole Is

Total Depth of Corehole Is

Water Level (TOIC)		
Date	Time	Level(Feet)

Well Location Sketch



Depth(Feet)	Splitspoon Sample Number	Blows on Sampler	Soil Components Rock Profile CL SL S GR	Penetration Times	Run Number	Core Recovery	RQD NA	Fracture Sketch	~~HNu~~/OVA (ppm)	Comments
1 2	1	3 7 8 9		1205		1.8'		NA	0ppm	1205 Collect Sample MWT2-B0250 for VOC, BNA, Pest/PCB TAL metals & CN
3 4	2	8 8 9 12				1.7'			0ppm	
5 6	3	8 4 8 12				1.5'			0ppm	
7 8	4	17 14 13 12				1.9'			0ppm	
9 10	5	4 8 12 8				1.5'			0ppm	
11 12	6	8 11 12 12		1308		0.2'			0ppm	
13 14	7	13 15 13 27				2.0'			0ppm	
15	8	37 50*		1418		0.6'			0ppm	Splitspoon Refusal *

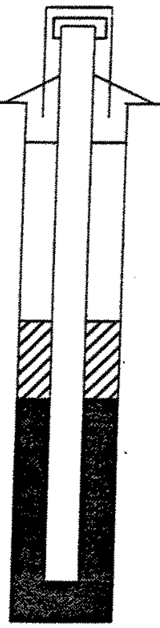
* Bouncing @ 15' BGS

Lock Number Master 3220

SCREENED WELL

Inner Casing Material PVC

Inner Casing Inside Diameter 2 inches



Stick-up ____ ft

GROUND SURFACE

Top of Grout ____ ft

Top of Seal at 5 ft

Top of Sand Pack 7 ft

Top of Screen at 9 ft

Bottom of Screen at 19' ft

Bottom of Hole at 19.5' ft

Bottom of Sandpack at 19.5'

Quantity of Material Used:

Bentonite Pellets 1-50lb. bag

Cement 1-94lb. bag

Borehole Diameter 8 inches

Cement/Bentonite Grout 3-100lb. bags Sand.

Screen Slot Size .010"

Screen Type

☒ PVC Sch.40

☐ Stainless Steel ____

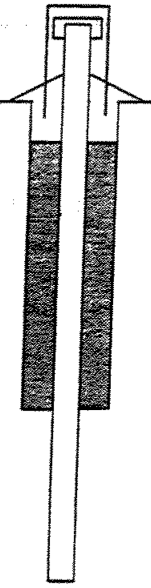
Pack Type/Size: #1

☒ Sand ____

☐ Gravel ____

☐ Natural ____

OPEN-HOLE WELL



Stick-up ____ ft

Inner Casing Material ____

Inner Casing Inside Diameter ____ inches

Outer Casing Diameter ____ inches

Borehole Diameter ____ ft

Bedrock ____ ft

Bottom of Rock Socket/ Outer Casing ____ ft

Bottom of Inner Casing ____ ft

Corehole Diameter ____

Bottom of Corehole ____ ft

NOTE: See pages 136 and 137 for well construction diagrams

Depth-ft.	NARRATIVE LITHOLOGIC DESCRIPTION	Moisture Content Dry	Moist	Wet
SS#1 1	0' to .45', Black crushed stone with some silt and Sand.	○	⊗	○
↓ 2	0.45' to 4.0', Red-Clay with Few Fill Materials; cinders,	⊗	○	○
SS#2 3	slag, wood Fragments, Tight, low Plasticity.	⊗	○	○
↓ 4		⊗	○	○
5	SS #3, 4' to 5.1', Same Clay as above with NO Fill Materials.	⊗	○	○
6	5.1' to 5.5' Silty Gray Clay with Some iron staining.	⊗	○	○
7	SS #4, 6' to 6.2' Gray Clay as above 6.2' to 7.9' is red	○	⊗	○
8	Fine SILT, uniform, No Fill, moderately Cohesive, None Plastic	○	⊗	⊗
9	SS#5, Till, Silt & VF Sand with ≃25% Sub-rounded Gravel and	○	⊗	⊗
10	trace clay, also 2-wet Fine Sand Seams ≃½" each	○	⊗	○
11	SS#6, 0.2' Recovery of till as above with broken dolostone	○	⊗	○
12	Cobble in splitspoon shoe. (moist Till)	○	⊗	○
13	SS#7, 12' to 14', Till as above	○	⊗	○
14		○	⊗	○
15	SS#8, 14' to 14.1' Till as above, 14.1' to 14.6' Broken Dolostone Fragments.	⊗	○	○

Depth(feet)	Sample Number	Blows on Sampler	Soil Components CL SL S GR	Rock Profile	Penetration Times	Run Number	Core Recovery	RQD	Fracture Sketch	~~HNu~~/OVA (ppm)	Comments
16					1420 1448	1	NA	NA	NA		
17										0 ppm	OVA off water returns
18											Lost water Returns @ 16.5' to 19'
19					1503					0ppm.	
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											
31											
32											
33											
34											
35											
36											
37											
38											
39											
40											
41											
42											
43											
44											
45											

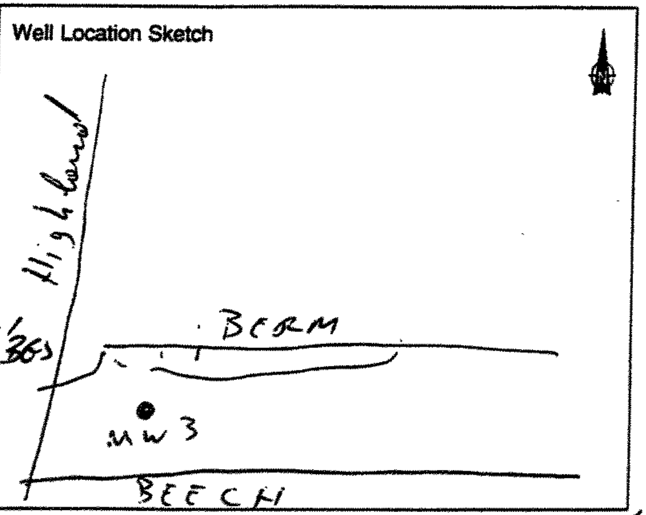
Depth(feet).	NARRATIVE LITHOLOGIC DESCRIPTION	Moisture Content		
		Dry	Moist	Wet
16	14.8' to 19.5', Drill through Dolostone with 3⅞" roller bit	○	○	○
17		○	○	○
18		○	○	○
19		○	○	○
20	B.O.H @ 19.5' BGS	○	○	○
21		○	○	○
22		○	○	○
23		○	○	○
24		○	○	○
25		○	○	○
26		○	○	○
27		○	○	○
28		○	○	○
29		○	○	○
30		○	○	○
31		○	○	○
32		○	○	○
33		○	○	○
34		○	○	○
35		○	○	○
36		○	○	○
37		○	○	○
38		○	○	○
39		○	○	○
40		○	○	○
41		○	○	○
42		○	○	○
43		○	○	○
44		○	○	○
45		○	○	○

DRILLING LOG FOR MW-3

Project Name TRACT II
Site Location Beech St.
Niag. Falls, NY
Date Started/Finished 12/2/98 - 12/4/98
Drilling Company Maxim Technologies
Driller's Name Ron Brown / Mike Keller
Geologist's Name Vassilis Angelakis
Geologist's Signature
Rig Type (s) CME-75
Drilling Method (s) HSA Tricone Roller Bit
Bit Size (s) 3 7/8" Auger Size (s) 4 1/4" ID
Auger/Split Spoon Refusal SS @ 20' Auger at 19.5'
Total Depth of Borehole Is
Total Depth of Corehole Is

Water Level (TOIC)		
Date	Time	Level(Feet)

Well Location Sketch

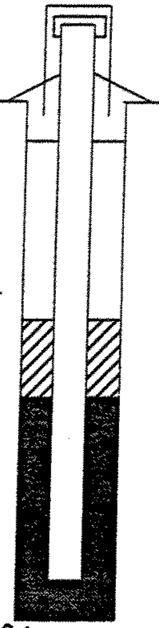


Depth(Feet)	Split Spoon Sample Number	Blows on Sampler		Soil Components Rock Profile CL SL S GR	Penetration Times	Run Number	Core Recovery	RQD	Fracture Sketch	HNu/OVA (ppm)	Comments
0		2	3				13"				Sample collected
1	1	6	8		1000						Photo MWTQ-A0350
2		50/4									met refusal auger down to 4ft.
3	2				10.06		1				
4		1	4				22"				
5	3	7	10								
6											
7	4	5	7		1018		23"				
8		5	9								
		2	3		1026						
9	5	4	6							0ppm	
10		1	3		1029		24"				
11		6	6								
12		7	8		1035		24"			0.5ppm in wet section	
13		7	5							@LEL 0ppm in augers	
14		4	8				~~34~~ 14"			0ppm in augers	
15		4	4								

took Geol. Sample
MWTQ-C03 5feet

Lock Number 3220

SCREENED WELL



Inner Casing Material PVC

Inner Casing Inside Diameter 2 inches

Stick-up 2.5 ft

GROUND SURFACE

Top of Grout ____ ft

Top of Seal at 10.5 ft

Top of Sand Pack 12.5 ft

Top of Screen at ~~14.5~~ 14 ft

Bottom of Screen at ~~23.0~~ 24 ft

Bottom of Hole at 24.5 ft BGS

Bottom of Sandpack at 24.5' BGS

Quantity of Material Used:

Bentonite [✓ Pellets] 1 bag

Cement Portland

Borehole Diameter 8 inches

Cement/ Bentonite ____

Grout ____

Screen Slot Size .010"

Screen Type ____

☒ PVC Sch 40

☐ Stainless Steel ____

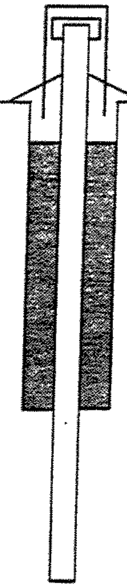
Pack Type/Size: #1

☒ Sand Granusil 2095

☐ Gravel ____

☐ Natural ____

OPEN-HOLE WELL



Stick-up ____ ft

Inner Casing Material PVC

Inner Casing Inside Diameter 2 inches

Outer Casing Diameter ____ inches

Borehole Diameter ____ ft

Bedfock ____ ft

Bottom of Rock Socket/ Outer Casing ____ ft

Bottom of Inner Casing ____ ft

Corehole Diameter ____

Bottom of Corehole ____ ft

NOTE: See pages 136 and 137 for well construction diagrams

Depth-ft.	NARRATIVE LITHOLOGIC DESCRIPTION	Moisture Content Dry	 Moist	 Wet
0 0"-5"	. Black silt with wood fragments	☒	○	○
1 5"-12"	Brown silt + sand some broken stone	⦶	○	○
2 12"-13"	Broken piece of wood	⦶	○	○
3 ~~2~~ 3'-4'	No recovery - piece of wood	⦶	○	○
4 3'~~-~~ 4'+2"	dark clay with some brown/orange clay	⦶	○	○
5 4'+2'-6'	Orange clay - little silt - dry	⦶	○	○
6	brittle, plastic when wet	⦶	○	○
7 6'-8'	Orange clay wet very plastic	⦶	○	○
8	with some darker silt little sand	○	☒	○
9	Wood fragments & brick fragments	○	○	○
10 8'-10'	Same as above - less silt no sand	☒	☒	○
10-12'	Same as above - pure orange clay	○	○	☒
13	moisture starts at 11' - plasticity			
14	high (v. little silt) rolls easy - soft	○	○	☒
15	v. cohesive	○	○	○

Depth(feet)	Sample Number	Blows on Sampler		Soil Components CL SL S GR	Rock Profile	Penetration Times	Run Number	Core Recovery	RQD	Fracture Sketch	HNu/OVA (ppm)	Comments
		4	4		~~10~~	1052		16"				
16												
17		7	10			1048		12"				
		24	40									
18		35	50			1100						
19		50/3						15"			0.5ppm in coarser part	
20												Auger refusal 19.5' BGS
21												
22												
23												
24						1157						24.5' BGS
25												
26												
27												
28												
29												
30												
31												
32												
33												
34												
35												
36												
37												
38												
39												
40												
41												
42												
43												
44												
45												

Depth(feet).	NARRATIVE LITHOLOGIC DESCRIPTION	Moisture Content		
		Dry	Moist	Wet
16	12-14 Same as above wet	○	○	☒
17	14-16 Same as above - moist (not as	○	☒	○
18	wet as previous section w/ some gravel	○	○	○
19	16 18 same as above w/ gravel subrounded	○	☒	○
20	-subangular in the clay (gray in color)	○	○	○
21	in the bottom of shoe a piece of rock	○	○	○
22	Lockport gray/black the gravel ranges in	○	○	○
23	size from 1/8 - 1/4 of inch	○	○	○
24	18'-20' Top 3" wet clay w/ gravel angular	○	○	☒
25	& sub rounded - angular → pieces of rock broken	○	☒	○
26	Piece of rock 3/4 of inch piece	☒	☒	○
27	18'+3' -~~19~~ 18'3" -silt Sand in w/ the clay not cohesive	☒	○	○
28	brittle - dry	○	○	○
29	Augered to 19.5' BGS → Refusal. 11:09 am	○	○	○
30	19.5-21.5' 2 1/5 minutes	○	○	○
31	3.9' in rock at 11:38 a.m.	○	○	○
32	25'3" at 11:45 am ≅ 30 gals of water lost in hole	○	○	○
33	11:48 drillers are cleaning hole	○	○	○
34	12:10 Pulled all eq. out of hole	○	○	○
35	Bottom of well 24.5' BGS	○	○	○
36		○	○	○
37		○	○	○
38		○	○	○
39		○	○	○
40		○	○	○
41		○	○	○
42		○	○	○
43		○	○	○
44		○	○	○
45		○	○	○

12/2/98

BP08 12/3/98

DRILLING LOG FOR MW4

Project Name TRACT II

Site Location Beech Str.
Niag. Falls NY

Date Started/Finished 12/3/98 - 12/4/98

Drilling Company Maxim Tech.

Driller's Name Ron Brown / Mike Keller

Geologist's Name Vassilios Angelaki

Geologist's Signature

Rig Type (s) CME-75

Drilling Method (s) HSA + Tricone Roller bit

Bit Size (s) 3 7/8" Auger Size (s) 4 1/4" ID

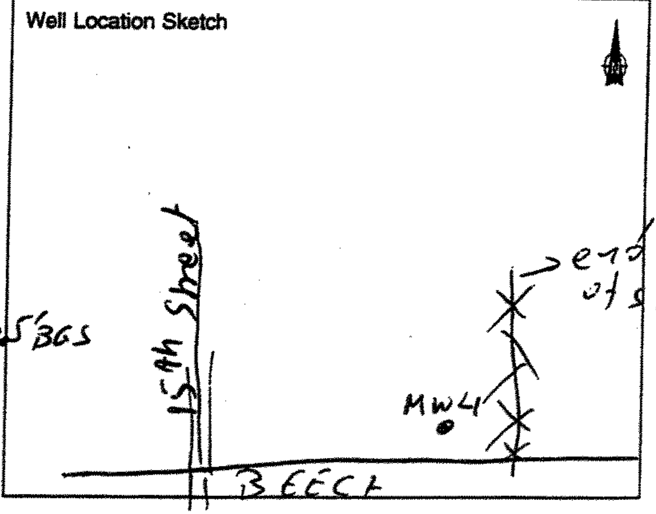
Auger/Split Spoon Refusal SS at 12' Auger at 12.5' BGS

Total Depth of Borehole Is

Total Depth of Corehole Is

Water Level (TOIC)		
Date	Time	Level(Feet)
12/4/98	09 50	12.2 ft BGS
12/4/98	03:10	15.22 ft TOIC → 9 ppm w/OVA in head space

Well Location Sketch

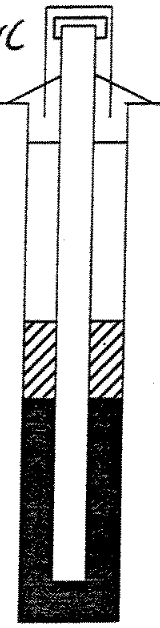


Depth(Feet)	Sample Number	Blows on Sampler		Soil Components Rock Profile CL SL S GR	Penetration Times	Run Number	Core Recovery	RQD	Fracture Sketch	HNu/OVA (ppm)	Comments
1		3 6	4 6		138		20"				Took Sample MWT2-A04SO MWT2-A04SM Photo
2											
3		4 8	4 8		145		20"			0 iec	Took Geotech Sample MWT2-B04SGeot 3 jars
4											
5		5 20	9 20		147		24"			0ppm	
6											
7		20 21	22 20		153		20"				
8											
9		3 11	7 14		203		20"			0ppm	
10											
11		10 50/5	26		215						
12											Spoon bounced at 12' Auger refusal at 12.5' BGS 02 33
13		50/1			228						
14											Roller bit
15											

MW 4 BP08

Lock Number ______

SCREENED WELL



Stick-up 2.5 ft PVC

Inner Casing Material PVC

Inner Casing Inside Diameter 2 inches

GROUND SURFACE

Top of Grout ______ ft

Quantity of Material Used:

[✓ Bentonite Pellets] ______

Cement Portland

1120

Top of Seal at 4.5 ft

Borehole Diameter 8 inches

Top of Sand Pack 6.5 ft

Cement/ Bentonite ______

Grout Bent/Cement

Top of Screen at 8.5 ft

Screen Slot Size 0.010"

Bottom of Screen at 18.5 ft

Screen Type 0.010"

☒ PVC Sch. 40

☐ Stainless Steel ______

Bottom of Hole at 19 ft

Pack Type/Size: #1

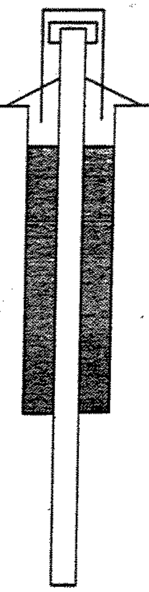
☒ Sand Granusil

☐ Gravel ______

☐ Natural ______

Bottom of Sandpack at 19

OPEN-HOLE WELL



Stick-up ______ ft

Inner Casing Material ______

Inner Casing Inside Diameter ______ inches

Outer Casing Diameter ______ inches

Borehole Diameter ______ ft

Bedrock ______ ft

Bottom of Rock Socket/ Outer Casing ______ ft

Bottom of Inner Casing ______ ft

Corehole Diameter ______

Bottom of Corehole ______ ft

NOTE: See pages 136 and 137 for well construction diagrams

Depth-ft.	NARRATIVE LITHOLOGIC DESCRIPTION	Moisture Content Dry	Moisture Content Moist	Moisture Content Wet
1	0-8" Ash mixed w/soil	☒	○	○
2	Best Clay w/ sand & silt black dry	⦶	○	○
3	2-4→ Clay orange w/ sand & silt	⦶	○	○
4	4-6' Clay orange w/ little sand & silt	⦶	○	○
.5	hard dry - (a little moist hard	⦶	○	○
6	6-8 Orange dry hard clay v. little silt	⦶	○	○
7	8-10 Same as above - bottom 2" grayer in	☒	○	○
8	color bottom ½ a bit moist	☒	☒	○
9	10-12 Same as above pieces of gravel (¼-½")	○	○	○
10	& pieces of rock on bottom of shoe	☒	○	○
11	(Lockport) ~~some~~ little sand & silt	⦶	○	○
12	02:33 pm. Auger refusal at 12.5 BGS	⦶	○	○
13	Will go on with roller bit	⦶	○	○
14	12/4/98 : Roller bit to 20 ft BGS (7.5 in rock)	○	○	○
15		○	○	○

MW4 '5008 12/4/9

Depth(feet).	NARRATIVE LITHOLOGIC DESCRIPTION	Moisture Content Dry	Moist	Wet
16		○	○	○
17		○	○	○
18		○	○	○
19	Bottom of hole 19' BGS	○	○	○
20		○	○	○
21		○	○	○
22		○	○	○
23		○	○	○
24		○	○	○
25		○	○	○
26		○	○	○
27		○	○	○
28		○	○	○
29		○	○	○
30		○	○	○
31		○	○	○
32		○	○	○
33		○	○	○
34		○	○	○
35		○	○	○
36		○	○	○
37		○	○	○
38		○	○	○
39	12/4/92	○	○	○
40		○	○	○
41		○	○	○
42		○	○	○
43		○	○	○
44		○	○	○
45		○	○	○

MW-4

9' BGS
1gm fhole
'er to 20

Depth(feet)	Sample Number	Blows on Sampler	Soil Components CL SL S GR	Rock Profile	Penetration Times	Run Number	Core Recovery	RQD	Fracture Sketch	HNu/OVA (ppm)	Comments
16											
17										02ER	
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											
31											
32											
33											
34											
35											
36											
37											
38											
39											
40											
41											
42											
43											
44											
45											

B

Geotechnical Laboratory Data

GEOTECHNICAL LABORATORY TEST PROCEDURES

NIAGARA FALLS TRACT II BROWNFIELD SITE
NIAGARA FALLS, NEW YORK
File No. 1300.42
January 22, 1999

1. The following tests were conducted in general accordance with the noted ASTM test method:

DESIGNATION	TEST METHOD
ASTM D 422-63	Particle-Size Analysis of Soils
ASTM D 2216-92	Laboratory Determination of Water (Moisture) Content of Soil and Rock
ASTM D 2487-92	Classification of Soils for Engineering Purposes (Unified Classification System) (see Item 2)
ASTM D 4318-93	Liquid Limit, Plastic Limit, and Plasticity Index of Soils

2. Soil descriptions are based upon particle-size analysis results and determination of the liquid limit, plastic limit and plasticity index.

3. The test results are presented on the sheets entitled "Geotechnical Laboratory Testing Data Summary" and "Particle-Size Analysis" which follow.

LEGEND FOR GEOTECHNICAL LABORATORY TESTING DATA SUMMARY

WATER CONTENT (ASTM D 2216)

% = WATER CONTENT IN PERCENT OF AS RECEIVED SAMPLE

ATTERBERG LIMITS (ASTM D 4318)

LL % = LIQUID LIMIT IN PERCENT

PL % = PLASTIC LIMIT IN PERCENT

PI = PLASTICITY INDEX

GRAIN SIZE ANALYSIS (ASTM D 422)

SIEVE -200 % = PERCENT FINES, MATERIAL FINER THAN NO. 200 SIEVE (0.074 MM)

HYD. -2μ % = PERCENT FINER THAN 2 MICRONS

MOISTURE-DENSITY RELATIONSHIP (Modified) (ASTM D 1557)

MAX. DRY DENSITY pcf = MAXIMUM DRY DENSITY IN POUNDS PER CUBIC FOOT

OPT. WATER CONTENT % = OPTIMUM WATER CONTENT IN PERCENT

PERMEABILITY TEST (ASTM D 5084)

PERMEABILITY cm/sec. = PERMEABILITY MEASURED IN CENTIMETERS PER SECOND

TYPE OF TEST Kr = RECONSTITUTED (REMOLDED) SAMPLE
K = UNDISTURBED SAMPLE

$\overline{\sigma}_c$ psf = EFFECTIVE CONFINING PRESSURE DURING PERMEABILITY TEST IN POUNDS PER SQUARE FOOT

DRY UNIT WT. pcf = INITIAL DRY DENSITY OF TEST SAMPLE IN POUNDS PER CUBIC FOOT

WATER CONTENT % = INITIAL WATER CONTENT OF TEST SAMPLE IN PERCENT

GZA GeoEnvironmental of New York
Engineers and Scientists

JAN 22 1995

GEOTECHNICAL LABORATORY TESTING DATA SUMMARY

PROJECT NAME: NIAGARA FALLS TRACT II BROWNFIELD SITE
LOCATION: NIAGARA FALLS, NY
PROJECT NO. 1300.42

PROJECT ENGINEER: ECOLOGY AND ENVIRONMENT, INC.

MATERIAL SOURCE: PROJECT SITE - NIAGARA FALLS, NY

DATE REPORTED: 1/22/99

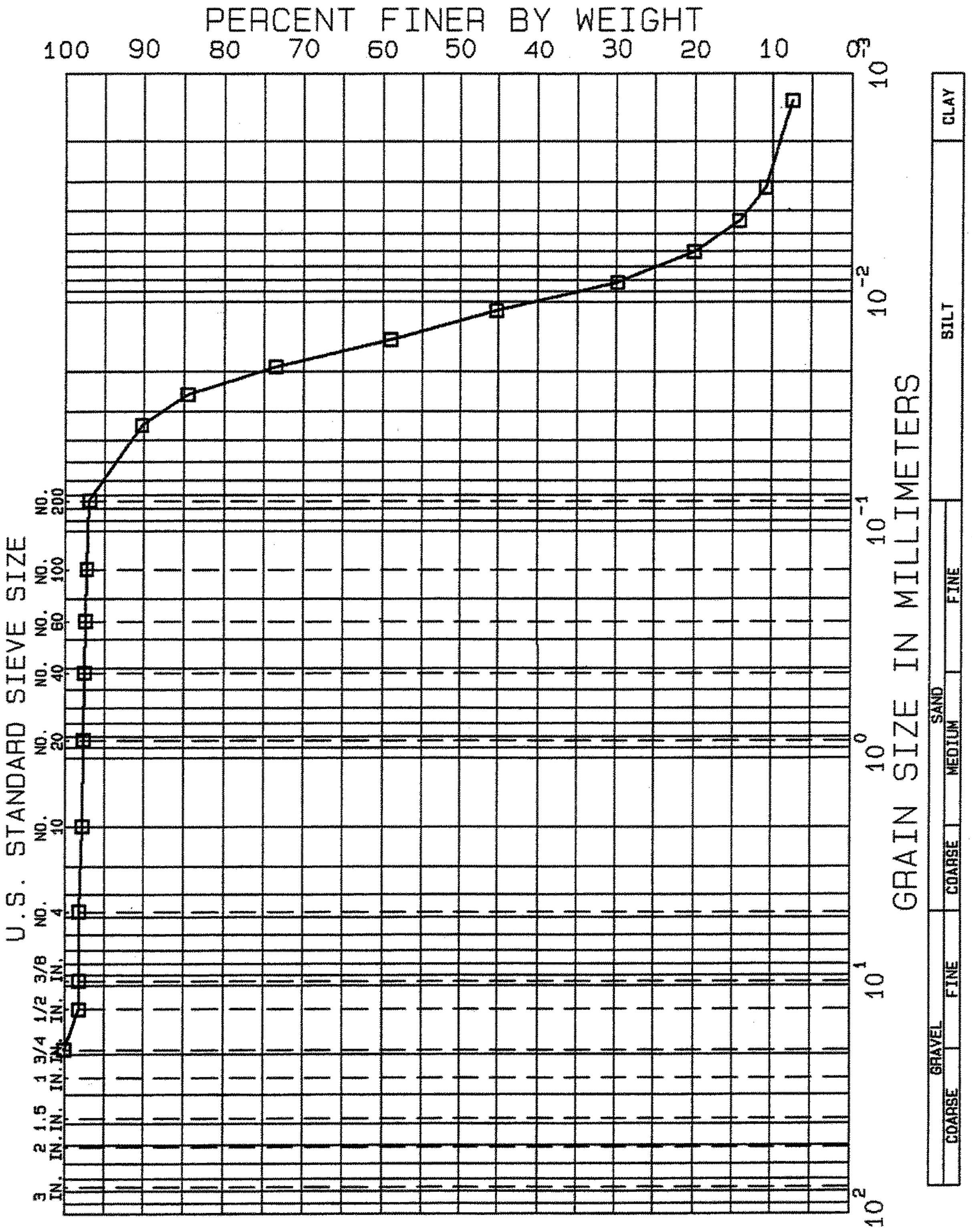
WORK ORDER NO. 3475

IDENTIFICATION			WATER CONTENT	ATTERBERG LIMITS			GRAIN SIZE ANALYSIS		MOISTURE-DENSITY RELATIONSHIP (Modified)		PERMEABILITY TEST					LABORATORY LOG AND SOIL DESCRIPTION
SAMPLE TYPE	SAMPLE NUMBER	DEPTH ft.	%	LL %	PL %	PI	SIEVE -200 %	HYD. -2μ %	MAX. DRY DENSITY pcf	OPT. WATER CONTENT %	PERME-ABILITY cm/sec.	TYPE OF TEST	$\bar{\sigma}_c$ psf	DRY UNIT WT pcf	WATER CONTENT %	
	MWT2-B04S	2.0 4.0	18.1	40	19	21	88	23								Reddish yellow, strong brown Lean Clay (CL)
	MWT2-G03S	12.0 14.0	23.5	23	18	5	97	9								Reddish brown Silty Clay (CL-ML)

Notes: 1) See Legend for Geotechnical Laboratory Testing Data Summary.

2) See Geotechnical Laboratory Test Procedures for specific test procedures completed.

GZA GeoEnvironmental of New York
Engineers and Scientists



TEST NO.	MATERIAL SOURCE	SAMPLE DESCRIPTION
1.1	**Project Site**	**Reddish brown Silty Clay (CL-ML)**

Test Procedure Information:

Sample separated on a No. 4 sieve. Sample dispersed with a mechanical stirring device, Type A, for 1 minute.

NIAGARA FALLS TRACT II BROWNFIELD SITE - NIAGARA FALLS, NY

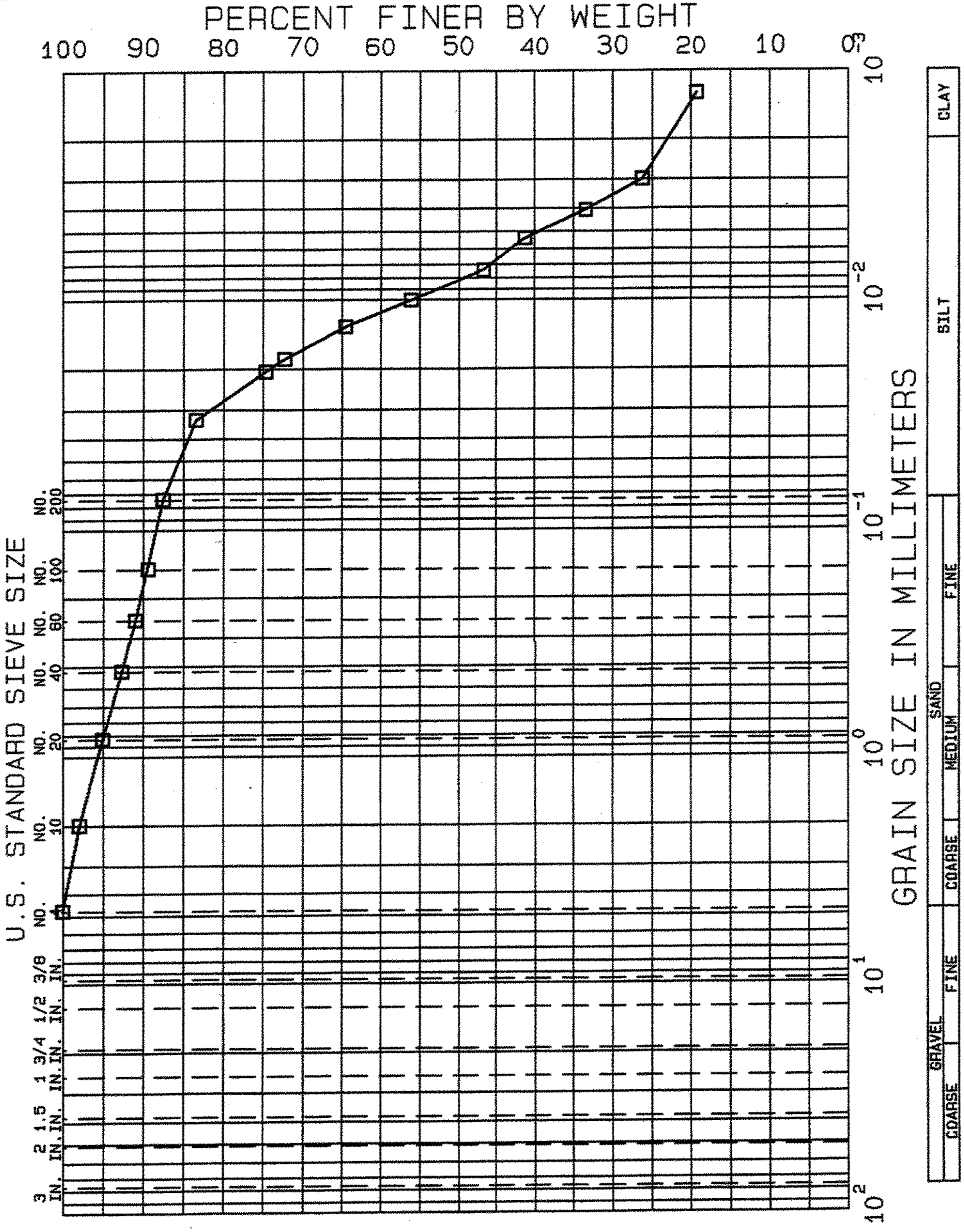
PARTICLE-SIZE ANALYSIS

EXPLOR. NO.
SAMPLE NO. **MWT2-S03S**
DEPTH **12.0-14.0 FT.**
TECH. **DJB**
REVIEWER **RAR**

WORK ORDER NO. **3475**
DATE **1/20/99**
FILE **1300.42**

GZA GeoEnvironmental of New York
Engineers and Scientists

JAN 22 1999



SAMPLE DESCRIPTION
Reddish yellow, strong brown Lean Clay (CL)

MATERIAL SOURCE
Project Site

TEST NO.
2.1

Test Procedure Information:

Sample separated on a No. 4 sieve. Sample dispersed with a mechanical stirring device, Type A, for 1 minute.

NIAGARA FALLS TRACT II BROWNFIELD SITE - NIAGARA FALLS, NY

PARTICLE-SIZE ANALYSIS

EXPLOR. NO.
SAMPLE NO. MWT2-B04S
DEPTH 2.0-4.0 FT.
TECH. DJB
REVIEWER RAR

WORK ORDER NO. 3475
DATE 1/20/99

FILE 1300.42

GZA GeoEnvironmental of New York
Engineers and Scientists

JAN 22 1999

Ecology and Environment, Inc., (E & E) Data Usability Summary Report (DUSR)

Prepared by: Marcia Meredith Galloway

Date Prepared: July 11, 2000

Project Name/E & E #: BP08 Tract II SI/RAR City of Niagara Falls

Lab Name: E & E Analytical Services Center

Lab Report No.(s): 0006053
Report Date (s): July 7, 2000
Date Sample(s) Taken: June 6, 2000

Sample Matrices: 4 Soils 0 Water
Field QC Samples: Field Dups – 1 (see Table 1)

Project Sample ID: = SST2-A,-B,-B/D, and –C

Specific analyses conducted on each sample are documented on the COC forms and include the following: Target Analyte List (TAL) Metals and Percent Solids. All methods follow Contract Laboratory Procedures (CLP) found in New York State Department of Environmental Conservation (NYSDEC) Analytical Services Protocol (ASP) 10/95.

The analytical data provided by the laboratory were reviewed for precision, accuracy, and completeness per NYSDEC Division of Environmental Remediation Guidance for the Development of DUSRs. Specific criteria for QC limits were obtained from the NYSDEC ASP 10/95. Qualifiers were assigned based on guidance in EPA's National Functional Guidelines for Inorganic Data Review. Compliance with the project QA program is indicated on the attached checklist and any major or minor concerns are listed below. The checklist also indicates whether data qualification is required and/or the type of qualifier assigned. Qualifiers for specific samples were marked on copies of laboratory summary reports.

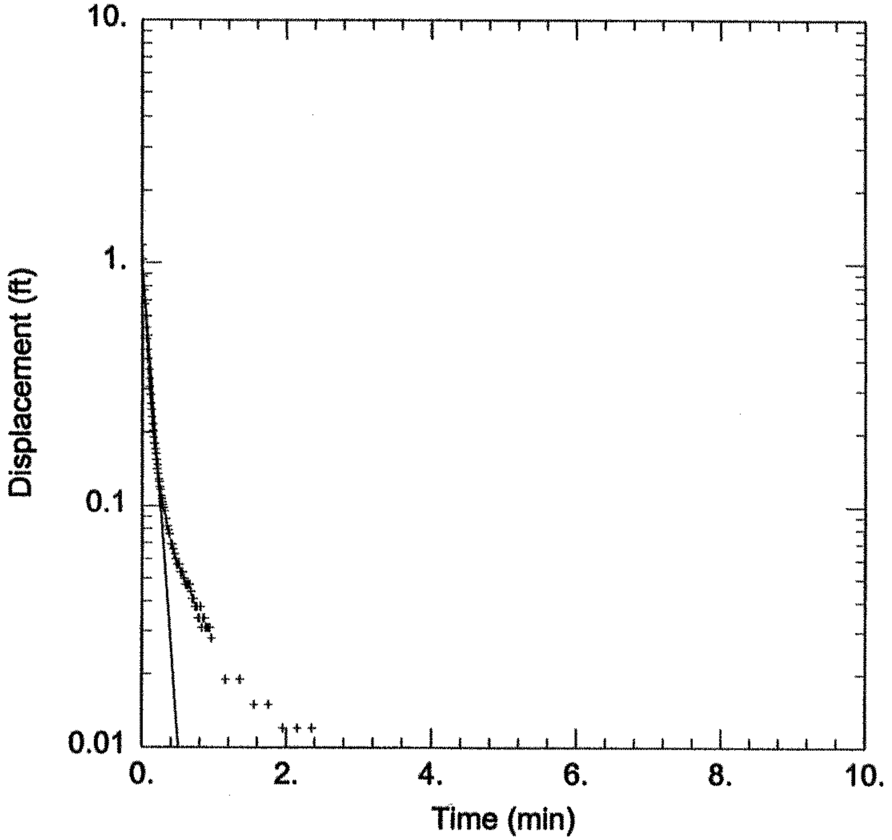
Major Concerns:
None

Minor Concerns:

1. Samples were received hand delivered without ice. Cooling was not required because the samples were only analyzed for metals.
2. Matrix spike (MS) recoveries were low for antimony, barium, chromium, copper, and silver. MS recoveries were high for manganese and mercury. The acceptable post-digestion spike recoveries confirm a matrix effect. All results are flagged "J" as estimated. Chromium recoveries are less than 30% but the field and laboratory duplicate results are acceptable. Therefore, the results are not rejected as indicated in the data validation guidance. The chromium results have a potential low bias.
3. Laboratory duplicate relative percent difference (RPD) values for antimony, selenium and zinc are greater than 35% indicating poor precision. The positive results are qualified "J" as estimated.
4. Preparation blank showed low levels of several metals. All metals were below the CRDL. All sample results were significantly greater than the blank levels except for silver. Low level silver results are flagged "J" as estimated and may have a positive bias.
5. The CRDL standard for mercury gave no recovery. All mercury results were positive and there is no impact on data usability.
6. Samples results flagged "B" as below CRDL are flagged "J" as estimated values.

C

Slug Test Results



TRACT II MW01 , RISING HEAD SLUG TEST

Data Set: A:\MW01.AQT
Date: 02/02/99 Time: 13:53:30

PROJECT INFORMATION

Company: Ecology & Environment, Inc.
Client: City of Niagara Falls
Project: BP08
Test Location: Tract II, Niagara Falls, NY
Test Well: Tract II MW01
Test Date: 12/10/98

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.01154 cm/sec
y0 = 0.9462 ft

AQUIFER DATA

Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 1.

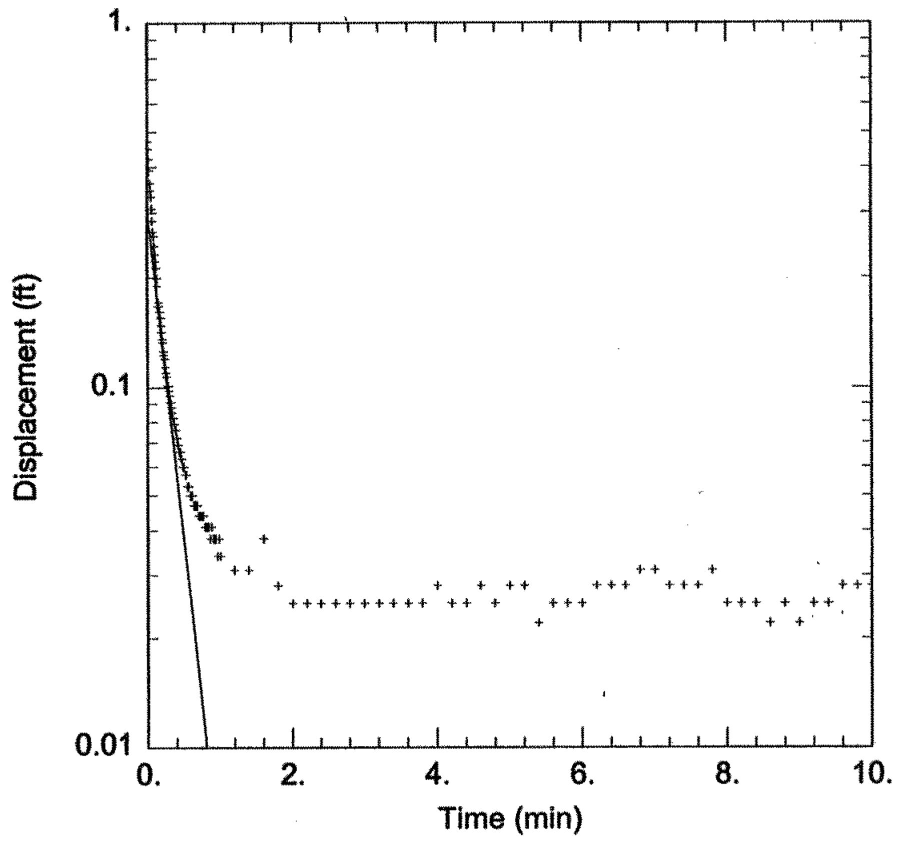
WELL DATA

Initial Displacement: 1.178 ft
Casing Radius: 0.083 ft
Screen Length: 10. ft

Water Column Height: 12.43 ft
Wellbore Radius: 0.167 ft
Gravel Pack Porosity: 0.4

TRACT II MW02 , RISING HEAD SLUG TEST

Data Set: A:\MW02.AQT
Date: 01/28/99 Time: 15:41:25



PROJECT INFORMATION

Company: Ecology & Environment, Inc.
Client: City of Niagara Falls
Project: BP08
Test Location: Tract II, Niagara Falls, NY
Test Well: Tract II MW02
Test Date: 12/10/98

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

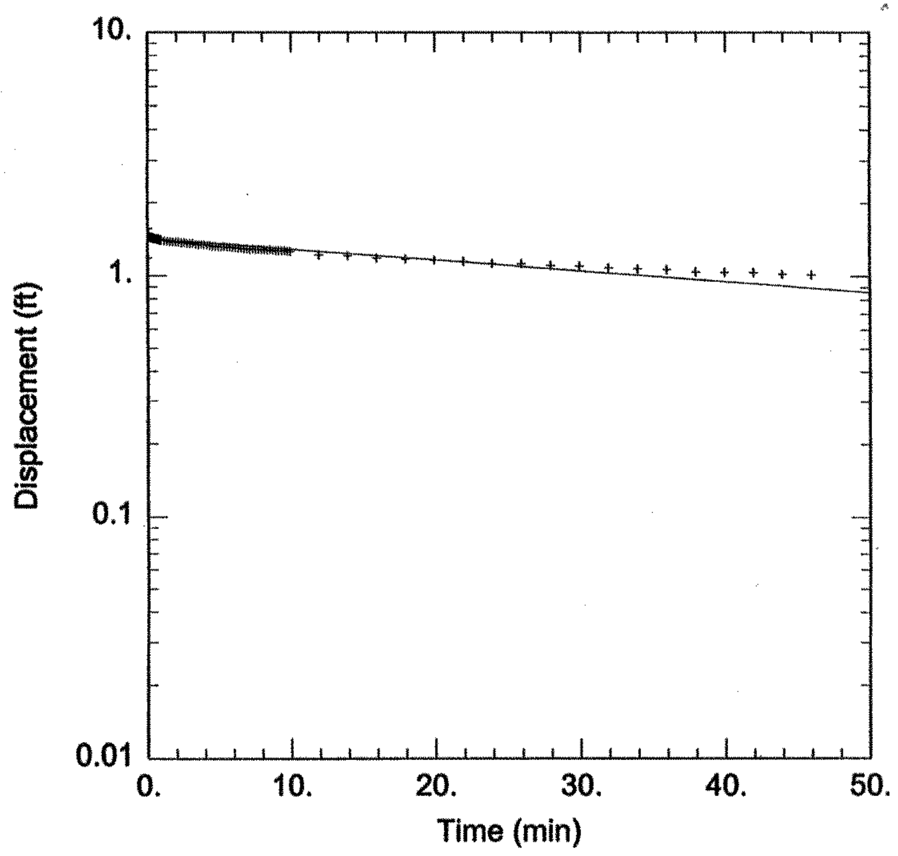
K = 0.003465 cm/sec
y0 = 0.3013 ft

AQUIFER DATA

Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Initial Displacement: 0.471 ft
Casing Radius: 0.083 ft
Screen Length: 10. ft
Water Column Height: 3.01 ft
Wellbore Radius: 0.167 ft
Gravel Pack Porosity: 0.4



TRACT II MW03 , RISING HEAD SLUG TEST

Data Set: A:\MW03.AQT
Date: 01/28/99 Time: 15:47:18

PROJECT INFORMATION

Company: Ecology & Environment, Inc.
Client: City of Niagara Falls
Project: BP08
Test Location: Tract II, Niagara Falls, NY
Test Well: Tract II MW03
Test Date: 12/10/98

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 1.261E-05 cm/sec
y0 = 1.416 ft

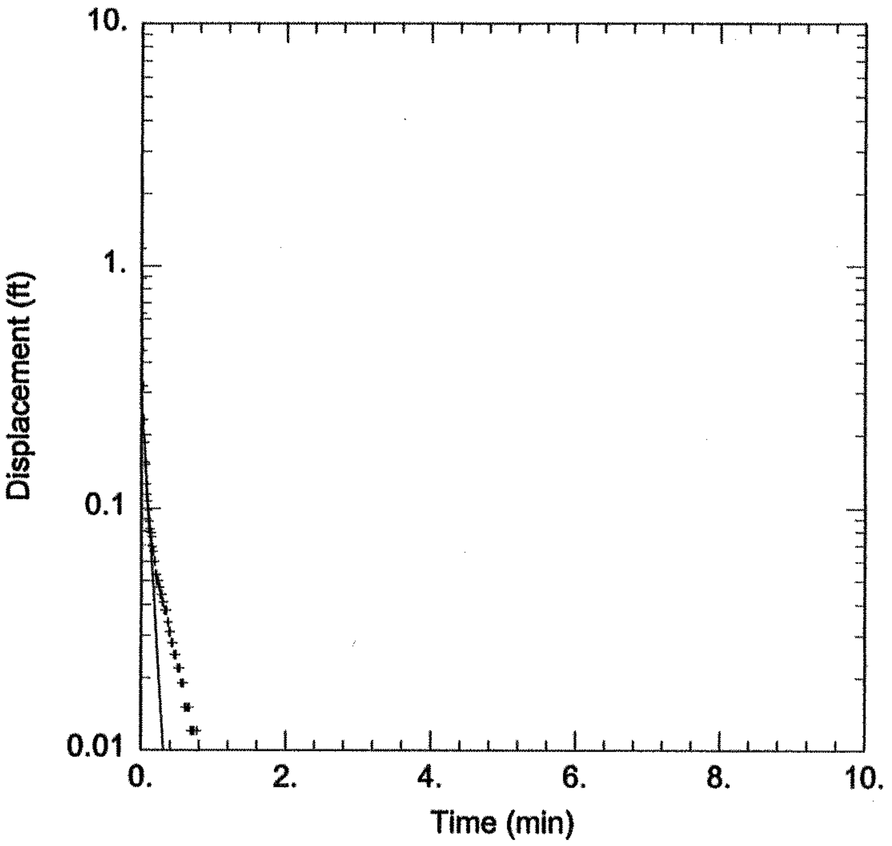
AQUIFER DATA

Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Initial Displacement: 1.178 ft
Casing Radius: 0.083 ft
Screen Length: 10. ft

Water Column Height: 11.91 ft
Wellbore Radius: 0.167 ft
Gravel Pack Porosity: 0.4



TRACT II MW04 , RISING HEAD SLUG TEST

Data Set: A:\MW04.AQT
Date: 01/28/99 Time: 15:50:53

PROJECT INFORMATION

Company: Ecology & Environment, Inc.
Client: City of Niagara Falls
Project: BP08
Test Location: Tract II, Niagara Falls, NY
Test Well: Tract II MW04
Test Date: 12/10/98

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.01072 cm/sec
y0 = 0.2712 ft

AQUIFER DATA

Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Initial Displacement: 1.178 ft
Casing Radius: 0.083 ft
Screen Length: 10. ft
Water Column Height: 5.88 ft
Wellbore Radius: 0.167 ft
Gravel Pack Porosity: 0.4

D

Asbestos Analysis Data

Laboratory Report

Client: **Ecology & Environment, Inc.**
4493 Walden Avenue
Lancaster, NY 14086

Attention: Don Johnson
Project Ref # BP08
Purchase Order #
Project: **Bulk Sample Analysis for Asbestos**
Niagara Falls Tract 2

Laboratory Project # NY812123
Project Manager: Paul Chopra
Start Date: 12/10/98
Report Date: 12/16/98
Analysis Type: **Bulk Asbestos Analysis by Polarized Light Microscopy**

Authorized Signature

☐ Daniel Miller, Senior Microscopist
☑ Paul S. Chopra, Laboratory Manager

Analysis Results Table

Client Sample	CLI Sample #	Sample Location / Description *Material Description(s)*	*Asbestos Content*	Analyst Comment *Non-Asbestos Content*	Analyst - Date
The following 3 samples were submitted by Ecology & Environment, Inc. on 12/10/98 and analyzed in accordance with PLM - ELAP Method 198.1					
AST201ACA0	415287	Pipe insulation			DM 12/15/98
		100% Gray fibrous	*68% Chrysotile*	*32% Non-Fibrous Material*	
68% asbestos in composite sample					
AST202EBA0	415288	Pipe insulation			DM 12/15/98
		100% Gray fibrous	*44% Chrysotile*	*29% Mineral Wool 27% Non-Fibrous Material*	
44% asbestos in composite sample					
AST203CBA0	415289	Pipe insulation			DM 12/15/98
		100% Gray fibrous	*10% Chrysotile*	*66% Cellulose 24% Non-Fibrous Material*	
10% asbestos in composite sample					

CHOPRA-LEE
Incorporated
1815 Love Road
Grand Island, NY 14072
716-773-7625 FAX 716-773-7624

NIST NVLAP Lab # 1208-01

NYS DOH ELAP Lab # 10954

Analysis Results Table

Client Sample	CLI Sample #	Sample Location / Description		Analyst Comment	
		Material Description(s)	*Asbestos Content*	*Non-Asbestos Content*	Analyst - Date

Additional testing is recommended for any material which contains <1% asbestos or NOB (non-friable organically bound) bulk materials which are negative or <1% asbestos. Analysis by Polarized Light Microscopy (PLM) has a degree of uncertainty that is dependent on the sample matrix, non-asbestos minerals present, size of the asbestos present, the sample homogeneity and analyst variability. PLM coefficients of variance range from approx. 1.8, at the quantitation limit of 1%, to 0.1 at high fiber concentrations. All PLM analyses must be reviewed with these factors taken into consideration.

These results are submitted pursuant to Chopra-Lee, Inc.'s current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results or recommendations are used or interpreted. These results pertain only to the items tested. Any reproduction of this document msut include the entire document in order for the report to be valid. Certification by NIST through NVLAP or New York State through ELAP does not constitute government endorsement of this testing facility. Unless notified in writing to return the samples covered by this report, Chopra-Lee, Inc. will store what remains of the samples for a period of 18 months before discarding.

Page #	2 of 2
Report Date:	12/16/98
Laboratory #	NY812123
Client:	Ecology & Environment, Inc.

EMSL Analytical, Inc.

440 Lawrence Bell Dr.
Buffalo, NY 14221
Phone: (716) 631-5887 *Fax: (716) 631-7693*

Attn.: Jon Nickerson
Ecology & Environment Inc.
Analytical Services Center
4493 Walden Ave
Lancaster, NY 14086

Friday, June 23, 2000

Ref Number: BU002168

POLARIZED LIGHT MICROSCOPY (PLM) - POINT COUNT

Performed by EPA 600/R-93/116 Method*

Project: HQ001833 / Tract II S16, Niagara Falls, NY

				ASBESTOS		NON-ASBESTOS			
Sample	Location	Appearance	Sample Treatment	%	Type	%	Fibrous	%	Non-Fibrous
T2DB0-1-AO		Brown Fibrous Homogeneous	Teased	< 1%	Chrysotile	30.%	Cellulose	70.%	Matrix
T2DB0-2-AO		Grey Fibrous Homogeneous	Teased	80.%	Chrysotile			20.%	Matrix
T2DB0-5-AO		Grey Fibrous Homogeneous	Teased	67.%	Chrysotile			33.%	Matrix
T2DB0-6-AO		Grey Fibrous Homogeneous	Teased	17.%	Chrysotile			83.%	Matrix

omments: For all obviously heterogeneous samples easily separated into subsamples, and for layered samples, each component is analyzed separately. Also, "# of Layers" refers to number of separable subsamples.

* NY samples analyzed by ELAP 198.1 Method.

Thomas M. Hanes

Thomas M. Hanes
Analyst

Approved
Signatory

nalysis performed by EMSL Buffalo (NVLAP Air and Bulk #200056, NYSDOH ELAP# 11606)

EMSL Analytical, Inc. 440 Lawrence Bell Drive, Suite #2
Williamsville, NY 14221
Phone (716) 631-5887
Fax (716) 631-7693

June 23, 2000

Ecology & Environment Inc.
Analytical Services Center
4493 Walden Avenue
Lancaster, New York 14086
Phone: (716) 685-8080
Fax: (716) 685-0852
Attention: **Jon Nickerson**
Project: **HQ001833 / Tract II S16, Niagara Falls, NY**
Ref #: **BU002169**

Analysis of New York State NOBs Performed by Transmission Electron Microscopy (TEM ELAP 198.4 Method*

SAMPLE ID	SAMPLE DESCRIPTION	COLOR	% NON FIBROUS MATERIAL	% NON-ASB FIBERS	TEM RESULTS % ASBESTOS
T2DB03-AO	mass	gray	82		18 chrysotile
T2DB04-AO	mass	gray	100		NAD
T2DB07-AO	mass	red	100		NAD

Analyst ____________________
Eric Fischer

Approved Signatory ____________________

NOTES: **NON-ACM** indicates a final residue weight <1% of subsample original weight
NAD - No Asbestos Detected

NVLAP #200056-0 NY STATE ELAP #11606

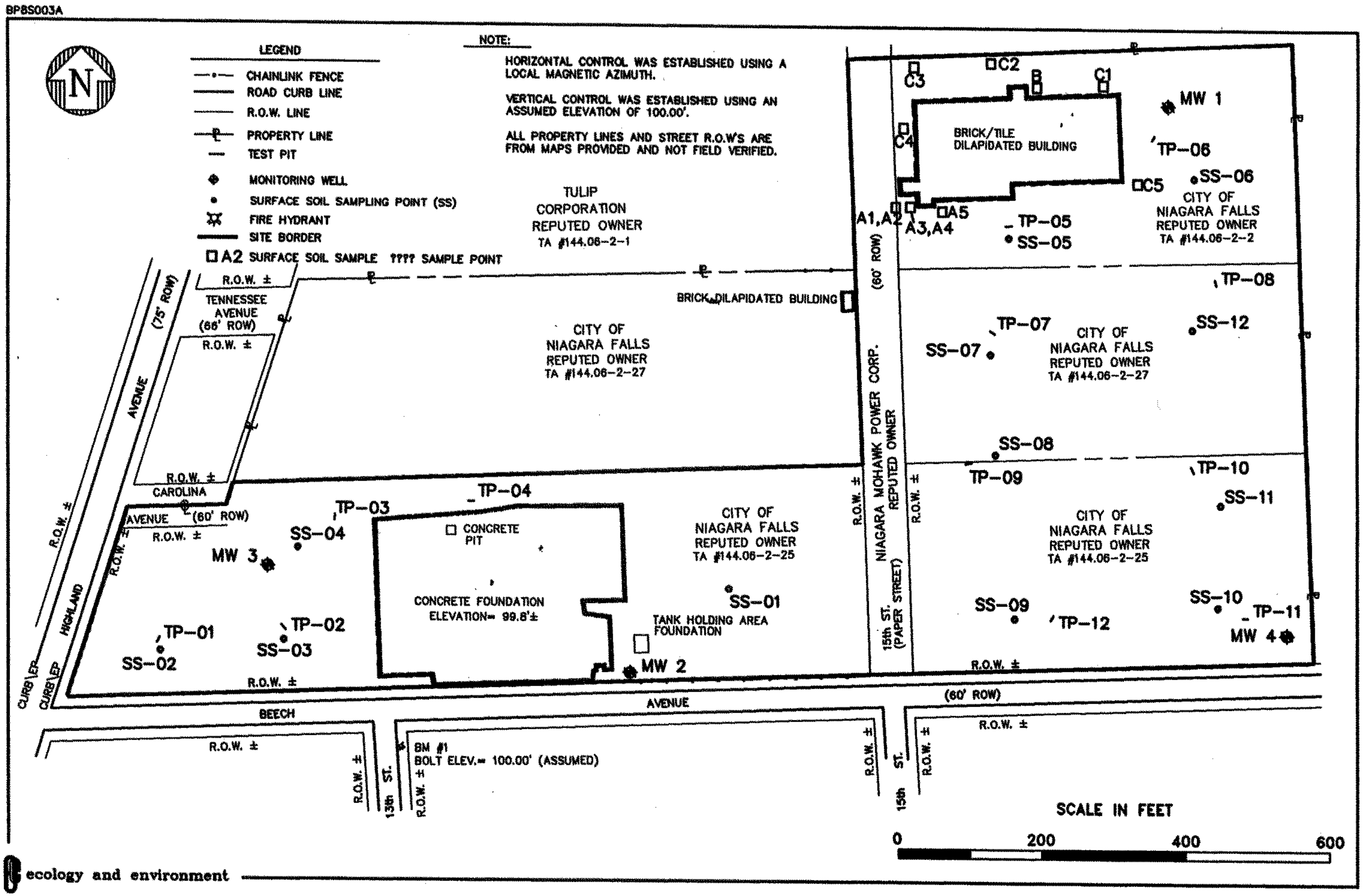


FIGURE 1-3 SAMPLE LOCATIONS TRACT II SITE, NIAGARA FALLS, NEW YORK

E

Photolog

PHOTOGRAPHIC RECORD

SITE NAME: TRACT II
SITE LOCATION: Niagara Falls, New York
JOB NUMBER: 000935.BP08.00.04.90

Photo Number:
1

Photographer:
D. Johnson

Date/Time:
12-1-98/0930 hrs

Direction of View:
North

Subject: Construction and demolition (C&D) debris excavated and 0.6' to 2.8' below ground surface (BGS) at test pit TP-01 at southwest corner of site.

Photo Number:
2

Photographer:
D. Johnson

Date/Time:
2-1-98/1025 hrs

Direction of View:
Northwest

Subject: Charred wood and brick 0.7' to 1.9' BGS at test pit TP-02 west of concrete foundation.

PHOTOGRAPHIC RECORD

SITE NAME: TRACT II
SITE LOCATION: Niagara Falls, New York
JOB NUMBER: 000935.BP08.00.04.90

Photo Number:
3

Photographer:
D. Johnson

Date/Time:
12-1-98/1110 hrs

Direction of View
West:

Subject: Burned cardboard and C&D fill from 0.3' to 4.4' below the surface of berm on northwest part of site.

Photo Number:
4

Photographer:
D. Johnson

Date/Time:
12-1-98/1215 hrs

Direction of View:
North and down

Subject: Cinders at ground surface and red brown clay with minor silt below 0.9' at test pit TP-04 at former railroad spur at north-central part of site.

PHOTOGRAPHIC RECORD

SITE NAME: TRACT II
SITE LOCATION: Niagara Falls, New York
JOB NUMBER: 000935.BP08.00.04.90

Photo Number:
5

Photographer:
D. Johnson

Date/Time:
12-1-98/1248 hrs

Direction of View:
North and down

Subject: C&D debris from 0.5' to 5.4' BGS in test pit TP-5 on south (west) side of dilapidated building. Strong organic odor and OVA response of ≤300 ppm observed here.

Photo Number:
6

Photographer:
D. Johnson

Date/Time:
12-1-98/1320 hrs

Direction of View:
Northeast

Subject: Cinder and brick from 0.5' to 3.5' BGS at test pit TP-06 on east side of dilapidated building.

PHOTOGRAPHIC RECORD

SITE NAME: TRACT II
SITE LOCATION: Niagara Falls, New York
JOB NUMBER: 000935.BP08.00.04.90

Photo Number:
7

Photographer:
D. Johnson

Date/Time
12-1-98/1316 hrs:

Direction of View:
West

Subject: C&D debris removed from 0.5' to 4.7' BGS at test pit TP-07 at east-central part of site.

PHOTOGRAPHIC RECORD

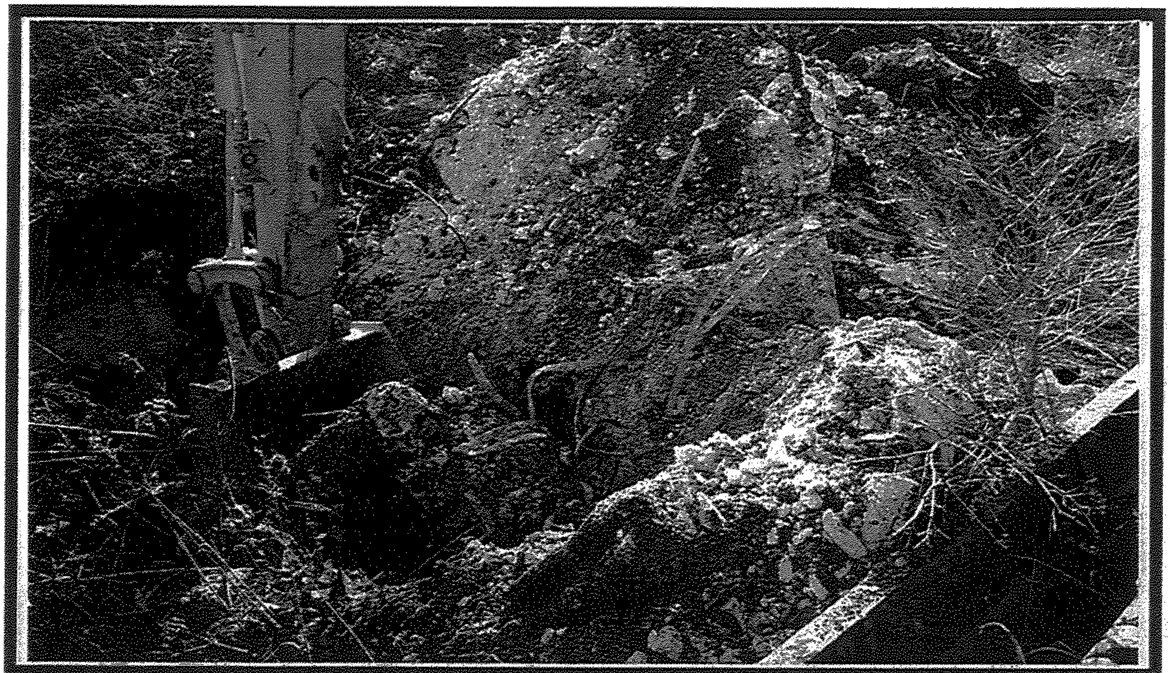
SITE NAME: TRACT II
SITE LOCATION: Niagara Falls, New York
JOB NUMBER: 000935.BP08.00.04.90

Photo Number:
8

Photographer:
D. Johnson

Date/Time:
12-1-98/1428 hrs

Direction of View:
Southwest and down



Subject: White paste-like substance and metal strapping removed from 1.0'-4.0' BGS in test pit TP-08 at east side of site.

Photo Number:
9

Photographer:
D. Johnson

Date/Time:
12-1-98/1510 hrs

Direction of View:
North

Subject: Large block of concrete and other C&D fill removed from 0.5 to 4.0' BGS at test pit TP-09 at east-central part of site.

PHOTOGRAPHIC RECORD

SITE NAME: TRACT II
SITE LOCATION: Niagara Falls, New York
JOB NUMBER: 000935.BP08.00.04.90

Photo Number:
10

Photographer:
D. Johnson

Date/Time:
12-1-98/1537 hrs

Direction of View:
Northwest

Subject: Broken battery casing and electrical conduit removed from 0.5' to 7.3' BGS in test pit TP-10 on east side of site.

Photo Number:
11

Photographer:
D. Johnson

Date/Time:
12-1-98/1616 hrs

Direction of View:
West

Subject: Tire and C&D debris removed from 0.5' to 4.6' BGS in test pit TP-11 at southeast corner of site.

PHOTOGRAPHIC RECORD

SITE NAME: TRACT II
SITE LOCATION: Niagara Falls, New York
JOB NUMBER: 000935.BP08.00.04.90

Photo Number:
12

Photographer:
D. Johnson

Date/Time:
12-1-98/1650 hrs

Direction of View:
West

Subject: Broken battery, casings, C&D debris, and dark brown foundry sand removed from 1.7' to 7.4' BGS in test pit TP-12 at east-central part of site.

F

Comparison of Sample Data to TAGM 4046 Levels

Table F-1 Summary of Analytical Results for Surface Soil, Tract II Site, Niagara Falls, New York

Compound	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Local Background Concentration	EPA Region III Industrial Soil RBC	Frequency of Exceeding RBC	NYSDEC TAGM 4046 Level	Frequency of Exceeding TAGM 4046
Volatile Organics (mg/Kg)								
None Detected								
Semi-Volatile Organics (mg/Kg)								
Naphthalene	10/12	0.051	4.9	ND	41,000	0/12	13^{e}	0/12
2-methylnaphthalene	9/12	0.043	2.6 J	ND	41,000^{b}	0/12	36.4^{e}	0/12
Acenaphthylene	12/12	0.15	17 J	ND	41,000^{b}	0/12	41^{e}	0/12
Acenaphthene	10/12	0.047	4.4	0.065 J	120,000	0/12	50^{f}	0/12
Dibenzofuran	9/12	0.058	6.9	ND	8,200	0/12	6.2^{e}	1/12
Fluorene	11/12	0.065	11 J	ND	82,000	0/12	50^{f}	0/12
Phenanthrene	11/12	0.75	72	0.45	41,000^{b}	0/12	50^{f}	1/12
Anthracene	12/12	0.24	20	0.1 J	610,000	0/12	50^{f}	0/12
Carbazole	11/12	0.12 J	11	0.071 J	290^{a}	0/12	—	0/12
Fluoranthene	11/12	1.8	71	0.67	82,000	0/12	50^{f}	1/12
Pyrene	11/12	0.15	49	0.63	61,000	0/12	50^{f}	0/12
Benzo(a)anthracene	11/12	0.75	29	0.4 J	7.8^{a}	1/12	0.224^{g}	11/12
Chrysene	11/12	0.79	29	0.48	780^{a}	0/12	0.4^{e}	11/12
Benzo(b)Fluoranthene	11/12	0.72	20	0.35 J	7.8^{a}	1/12	1.1^{e}	6/12
Benzo(k)Fluoranthene	11/12	0.64	21	0.36 J	78^{a}	0/12	1.1^{e}	6/12
Dibenz(a,h)anthracene	11/12	0.13	9.8	0.13 J	0.78^{a}	3/12	0.014^{g}	11/12
bis(2-ethylhexyl)phthalate	8/12	0.042	0.53	ND	410	0/12	50^{f}	0/12
Benzo(a)pyrene	10/12	0.11	25	0.41 J	0.78^{a}	8/12	0.061^{g}	10/12
Indeno(1,2,3-cd)pyrene	10/12	0.095	26	0.29 J	7.8^{a}	1/12	3.2^{e}	1/12

Table F-1 Summary of Analytical Results for Surface Soil, Tract II Site, Niagara Falls, New York

Compound	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Local Background Concentration	EPA Region III Industrial Soil RBC	Frequency of Exceeding RBC	NYSDEC TAGM 4046 Level	Frequency of Exceeding TAGM 4046
Benzo(g,h,I)perylene	9/12	0.17	20	0.34 J	—	NA	50^f	0/12
Butylbenzylphthalate	3/12	0.055	0.27	ND	410,000	0/12	50^f	0/12
Di-n-butylphthalate	2/12	0.067	0.13	ND	200,000	0/12	8.1^e	0/12
Di-n-octylphthalate	1/12	—	1.2	ND	410,000	0/12	50^f	0/12
n-Nitroso-diphenylamine	1/12	—	0.14	ND	1,200	0/12	—	NA
Pesticides/PCBs (mg/Kg)								
Aldrin	7/12	0.0032 J	0.022 DJ	ND	0.34	0/12	0.041^g	0/12
Heptachlor Epoxide	11/12	0.0025 J	0.19 J	0.0025 J	0.63	0/12	0.02^e	7/12
4,4'-DDT	8/12	0.01 J	0.061 J	ND	17^a	0/12	2.1^g	0/12
Methoxychlor	9/12	0.018 J	0.3 DJ	ND	10,000	0/12	—	NA
Endrin Ketone	8/12	0.0077 J	0.048	ND	610^c	0/12	—	NA
gamma-Chlordane	3/12	0.0024 J	0.016	ND	16^a	0/12	0.54^g	0/12
Dieldrin	7/12	0.0043	0.06	0.3 D	0.36^a	0/12	0.044^g	1/12
4,4'-DDE	5/12	0.008 J*	0.017	ND	17^a	0/12	2.1^g	0/12
Heptachlor	3/12	0.002	0.0089 *	ND	1.3^a	0/12	0.1^e	0/12
Endrin	3/12	0.0047	0.021 J*	ND	610^a	0/12	0.1^e	0/12
delta-BHC	2/12	0.0013 J*	0.0024 J	ND	—	NA	0.3^e	0/12
gamma-BHC (Lindane)	1/12	—	0.0073*	ND	4.4^a	0/12	0.06^e	0/12
4,4'-DDD	3/12	0.008*	0.014 J	ND	2.4^a	0/12	2.9^h	0/12
Endrin Aldehyde	1/12	—	0.008*	ND	—	NA	—	NA
alpha-Chlordane	1/12	—	0.013 J	ND	16^a	0/12	0.54^h	0/12
Aroclor-1260	9/12	0.076	0.9	ND	2.9^a	0/12	1^h	0/12

Table F-1 Summary of Analytical Results for Surface Soil, Tract II Site, Niagara Falls, New York

Compound	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Local Background Concentration	EPA Region III Industrial Soil RBC	Frequency of Exceeding RBC	NYSDEC TAGM 4046 Level	Frequency of Exceeding TAGM 4046
Inorganics (mg/Kg)								
Aluminum	15/15	3590	12150*	18700	2,000,000	0/15	128,000^{i}	0/15
Antimony	15/15	1.9 B	182	4.5 B	820	0/15	4.5^{j}	12/15
Arsenic	15/15	5.7	31	11	3.8^{a}	15/15	16^{i}	1/15
Barium	15/15	85.6	2073*	120	140,000	0/15	867^{i}	1/15
Beryllium	15/15	0.28	1.3	0.69 B	4,100	0/15	1.81^{i}	0/15
Cadmium	15/15	0.47	195	0.31 B	1,000	0/15	10^{k}	1/15
Calcium	15/15	6140	99300	16000	—	NA	16,000^{j}	13/15
Chromium	15/15	18	136	36.3	6,100	0/15	50^{k}	3/15
Cobalt	15/15	1.8	6.3	9.3 B	120,000	0/15	30^{l}	0/15
Copper	15/15	26.6	520	35.3	82,000	0/15	48.7^{i}	10/15
Iron	15/15	11300	36700	30400	610,000	0/15	58,000^{i}	0/15
Lead	15/15	120	32500	128	400^{d}	0/15	128^{j}	13/15
Magnesium	15/15	1940*	50000	7170	—	NA	7,170^{j}	12/15
Manganese	15/15	317	12600	838	41,000	0/15	1450^{i}	1/15
Mercury	12/15	0.34	100	0.38	610	0/15	0.27^{i}	12/15
Nickel	15/15	14.8	54.8*	32.4	41,000	0/15	38.2^{i}	1/15
Potassium	15/15	440	1690	2570	—	NA	23,500^{i}	0/15
Selenium	15/15	1.1	12.7	11.5	10,000	0/15	11.5^{j}	1/15
Silver	15/15	0.46	3.7	0.37 B	10,000	0/15	0.37^{j}	15/15
Sodium	3/15	133	186	113 U	—	NA	17400^{i}	0/15
Thallium	15/15	0.61	16.1	2 B	140	0/12	13.8^{i}	0/15
Vanadium	15/15	14	30.8*	38.6	14,000	0/12	150^{k}	15/15

Table F-1 Summary of Analytical Results for Surface Soil, Tract II Site, Niagara Falls, New York

Compound	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Local Background Concentration	EPA Region III Industrial Soil RBC	Frequency of Exceeding RBC	NYSDEC TAGM 4046 Level	Frequency of Exceeding TAGM 4046
Zinc	15/15	134	1530*	130	610,000	0/12	130[j]	1/15
Cyanide	1/12	—	3.6	0.66 U	41,000	0/12	0.66[j]	1/12

[a] Corresponds to an upper-bound cancer risk of 1 x 10^{-6}.
[b] RBC for naphthalene.
[c] RBC for endrin.
[d] EPA screening level for lead in soil in residential setting.
[e] Soil cleanup objective to protect groundwater quality.
[f] Objective for individual SVOCs is <50 ppm.
[g] Objective based on potential cancer risk for soil.
[h] Objective for total pesticides is <10 ppm.
[i] 90th percentile concentration in eastern U.S. soil (USGS 1984).
[j] Concentration reported in the local background sample.
[k] Concentration specified by NYSDEC Region 9 (Locey 1998).
[l] Concentration specified in TAGM 4046.

Key:

* = Average for duplicates.
J = The associated numerical value is an estimated quantity.
B = Indicates analyte result is between instrument detection limit and contract required detection limit (inorganics).
ND = Not detected at or above the Contract Required Detection Limit (CRDL).
— = No value or not applicable.

Table F-2 Summary of Analytical Results for Subsurface Soil, Tract II Site, Niagara Falls, New York

Compound	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Local Background Concentration	EPA Region III Industrial Soil RBC	Frequency of Exceeding RBC	NYSDEC TAGM 4046 Level	Frequency of Exceeding TAGM 4046
Volatile Organics (mg/Kg)								
Acetone	2/16	0.018	0.09	ND	200,000	0/16	0.2^{e}	0/16
Ethylbenzene	1/16	—	0.005 J	ND	200,000	0/16	5.5^{e}	0/13
Hexachlorobenzene	1/16	—	0.072 J	ND	3.6^{a}	0/16	0.4^{g}	0/13
Trichloroethene	1/16	—	0.002 J	ND	520^{a}	0/16	0.7^{e}	0/13
1,2,4-Trichlorobenzene	1/16	—	0.075 J	ND	20,000	0/16	3.4^{e}	0/13
Xylene (Total)	1/16	—	0.055	ND	4,100,000	0/16	1.2^{e}	0/13
Semi-Volatile Organics (mg/Kg)								
Naphthalene	9/16	0.099	1.7	ND	41,000	0/16	13^{e}	0/16
2-methylnaphthalene	7/16	0.16	1.7	ND	41,000^{b}	0/16	36.4^{e}	0/16
Acenaphthylene	9/16	0.07	4	ND	41,000^{b}	0/16	41^{e}	0/16
Acenaphthene	8/16	0.043	4.3 DJ	0.065 J	120,000	0/16	50^{f}	0/16
Dibenzofuran	9/16	0.047	4.3 DJ	ND	8,200	0/16	6.2^{e}	0/16
Fluorene	9/16	0.059	8 DJ	ND	82,000	0/16	50^{f}	0/16
Phenanthrene	12/16	0.12	81 D	0.45	41,000^{b}	0/16	50^{f}	1/16
Anthracene	11/16	0.084	25 D	0.1 J	610,000	0/16	50^{f}	0/16
Carbazole	11/16	0.042	9.3 DJ	0.071 J	290^{a}	0/16	—	—
Fluoranthene	13/16	0.1115	120	0.67	82,000	0/16	50^{f}	1/16
Pyrene	13/16	0.0855	85	0.63	61,000	0/16	50^{f}	1/16
Benzo(a)anthracene	13/16	0.092	59	0.4 J	7.8^{a}	3/16	0.224^{g}	11/16
Chrysene	13/16	0.11	60	0.48	780^{a}	0/16	0.4^{e}	8/16
Benzo(b)Fluoranthene	13/16	0.078	46	0.35 J	7.8^{a}	2/16	1.1^{e}	7/16

Table F-2 Summary of Analytical Results for Subsurface Soil, Tract II Site, Niagara Falls, New York

Compound	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Local Background Concentration	EPA Region III Industrial Soil RBC	Frequency of Exceeding RBC	NYSDEC TAGM 4046 Level	Frequency of Exceeding TAGM 4046
Benzo(k)Fluoranthene	13/16	0.079	38	0.36 J	78^{a}	0/16	1.1^{e}	7/16
Dibenz(a,h)anthracene	12/16	0.043	19	0.13 J	0.78^{a}	6/16	0.014^{g}	12/16
bis(2-ethylhexyl)phthalate	2/16	0.17	0.78 J	ND	410	0/16	50^{f}	0/16
Benzo(a)pyrene	13/16	0.095	53	0.41 J	0.78^{a}	7/16	0.061^{g}	13/16
Indeno(1,2,3-cd)pyrene	13/16	0.075	48	0.29 J	7.8^{a}	3/16	3.2^{e}	6/16
Benzo(g,h,I)perylene	13/16	0.059	38	0.34 J	—	—	50^{f}	0/16
Butylbenzylphthalate	1/16	—	1.1	ND	410,000	0/16	50^{f}	0/16
Di-n-butylphthalate	0/16	—	—	ND	200,000	0/16	8.1^{e}	0/16
Di-n-octylphthalate	0/16	—	—	ND	410,000	0/16	50^{f}	0/16
4-Methylphenol	1/16	—	0.67 J	ND	10,000	0/16	—	—
Diethylphthalate	1/16	—	0.048 J	ND	1,600,000	0/16	7.1^{e}	0/16
Pesticides/PCBs (mg/Kg)								
Aldrin	6/16	0.00089 J	0.59	ND	0.34^{a}	1/16	0.041^{g}	2/16
Heptachlor Epoxide	7/16	0.003 J	1.7	0.0025 J	0.63^{a}	1/16	0.02^{e}	5/16
4,4'-DDT	3/16	0.0054	0.36	ND	17^{a}	0/16	2.1^{g}	0/12
Methoxychlor	8/16	0.011 J	1.8	ND	10,000	0/16	—	—
Endrin Ketone	8/16	0.0022 J	0.48	ND	610^{c}	0/16	—	—
gamma-Chlordane	1/16	—	0.054	ND	16^{a}	0/16	0.54^{g}	0/16
Dieldrin	2/16	0.011	0.18 J	0.3 D	0.36^{a}	0/16	0.044^{g}	1/16
4,4'-DDE	4/16	0.0071 J	0.18 J	ND	17^{a}	0/16	2.1^{g}	0/16
Heptachlor	0/16	—	—	ND	1.3^{a}	0/16	0.1^{e}	0/16
Endrin	2/16	0.0029 J	0.0091 J	ND	610^{c}	0/16	0.1^{e}	0/16

Table F-2 Summary of Analytical Results for Subsurface Soil, Tract II Site, Niagara Falls, New York

Compound	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Local Background Concentration	EPA Region III Industrial Soil RBC	Frequency of Exceeding RBC	NYSDEC TAGM 4046 Level	Frequency of Exceeding TAGM 4046
delta-BHC	0/16	—	—	ND	—	—	0.3[e]	0/16
gamma-BHC (Lindane)	0/16	—	—	ND	4.4[a]	0/16	0.06[e]	0/16
4,4'-DDD	0/16	—	—	ND	2.4[a]	0/16	2.9[h]	0/16
Endrin Aldehyde	4/16	0.0017 J	0.15 J	ND	—	—	—	—
alpha-Chlordane	0/16	—	—	ND	16[a]	0/16	0.54[h]	0/16
Aroclor-1260	5/16	0.043	1.4 J	ND	2.9[a]	0/16	1[h]	1/16
Inorganics (mg/Kg)								
Aluminum	15/16	5960	18500	18700	2,000,000	0/16	128,000[i]	0/16
Antimony	16/16	1.6	887	4.5 B	820	1/16	4.5[j]	9/16
Arsenic	16/16	2.6	74.2	11	3.8[a]	15/16	16[i]	2/16
Barium	16/16	3.8	371	120	140,000	0/16	867[i]	0/16
Beryllium	16/16	0.19	1.4	0.69 B	4,100	0/16	1.81[i]	0/16
Cadmium	13/16	0.17	2.9	0.31 B	1,000	0/16	10[k]	0/16
Calcium	16/16	3670	113000	16000	—	—	16,000[j]	9/16
Chromium	16/16	2.4 B	66.7	36.3	6,100	0/16	50[k]	1/16
Cobalt	16/16	0.72 B	11.5	9.3 B	120,000	0/16	30[i]	0/16
Copper	16/16	6 B	268	35.3	82,000	0/16	48.7[i]	5/16
Iron	16/16	1710	33700	30400	610,000	0/16	58,000[i]	0/16
Lead	16/16	7.1	9950	128	400[d]	6/16	128[j]	10/16
Magnesium	16/16	584	20900	7170	—	—	7,170[j]	9/16
Manganese	16/16	9	863	838	41,000	0/16	1,450[i]	0/16
Mercury	11/16	0.13	3.97	0.38	610	0/16	0.27[i]	6/16

Table F-2 Summary of Analytical Results for Subsurface Soil, Tract II Site, Niagara Falls, New York

Compound	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Local Background Concentration	EPA Region III Industrial Soil RBC	Frequency of Exceeding RBC	NYSDEC TAGM 4046 Level	Frequency of Exceeding TAGM 4046
Nickel	16/16	2.8 B	31.9	32.4	41,000	0/16	38.2[i]	0/16
Potassium	14/16	741	2240	2570	—	—	23,500[i]	0/16
Selenium	15/16	3.2	12.6	11.5	10,000	0/16	11.5[j]	4/16
Silver	12/16	0.37*	4.9	0.37 B	10,000	0/16	0.37[j]	12/16
Sodium	0/16	—	—	113 U	—	—	17,400[i]	0/16
Thallium	0/16	—	—	2 B	140	0/16	13.8[i]	0/16
Vanadium	16/16	2.3 B	34.9	38.6	14,000	0/16	150[k]	0/16
Zinc	16/16	12.1	1860	130	610,000	0/16	130[j]	10/16
Cyanide	1/16	—	3.1	0.66 U	41,000	0/16	0.66[j]	1/16

[a] Corresponds to an upper-bound cancer risk of 1 x 10^{-6}.
[b] RBC for naphthalene.
[c] RBC for endrin.
[d] EPA screening level for lead in soil in residential setting.
[e] Soil cleanup objective to protect groundwater quality.
[f] Objective for individual SVOCs is <50 ppm.
[g] Objective based on potential cancer risk for soil.
[h] Objective for total pesticides is <10 ppm.
[i] 90th percentile concentration in eastern U.S. soil (USGS 1984).
[j] Concentration reported in the local background sample.
[k] Concentration specified by NYSDEC Region 9 (Locey 1998).
[l] Concentration specified in TAGM 4046.

Key:

* = Average for duplicates.
J = The associated numerical value is an estimated quantity.
B = Indicates analyte result is between instrument detection limit and contract required detection limit (inorganics).
ND = Not detected at or above the Contract Required Detection Limit (CRDL).
— = No value or not applicable.

Table F-3 Groundwater Analytes Exceeding Class GA Groundwater Standards, Tract II Site, Niagara Falls, New York

	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Class GA Groundwater Standard	Frequency of Exceeding Standard
Volatile Organics (µg/L)					
Acetone	1/4	—	9 J	50	0/4
Chloroform	1/4	—	2 J	7	0/4
Methylene Chloride	1/4	—	28.5 *	5	1/4
Toluene	2/4	1 J	2.5 *	5	0/4
Xylene (total)	2/4	1J	2.5 *	5	0/4
Semi-Volatile Organics (µg/L)					
bis(2-ethylhexyl) phthalate	1/4	—	2 J	5	0/4
Pesticides/PCBs (µg/L)					
None Detected					
Inorganics (µg/L)					
Aluminum	4/4	151	1425*	—	0/4
Arsenic	2/4	7.7*	11.3	25	0/4
Barium	4/4	48.9	83.4*	1000	0/4
Cadmium	2/4	0.825*	1.1	5	0/4
Calcium	4/4	68500	204000	—	0/4
Chromium	4/4	2.6 B	8.3 B	50	0/4
Cobalt	3/4	1.1 B	1.6 B	—	0/4
Iron	4/4	353	2022*	300	4/4
Iron & Manganese[a]	4/4	464.7	2169.8*	500	3/4
Lead	4/4	3.4	20.5*	25	0/4
Magnesium	4/4	44800	54250*	35000	4/4
Manganese	4/4	51.6	302	300	1/4
Nickel	4/4	4.4 B	9.1 B	100	0/4
Potassium	4/4	4080 B	5445*	—	0/4
Silver	3/4	2.1 B	2.7 B	50	0/4
Sodium	4/4	12600	50500	20000	3/4
Vanadium	1/4	—	2.65 B*	—	0.4

Table F-3 Groundwater Analytes Exceeding Class GA Groundwater Standards, Tract II Site, Niagara Falls, New York

	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Class GA Groundwater Standard	Frequency of Exceeding Standard
Zinc	3/4	21.5	174.25*	2000	0/4
Cyanide	1/4	—	43	200	0/4

[a] Iron and Manganese combined cannot exceed 500 µg/L.

Key:

*	= Average of duplicates.
J	= The associated numerical value is an estimated quantity.
B	= Indicates analyte result is between instrument detection limit and contract required detection limit.
ND	= Not detected at or above the Contract Required Detection Limit (CRDL).
—	= No value or not applicable.