REMEDIAL DESIGN / REMEDIAL ACTION WORK PLAN

Pfohl Brothers Landfill
Cheektowaga, New York

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LIST OF ACRONYMS

ARAR	-	Applicable or Relevant and Appropriate Requirements
BOD	-	Biochemical Oxygen Demand
CDM	-	Camp Dresser & McKee
CERCLA	-	Comprehensive Environmental Response, Compensation and Liability Act
CMP	-	Construction Management Plan
COD	-	Chemical Oxygen Demand
CQA	-	Construction Quality Assurance
CQAP	-	Construction Quality Assurance Plan
CRA	-	Conestoga-Rovers & Associates
CRZ	-	Contaminant Reduction Zone
CSEP	-	Confined Space Entry Permit
DOT	-	Department of Transport
DQO	-	Data Quality Objective
EPA	-	Environmental Protection Agency
EZ	-	Exclusion Zone
FOP	-	Field Operations Plan
FS	-	Feasibility Study
HDPE	-	High Density Polyethylene
HEPA	-	High Efficiency Particulate Air
HSP	-	Health and Safety Plan
IDLH	-	Immediate Danger to Life and Health
IRM	-	Interim Remedial Measures
MS	-	Matrix Spike
MSD	-	Matrix Spike Duplicate
MSDS	-	Material Safety Data Sheet
NRC	-	National Response Center
NYSDEC	-	New York State Department of Environmental Conservation
NYSDOH	-	New York State Department of Health
O & M	-	Operation and Maintenance
OSHA	-	Occupational Safety and Health Act
OV/AG	-	Organic Vapor/Acid Gas
POTW	-	Publicly Owned Treatment Works
PCB	-	Polychlorinated Biphenyls
PCDD	-	Polychlorinated Dioxin
PCDF	-	Polychlorinated Furan
PPE	-	Personal Protective Equipment
PRAP	-	Proposed Remedial Action Plan
PRPs	-	Potentially Responsible Parties
QA/QC	-	Quality Assurance/Quality Control
QAPP	-	Quality Assurance Project Plan
RA	-	Remedial Action
RAO	-	Remedial Action Objectives
RD	-	Remedial Design

LIST OF ACRONYMS

RI	-	Remedial Investigation
ROD	-	Record of Decision
SARA	-	Superfund Amendments and Reauthorization Act
SCBA	-	Self-Contained Breathing Apparatus
SITE	-	Pfohl Brothers Landfill
SOW	-	Scope of Work
SSO	-	Site Safety Officer
SVOCs	-	Semi-volatile Organic Compounds
SZ	-	Support Zone
TAGM	-	Technical and Administrative Guidance Memorandum
TAL	-	Target Analyte List
TCL	-	Target Compound List
TDS	-	Total Dissolved Solids
TLV	-	Threshold Limit Value
TOC	-	Total Organic Carbon
TSS	-	Total Suspended Solids
VOCs	-	Volatile Organic Compounds

1.0 INTRODUCTION

This report has been prepared on behalf of the Pfohl Brothers Landfill Steering Committee (Steering Committee) by Conestoga-Rovers & Associates (CRA) to present the Remedial Design (RD) and Remedial Action (RA) Work Plan for the Pfohl Brothers Landfill (Site) located in Cheektowaga, New York. Implementation of the RD/RA Work Plan, in whole or in part, is contingent upon the execution of a Consent Order by the Potentially Responsible Parties (PRPs).

1.1 PURPOSE AND ORGANIZATION OF THE REPORT

The purpose of the RD/RA Work Plan is to provide a framework for the implementation of the RD and RA.

The RD/RA Work Plan is organized as follows:

i) Section 1 states the purpose of the RD/RA Work Plan, presents a general introduction and history of the Site and presents a summary of the proposed remedial action for the Site;
ii) Section 2 presents the work plan for the pre-design activities;
iii) Section 3 presents the work plan for the remedial design activities;
ix) Section 4 presents the work plan for the implementation of the RA; and
x) Section 5 identifies the reports and documentation required during the RD/RA activities.

1.2 SITE DESCRIPTION

The Pfohl Brothers Landfill is a 120-acre inactive hazardous waste site located in the Town of Cheektowaga, Erie County, New York. The Site location is shown on Figure 1.1 and the Site layout is shown on Figure 1.2. The Site is bordered by wetlands and the New York State thruway to the north, Transit Road to the east, private residential properties on Pfohl Road to the south and the Niagara Mohawk power easement and Pfohl Trucking property to the west.

The Site has been divided into three geographic areas that have been designated A, B and C. These areas are shown on Figure 1.2.

1.3 SITE HISTORY

The Pfohl Brothers Landfill operated between 1932 and 1971 as a landfill receiving both municipal and industrial waste from the surrounding areas. Various sources have indicated that the Site received industrial wastes from steel and metal manufacturers, chemical and petroleum companies, utilities, manufacturers of optical and furnace-related materials and other miscellaneous manufacturing and process facilities.

1.4 PREVIOUS STUDIES

In June 1982, Fred C. Hart Associates, under contract with the EPA, performed a hazardous ranking of the Site. The investigation included the collection of water and sediment samples from seep locations, drainage ditches and domestic wells for organics, inorganics, sulphide, cyanide and ammonia analysis.

In February 1984, an additional investigation of the Site was performed by Ecology and Environment to determine if the landfill at that time posed, or had the potential to pose, either a risk to the environment or public health. The investigation involved the collection and analysis of groundwater, sediment and seep samples for VOCs, SVOCs, inorganics, phenols, PCBs, pesticides and oil and grease.

In November 1986, the New York State Department of Environmental Conservation (NYSDEC) collected leachate, soil and waste from surface drums that contained a tar-like material. The samples were analyzed by the New York State Department of Health (NYSDOH).

The NYSDEC initiated a Remedial Investigation/ Feasibility Study (RI/FS) in 1988. The RI portion was completed in 1991 by the NYSDEC Contractor, Camp Dresser & McKee (CDM) and presented in the report entitled:

"Draft Remedial Investigation Report
Pfohl Brothers Landfill
Cheektowaga, New York"
January 1991.

The report was updated by the errata entitled:

"Final Remedial Investigation Report
Pfohl Brothers Landfill
Cheektowaga, New York"
February 1992.

The RI included six major field activities. These were:

- geophysical survey;
- surface water, leachate seep and sediment sampling;
- gamma radiation survey;
- test pit investigation;
- soil boring investigation; and
- groundwater investigation.

The FS portion was completed in September 1991 by CDM and presented in the report entitled:

"Draft Feasibility Study Report
Pfohl Brothers Landfill
Cheektowaga, New York"
September 1991.

The FS presented an evaluation of remedial alternatives for the Site and the selection of a preferred remedy which included:

i) slurry wall containment;
ii) groundwater extraction, pretreatment and off-Site disposal;

iii) single barrier cap with on-Site wetland replacement;

iv) excavation and consolidation of shallow and peripheral landfill wastes; and

v) zoning and deed restrictions.

In addition, the NYSDEC and NYSDOH collected supplemental data throughout the period of April 1989 to June 1991. The data collected consisted of groundwater radioactivity measurements, residential radon testing, blood lead testing and samples of residential basement sump groundwater, residential well water, surface water, surface soil and sediment.

1.5 REGULATORY ACTIVITIES

In November 1991, the NYSDEC released the report entitled:

"Proposed Remedial Action Plan (PRAP)
Pfohl Brothers Landfill
Cheektowaga, New York"

The purpose of the PRAP was to:

i) identify the preferred alternative and the reasons for that preference;

ii) describe briefly the alternative detailed in the RI/FS report; and

iii) solicit public review and comment on all alternatives set forth in the detailed analysis section of the FS.

Public comments received on the PRAP were issued in the document entitled:

"Responsiveness Summary for
Proposed Remedial Action Plan
Pfohl Brothers Landfill
Cheektowaga, New York
February 1992.

Subsequently, the remedial action selected by the NYSDEC for remediation of the Site was issued in the document entitled:

"Record of Decision
Pfohl Brothers Landfill
Cheektowaga, New York"
February 1992.

The remedial action plan outlined in the ROD was developed in accordance with the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) of 1980, Superfund Amendments and Reauthorization Act (SARA) of 1986 and the New York State Environmental Conservation Law (ECL).

1.6 PROPOSED REMEDIAL ACTION

The RA selected by the NYSDEC for the Site is presented in the ROD dated February 1992. Pursuant to the ROD, additional data will be generated by an off-Site Remedial Investigation (off-Site RI) which is to be performed in 1992 by the NYSDEC. Details of the off-Site RI are presented in the report entitled "Phase II Remedial Investigation Final Work Plan" dated June 1991. As stated in the ROD, off-Site areas are to be addressed as a separate operable unit.

The major components of the RA for the Site include:

i) Interim Remedial Measures (IRM);
ii) Site containment;
iii) Overburden groundwater collection and pretreatment;
iv) Wetlands/floodplain assessment;
v) Institutional controls; and
vi) Post RA groundwater monitoring.

The NYSDEC has elected to perform the IRM, which is currently underway and scheduled to be completed in 1992 or early 1993. Thus, this report does not deal with the IRM and will focus on the Source Area (Landfill) remedy consisting of items ii) through vi) above.

The general remedial action objective (RAO) is to remediate the Site to be protective of human health and the environment by treatment of media to protective levels and/or by limiting exposure to the chemicals of concern. Specific RAOs for the remedy selected for the Pfohl Brothers Landfill in the ROD are:

i) Reduce organic and inorganic chemical loads to the surface water streams from leachate seeps and groundwater to assist in meeting Class B and D stream standards;

ii) Reduce potential carcinogenic risks caused by dermal absorption and ingestion of sediments;

iii) Reduce potential carcinogenic and non-carcinogenic risks caused by dermal exposure to leachate seeps;

iv) Prevent migration of chemicals from sediments that could result in surface water exceedence of Class B or D stream standards;

v) Reduce potential carcinogenic and non-carcinogenic risks caused by ingestion and dermal contact of landfill soils;

vi) Reduce risk or exposure to groundwater via ingestion and dermal contact; and

vii) Minimize migration of chemicals into uncontaminated groundwater.

Identified location-specific applicable or relevant and appropriate requirements (ARARs) pertain to the wetlands and flood plains present on or adjacent to the Site.

A description of the RA to be implemented at the Site is presented in the document entitled:

"Proposed Scope of Work for the Remedial
Design and Remedial Action
Pfohl Brothers Landfill"
October 1992.

The RD/RA SOW describes in detail the RA to be implemented at the Site.

The major components of the Site containment portion of the RA selected for the Site include the following:

i) Conduct predesign soil investigations to identify and evaluate areas to be excavated and consolidated on the Site;

ii) Excavate soils and landfill material, including those at the periphery of the landfill, where practical and consolidate on the Site;

iii) Conduct materials compatibility studies, if determined to be required;

iv) Conduct fill materials assessments including available volume and material sources/generation rates;

v) conduct predesign landfill gas study;

vi) Develop Site grading plans using fill materials;

vii) Design and construct a perimeter barrier containment system;

viii) Design and construct a single barrier landfill cap; and

ix) Develop and implement final treatment/storage plan for waste temporarily stored on Site from the IRM.

The major components of the overburden groundwater collection and pretreatment portion of the RA selected for the Site include the following:

i) Install and perform pumping test of prototype overburden groundwater collection system to determine overburden characteristics and zones of capture to be used for the overburden groundwater collection system design;

ii) Perform groundwater treatability studies, if required, utilizing groundwater pumped from the prototype collection system installations;

iii) Design overburden groundwater collection, pretreatment, if required, and discharge systems;

iv) Construct overburden groundwater collection, pretreatment, if required, and discharge systems;

v) Test the system performance; and

vi) Remove and dispose of groundwater pretreatment residuals at an appropriate off-Site waste facility, if required.

Other components of the RA include the following:

i) Conduct groundwater monitoring during and following remedial construction at the Site;

ii) Conduct a wetlands assessment and a floodplains assessment during the RD phase; and

iii) Implement institutional controls.

2.0 PREDESIGN ACTIVITIES

2.1 GENERAL

In order to perform the RD, additional studies and investigations are required to supplement the data presented in the RI Report. The predesign activities required to provide the additional data consist of the following:

i) fill material assessments;
ii) securement of access agreements;
iii) generate accurate base and topographic maps;
iv) predesign soil investigations;
v) install and pump test a prototype groundwater collection system;
vi) materials compatibility studies (if required);
vii) groundwater treatability studies (if required); and
viii) predesign landfill gas study.

All predesign activities will be conducted in accordance with the Field Operations Plan (FOP), Health and Safety Plan (HSP) and Quality Assurance Project Plan (QAPP) presented in Appendices A, B and C, respectively. These project plans have been specifically developed for the implementation of the predesign activities. The predesign activities are discussed in detail in the following subsections.

It is recognized that the scope and specifics (i.e. borehole/test pit location) of the predesign activities may be modified as additional information becomes available. Two specific sources of additional information which could change the scope and specifics of the predesign are the IRM and off-Site RI.

During the performance of the predesign activities, all existing monitoring wells will be protected from damage.

2.2 ACCESS AGREEMENTS

Prior to conducting the predesign activities, it will be necessary to obtain on- and off-Site access agreements. On- and off-Site access agreements as required to implement the predesign, RD and RA activities will be obtained by the PRPs. Should the PRPs be unable to obtain access and a good faith effort has been made to do so, then the NYSDEC will assist in obtaining access. Site access agreements will extend for the duration and implementation of the RD/RA and will include allowances for all operation and maintenance considerations and State and Federal oversight activities.

2.3 SITE SURVEY

2.3.1 Base and Topographic Maps

An accurate base map of the Site and surrounding area at a scale of 1 inch = 100 feet will be generated from aerial photographs of the

Site. The aerial photographs will also be used to generate a topographic map of the Site at a scale of 1 inch = 100 feet with a contour interval of 1 foot.

2.3.2 Horizontal Control

The base map will be relatable to both the New York Transverse Mercator and the New York State Plane Grid System. This relationship will be identified on the base map.

All existing wells to be used during RD/RA activities and all proposed wells, boreholes and test pits/trenches will be tied into the grid coordinate system with an accuracy of ±1 foot. All survey work will be undertaken by a certified land surveyor licensed by the State of New York.

2.3.3 Vertical Control

All existing monitoring wells to be used during RD/RA activities and all proposed wells will be surveyed by a certified land surveyor licensed by the State of New York. The top of the casing of all such wells will be surveyed to an accuracy of ±0.01 feet.

2.3.4 Permanent Markers

The locations and elevations of permanent markers used for the survey will be identified on the base map.

2.4 PREDESIGN SOIL INVESTIGATIONS

Two predesign soil investigations will be conducted prior to remedial design. The first will be primarily to delineate areas of waste to be excavated and consolidated on the landfill. The second investigation will be primarily to provide information necessary to design and construct a perimeter barrier containment system. Details of each investigation are provided in the following subsections.

2.4.1 Areas To Be Excavated and Consolidated

The purpose of this predesign soil investigation is to:

i) compile all available information regarding fill thickness including that developed during the IRM;

ii) delineate landfill areas which could be excavated and consolidated on the Site;

iii) resolve data gaps in the existing data on the perimeter of Areas B and C and in areas where no clay/till unit exists or where the landfill materials contact the bedrock;

iv) evaluate landfill materials for use in the Site grading; and

v) evaluate native materials for use in the cap and/or slurry wall.

Based on the data currently available, the soil investigation to determine the areas to be excavated and consolidated will consist of boreholes or test pits/trenches as follows:

i) boreholes will be installed at approximately 200-foot centers along the south, east and west property boundaries of Areas B and C;

ii) test pits or trenches will be installed in pairs at approximately 400-foot centers along Aero Drive (one north and one south of Aero Drive); and

iii) a test pit or trench will be installed in the vicinity of borehole DR-33.

The locations of the initial boreholes and test pits/trenches are shown on Figure 2.1.

The information from the investigations along the perimeter of Areas B and C will also be used in the evaluation of the perimeter barrier containment system (see Section 2.4.2). Therefore, the installations at these locations are required to be installed to a greater depth to penetrate the clay/till confining unit. Due to the depth of installation, boreholes were selected as the method of construction. In contrast, the information from the locations along Aero Drive will be used to determine the thickness of the landfill materials in this area. Since the thickness of the landfill materials along Aero Drive is expected to be thin, test pits were selected as the method of construction.

A total of 37 boreholes will be initially installed for this investigation. Each borehole will extend to a depth of two feet below the top of the confining layer (i.e. clay/till unit). Soil samples will be collected in advance of augering using standard split-spoon sampling techniques. All soil samples will be screened with a photoionization detector for volatile organic vapors. The samples shall be visually examined to determine stratigraphy and shall be described using the Unified Soil Classification System. Following completion of the boreholes, selected locations exhibiting less than four feet of fill will be re-investigated using test pits or trenches to provide additional information regarding the native soils applicability to be used as a cap and/or slurry trench material and to determine how quickly the thickness of the fill changes with respect to distance from the Site boundary. Based on the results of the initial investigation, additional boreholes and/or test pits also may be installed progressing towards the interior of Areas B and C to determine the variation of landfill material thickness.

To evaluate the native soils suitability for use in a slurry wall or in the cap, representative soil samples will be collected from each borehole to determine the grain size distribution and moisture content of the native materials. Samples from each different geologic layer of substantial thickness within these boreholes will be submitted. Undisturbed samples of the clay/till material from every second borehole encountering the clay/till layer as the confining unit will also be submitted for permeability and Atterburg limit testing. The testing protocols are presented in Appendix A.

A total of 14 test pits/trenches will be installed along Aero Drive. Each test pit/trench will extend to the fill/native material contact or to a maximum depth of ten feet, or to the groundwater table, whichever is encountered first. In areas where the fill/native material contact is less than four feet below ground surface and the fill is unsaturated, test trenches may be used to determine if soils underlying the fill are suitable for use in the Site cap or slurry wall and to determine the variation of fill thickness with respect to distance from Aero Drive. The test pits or trenches will be excavated using a backhoe. Soil samples will be collected and visually examined to determine stratigraphy and will be logged using the Unified Soil Classification System. The underlying native materials will be screened with a photoionization detector. A sample of the underlying native material from each test pit will be submitted for grain size distribution and moisture content.

The borehole installation, test pit/trench excavation and soil sampling protocols are presented in the FOP (Appendix A).

An additional test pit/trench will be excavated in the immediate vicinity of former test pit DR-33 (see Figure 2.1). The original test pit excavation indicated that a confining layer between the fill and bedrock units did not exist at this location. The additional test pit/trench will be excavated to sufficient depth and extent to adequately define the areal extent of the fill/bedrock interface in this area.

As shown on Figure 2.1, there are several proposed boreholes located along the southwest boundary of the Site. The NYSDEC is currently performing an off-site RI immediately adjacent to these locations to identify any waste that may be present in the off-site area. Following completion of the off-site RI and review of the results, it may be necessary to modify the borehole locations in the vicinity of the area investigated by the off-Site RI. In addition, the NYSDEC is also performing the IRM within the landfill itself. It is anticipated that a substantial amount of data relevant to determine the extent of the areas to be excavated and consolidated will be generated. Based on review of these data, it may also be necessary to modify borehole and test pit locations. If modifications are necessary, a document will be submitted to the NYSDEC outlining the modifications.

The results of the predesign soil investigation and the fill material availability assessment (Section 2.7) will be evaluated and the vertical and horizontal limits of the landfill materials requiring excavation and consolidation will be determined and incorporated into the RD. A report will be prepared presenting the soil investigation results and the limits of soil to be excavated. In addition, the suitability of the materials encountered for use as grading and cap and slurry wall materials will be evaluated and presented in the report.

2.4.2 Perimeter Barrier Containment System

A predesign soil investigation will be conducted to provide information necessary to design and construct a perimeter barrier containment system. The investigation will be undertaken to:

i) identify the depth of the clay/till unit (confining unit) along the proposed alignment of the perimeter barrier containment system; and

ii) evaluate the materials for use in the construction of a slurry wall, if a slurry wall is selected as the method of construction for the perimeter barrier collection system.

The perimeter barrier containment system shall encircle the consolidated Site wastes in Areas B and C. The perimeter barrier containment system may consist of either:

i) a slurry wall supplemented with an overburden groundwater collection system within the confines of the slurry wall; or
ii) a hydraulic barrier, e.g. interceptor drain, or series of extraction wells, supplemented with an overburden groundwater collection system within the confines of the hydraulic barrier, if required; or
iii) a combination of a hydraulic barrier supplemented with a physical barrier in areas where an upgradient water source (i.e. wetlands, surface water body) exists. The physical barrier may consist of a slurry wall, or HDPE liner on the outward side of the interceptor drain, or sheet piles or performance equivalent.

The type or combination of barrier systems that will be used as the perimeter barrier containment system will be evaluated as part of the RD. The evaluation of the recommended barrier system will be submitted to the NYSDEC in the 30 percent Preliminary Design.

Due to the low hydraulic conductivity of the fill materials, the relatively thin saturated overburden, and the lack of recharge available upon capping of the Site, it is anticipated that a perimeter barrier system consisting of an interceptor drain system will be more effective than a slurry wall barrier system supplemented by an overburden groundwater collection system. Therefore a hydraulic barrier consisting of a perimeter interceptor drain is the preferred option.

The soil investigation will involve the installation of 52 boreholes extending to a depth of two feet below the top of the confining unit. A total of 37 of these boreholes along the south, east and west property boundaries of Areas B and C are also part of the soil investigation discussed in Section 2.4.1. The boreholes will be spaced at approximately 200-foot centers along the proposed alignment of the perimeter barrier system as shown on Figure 2.1. At the present time, the proposed alignment of the perimeter barrier system is assumed to be along the exterior boundaries of Areas B and C.

Soil samples will be collected and examined to determine stratigraphy and logged using the Unified Soil Classification System. Borehole installation protocols and soil sampling protocols are provided in Appendix A.

Based on the results of the predesign soil investigation to determine the area to be excavated and consolidated, the off-Site RI and the IRM, it may be necessary to modify the alignment of the proposed barrier containment system and consequently the locations and number of the boreholes. Any modifications will be submitted to the NYSDEC for approval.

To evaluate the native soils suitability for use in a slurry wall, or in the cap, representative soil samples will also be collected from each borehole to determine the grain size distribution and moisture content of the native soils encountered. Samples from each different geologic layer of substantial thickness within these boreholes will be submitted. Undisturbed samples of the clay/till material from every second borehole encountering the clay/till layer as the confining unit will also be submitted for permeability and Atterburg limits testing. The testing protocols are presented in Appendix A.

A report will be prepared presenting the perimeter barrier investigation results.

2.5 INSTALL AND PUMP TEST PROTOTYPE GROUNDWATER COLLECTION SYSTEM

If hydraulic barrier techniques are selected as the method of construction for the perimeter barrier system, three options are available:

i) a series of overburden extraction wells; or
ii) an interceptor drain (the preferred option); or
iii) a combination of the above.

In addition, some portions of the hydraulic barrier may be supplemented with a physical barrier to sever the hydraulic pathway between the hydraulic barrier and a source of recharge (i.e. Aero Lake) exterior to the perimeter barrier to reduce the quantity of clean water collected.

During the RD, an evaluation will be performed to determine whether an overburden groundwater collection system is required within the confines of the perimeter hydraulic barrier system to reduce the migration of overburden groundwater to the bedrock. Particular attention will be paid to areas where no clay/till unit is present or the fill contacts the bedrock. This interior system may consist either of drain tiles or extraction wells. Another alternative in areas where the fill contacts the rock is grouting of the upper bedrock.

To provide data to evaluate which of the three options will be used, three overburden wells shall be pump tested as a prototype groundwater collection system to determine overburden characteristics and zones of capture. The existing overburden wells at the Site have been reviewed to determine if any of the existing wells are suitable for the pumping test. All existing overburden wells are 2-inch diameter which are considered too small for use as a pumping well. Based on this review, it has been determined that three new 6-inch diameter pumping wells will have to be installed. In addition, the review has indicated that there is an insufficient number of monitoring wells to adequately monitor the pumping test. Therefore an additional three monitoring wells are proposed. Details of extraction and monitoring wells installation and the pump tests are described in the following subsections.

Representative samples of the water extracted during the pumping tests will be collected for analysis to evaluate the alternatives of direct discharge of the collected water to the local POTW (the preferred alternative) or pretreatment prior to discharge to the POTW.

2.5.1 <u>Prototype Extraction Well Location And Installation</u>

Three prototype extraction wells will be installed and pump tested at the locations shown on Figure 2.2. These well locations were selected because they are representative of:

i) the range of concentrations and type of compounds detected as indicated in the RI (Wells GW-14S, GW-15S and GW-16S); and

ii) spatial variability (i.e. they are located in different areas of the Site).

The prototype extraction wells will be installed approximately 50 feet away from the corresponding existing monitoring well (GW-14S, GW-15S and GW-16S) and will extend to the top of the confining layer to match the bottom of the screened interval of the monitoring well. Care will be taken to ensure that the confining layer is not significantly penetrated. The well will consist of a six-inch diameter steel riser pipe and stainless steel screen to allow for variability in the size of extraction pump that may be required during the pumping test and allow potential use of the wells as part of the final groundwater collection system.

Detailed procedures for the installation of the extraction wells are contained in the FOP presented in Appendix A.

2.5.2 Monitoring Well Location And Installation

Three overburden monitoring wells will be installed at the locations shown on Figure 2.2. Each monitoring well will be installed approximately 5 to 10 feet from its respective prototype extraction well. The three monitoring wells will be used in conjunction with the three existing monitoring wells to collect hydraulic data to assess the performance of the pumping tests.

Each monitoring well will be installed to the same depth and screened at the same interval (to the extent possible) as the corresponding prototype extraction well. Care will be taken to ensure that the confining layer is not significantly penetrated.

The monitoring wells will be constructed using two-inch diameter steel pipe and a stainless steel screen. Drilling and installation procedures are contained in Appendix A.

2.5.3 Pumping Tests

The objective of the pumping tests is to provide sufficient hydraulic and water quality data for the detailed design of the groundwater extraction system and sizing of the groundwater pretreatment system, if required. Specifically, the tests will provide data for the following:

i) determination of overburden hydraulic characteristics to assist in the design of the overburden groundwater collection system;

ii) determination of zones of capture; and

iii) determination of overburden groundwater quality to evaluate the alternatives of direct discharge to the local POTW (the preferred alternative) or pretreatment prior to discharge to the local POTW.

Pumping tests will be performed on the installed prototype extraction wells. Prior to the tests, water levels will be monitored for a 48-hour period of time to establish static water levels. The tests will include step-drawdown tests and a constant-rate pumping test.

A step-drawdown test will be conducted in advance of the constant-rate pumping test. The results of the step-drawdown test and water treatment considerations will be used to determine the pumping rate for the constant-rate test. The step-drawdown test will consist of pumping the well at three different increasing flow rates each for a period of one hour. Pumping at the three different rates will be performed in succession over a three hour period, if practical. A review of the existing data indicates that preliminary pumping rates for the step drawdown test of 4, 8 and 12 gallons per minute (gpm) are appropriate. Upon completion of the step-drawdown test, the drawdown data will be plotted on semi-logarithmic graph paper. The slope of the drawdown curves will be examined to determine the highest pumping rate the well would be expected to maintain for a 48-hour period.

The constant-rate pumping test will be conducted on each prototype extraction well for 48 hours at the maximum pumping rate determined from the results of the step-drawdown test consistent with the practicality of available water treatment (maximum allowable pumping rate will not exceed 25 gpm). Water levels will be measured in the prototype extraction well and in the nearby monitoring wells during the test. The observation wells to be monitored during the constant-rate pumping test are shown on Figure 2.2. In the event that steady state conditions have not occurred within the 48 hours of the test, consideration will be given to extending the test for up to 24 hours as mutually agreed by the field representatives of the Steering Committee and NYSDEC.

The water level measurements in the prototype extraction wells and the observation wells will be obtained by means of pressure transducers and dataloggers. These dataloggers will provide continuous groundwater level data. The water levels in the observation wells will be confirmed at four hour intervals for the first 12 hours of the test and at eight-hour intervals thereafter using manual water level indicators. The water levels in the pumping well will be confirmed at hourly intervals. The water level indicators will be cleaned between measurements in different observation wells. The pumping test flow rate will be continuously recorded using a flow meter with a flow totalizer.

Following termination of pumping, water levels in the prototype extraction well and monitoring wells will be monitored for a period of six hours or until 80 percent of recovery is achieved, whichever is longer, to assess recovery.

Data from the constant-rate pumping test will be used to calculate overburden hydraulic parameters (transmissivity, storativity) at the prototype extraction well locations and to evaluate the extent of the capture zone. The drawdown and recovery data will be reduced and analyzed by the methods of Theis (1935) and/or Cooper and Jacobs (1946), and/or Neuman (1975) as appropriate.

The hydraulic parameters determined from the testing program will be assessed along with all previously collected data to conceptualize the overburden for evaluation of a groundwater extraction system by means of two-dimensional steady-state horizontal groundwater flow model (FLOWPATH, Franz and Guiger, 1992). FLOWPATH is a finite difference numerical model using the block-centered finite difference scheme. This model can simulate two-dimensional steady state groundwater flow in confined and unconfined aquifers. The model can incorporate heterogeneous aquifer characteristics, boundary conditions, infiltration and extraction/injection wells. This model is also capable of performing particle tracking which can be used to delineate extraction well capture zones.

All water generated during pumping will be handled in accordance with the FOP as presented in Appendix A. To the extent practical, all groundwater extracted during predesign activities shall be discharged to the POTW without pretreatment. The next alternative is discharge to Ellicott Creek after on-Site pretreatment.

Monitoring of groundwater quality with time will be accomplished by sampling the effluent from each prototype extraction well 24 and 48 hours after the start of the 48-hour pumping test. A groundwater sample also will be collected from each prototype extraction well 10 minutes after initiation of the step-test. In addition, a sample will be collected from well GW-2S due to the detection of halogenated hydrocarbons at elevated concentrations (21,040 µg/L). This class of compounds was not detected at elevated concentrations in wells GW-14S, GW-15S or GW-16S. Sampling protocols for these samples are provided in the FOP (Appendix A). The protocols presented in the QAPP (Appendix C) and the HSP (Appendix B) will be followed during sample collection and analysis.

All samples collected from the prototype extraction wells will be analyzed for the TCL and TAL parameters. These data will be used to evaluate the alternatives of direct discharge of the collected groundwater to the local POTW or pretreatment prior to discharge to the local POTW. In addition, the last sample collected at each test extraction well (48-hour sample) and at well GW-2S will be analyzed for additional parameters to provide data necessary for evaluation of design of various treatment systems, if required (see Appendix E). These parameters are presented in Table 2.1.

At the completion of each 48-hour pumping test, an additional ten gallons of water will be collected from each extraction well for use in the groundwater treatability studies , if required, discussed in Section 2.7. An additional ten gallon sample will also be collected from well GW-2S.

2.6 MATERIALS COMPATIBILITY STUDIES

It is anticipated that a materials compatibility study shall be required if slurry wall techniques are selected as the method of construction for the perimeter barrier system. The RD/RA SOW identified that other material compatibility tests which may be required are testing of drain tile/forcemain materials (e.g. HDPE, PVC, polypropylenes, carbon steel and stainless steel). The work plan for the slurry wall compatibility study, should it be required, is summarized in the following subsections. Based on compatibility testing results from the literature, it is believed that HDPE is the appropriate drain tile/forcemain material and that no compatibility study is required.

2.6.1 Slurry Wall Materials

If slurry wall techniques are selected as the method of construction for the perimeter barrier system, accelerated materials compatibility testing shall be undertaken to demonstrate to what extent, if any, the permeability of the slurry wall material will be affected by Site chemicals.

The compatibility testing of slurry wall materials for the Site shall consist of three phases of testing. The objective of Phase I is to determine the potential reactivity of different bentonite slurry mixtures when hydrated with tap water and Site groundwater. Phase I shall involve the testing of four types of bentonite clays in various bentonite-water mixtures as would be used to maintain trench stability prior to backfilling. Previous work at other sites has indicated that the two appropriate types of bentonite clays to be tested are untreated and treated bentonite produced by N.L. Bariod and American Colloid. Each of the four bentonites shall be mixed into a slurry with bentonite concentrations of 3.5, 5 and 6.5 percent by weight. The four bentonites shall be hydrated with clean tap water and also with Site groundwater (aqueous phase liquid-APL). Table 2.2 summarizes the Phase I testing. Site APL shall be collected from the prototype overburden groundwater collection system (see Section 2.5.3) if available, or from overburden wells in the vicinity of the barrier wall alignment which are representative of the groundwater with the highest chemical concentrations. A total of twenty-four slurry samples shall be prepared and tested for the following:

i) viscosity
ii) apparent viscosity
iii) plastic viscosity
iv) yield point
v) filtrate loss
vi) filter cake thickness, and
vii) density.

The best two types of bentonite, based on the criteria presented in Appendix F, will be selected for Phase II testing.

Phase II testing shall determine the two design backfill mixtures which provide the lowest hydraulic conductivity when permeated with tap water. Phase II shall involve creating three soil/bentonite mixtures for each type of bentonite for a total of six samples. The three mixtures for each bentonite type shall use the best percentage of bentonite identified in Phase I. In two of the three mixtures for each type of bentonite, an additional 1 and 2 percent by dry weight of bentonite shall be added to the soil prior to slurry addition. A summary of Phase II testing is shown in Table 2.3. Each sample shall be hydrated and permeated using tap water for approximately one week.

The purpose of the Phase III testing is to determine the long-term effects of various permeants on the hydraulic conductivity of the two Phase II mixtures which demonstrate the lowest hydraulic conductivity. These mixtures shall be subjected to long term (Phase III) testing to determine the durability of the mixtures when permeated by tap water and Aqueous Phase Liquid (APL) from the Site. The test shall continue for 180 days or until a minimum of three pore volumes of the permeants pass through the soil/bentonite mixture (maximum of ten pore volumes). Previous work of other local sites has indicated a testing time of approximately 90 days for three pore volumes. A total of four samples shall be subjected to hydraulic conductivity testing during Phase III as shown below:

Sample	*Hydrating Fluid*	*Permeant*
1st best Phase II mixture	tap water	APL
1st best Phase II mixture	tap water	tap water
2nd best Phase II mixture	tap water	APL
2nd best Phase II mixture	tap water	tap water

Based on similar programs at other sites, it may be required to collect a fresh supply of permeant (APL) on a monthly basis from the Site.

The soil to be used in the testing will be select Site soils based on the grain size results of the predesign investigations described in Section 2.4. If the Site soils are found to be unsuitable for use in the slurry wall (i.e. poor quality, lack of fines), imported materials will be used.

The Work Plan for the slurry wall materials compatibility study, should it be required, is presented in Appendix F.

Following Phase III, the soil/bentonite mixture exhibiting the lowest hydraulic conductivity based on Phase III testing shall be selected as the design mixture for the slurry wall.

2.6.2 Drain Tile/Forcemain Materials

The material of choice for the drain tile and forcemains that may be required as part of the RA will be high density polyethylene (HDPE). Compatibility testing results available from the literature indicate that the use of HDPE is appropriate for the type and concentration of chemistry present at the Site. Manufacturer's chemical compatibility data for HDPE and a summary of Site soil and groundwater chemicals and concentration ranges, as presented in the ROD, are included in Appendix D.

2.7 GROUNDWATER TREATABILITY STUDY

Three discharge options are possible for the collected overburden groundwater:

i) direct discharge by forcemain to the Public Owned Treatment Works (POTW) without pretreatment;

ii) discharge by forcemain to the POTW with pretreatment; and

iii) discharge by forcemain to nearby surface waters with treatment.

A review of potential discharge options for the Site shows that direct discharge to the POTW without pretreatment is the preferred alternative.

Influent restrictions to the POTW shall be reviewed with the Erie County Sewer Authority to determine if pretreatment of the overburden groundwater is required prior to discharge to the POTW. If no pretreatment is required, discharge of the collected groundwater will be direct to the POTW and no treatability study is required. If direct discharge to the POTW is not possible, and available literature and the Site data are not sufficient to evaluate pretreatment options, a small scale groundwater treatability study shall be performed to complete the groundwater pretreatment system design. The groundwater pretreatment system shall be designed to treat extracted groundwater to meet the required standards for discharge of the treated water to the local sanitary sewer system for conveyance to the Erie County Sewer Authority POTW. Preliminary evaluation of potential pretreatment options indicate precipitation/settling/filtration for metals removal and air stripping/granular activated carbon for organics removal.

The work plan for the groundwater treatability study, should it be required, is provided in Appendix E. Groundwater for the treatability studies will be collected from the three extraction wells at the conclusion of the 48-hour pumping tests and from existing monitoring well GW-2S as this well exhibits the highest chemical concentrations for the compound group halogenated hydrocarbons at the Site. Procedures for collecting the groundwater are provided in Appendix A.

2.8 FILL MATERIALS ASSESSMENTS

Fill materials are required to grade the Site and construct the landfill cap. To evaluate the feasibility of using off-site fill materials for the grading project at the Site, the following assessments will be performed:

i) available volume assessments; and
ii) material sources/generation rates assessment.

The available volume assessment shall evaluate various Site contouring options to determine the volume available at the Site for fill materials. The assessment shall consider:

i) the impact of different end uses; and

ii) the impact of excavation and consolidation of landfill materials on the available volume.

The material sources/generation rates assessment shall involve the following activities:

i) contacting local municipalities and industries to determine the type, quantity and generation rates of fill material available;
ii) evaluating which fill materials are acceptable; and
iii) evaluating revenue and cost of operation.

After obtaining this information, a Site Operations Plan (SOP) for operation of the Site during the grading project shall be developed. Placement of the fill materials shall occur directly into the areas requiring fill for grading purposes once the RA begins. Consequently, the fill placement operation shall occur over a large portion of the Site using a systematic fill management plan as set forth in the SOP. It is anticipated that the process area for fill materials will be of small size and will be relocated as specific areas within the Site are completed to pre-capping elevations.

In order to minimize the length of time to ultimately close this Site, a materials staging plan will be developed as part of the SOP. This staging plan would allow fill material to be brought to the Site prior to initiation of the RA. This accumulated volume will reduce the required operations period later once the RA actually begins. The materials staging plan will include details on stockpiling, access and material sorting.

Preliminary evaluation of fill materials indicate the following materials are acceptable at the Site for the grading project:

i) excavated soils meeting site acceptance criteria;

ii) road construction debris, e.g. asphalt pieces and soils (other than planed asphalt); and

iii) construction/demolition debris, e.g. brick, wood and concrete.

Alternate material that may be acceptable in addition to the above materials for use in the grading/capping project are:

i) pretested (TCLP) non-hazardous incinerator ash;

ii) recyclable materials e.g. shredded rubber below the barrier layer and crushed glass for the gas venting layer; and

iii) other non-hazardous fill.

Specific alternative materials will be proposed to the NYSDEC for use in the grading and capping projects. Such alternative materials must have the prior approval of the NYSDEC before they are used in the projects.

It is anticipated that with proper processing, (e.g. crushing/chipping, handling, and placement in thin lifts and compaction to reduce excessive settlement), minimal volumes of vegetative matter consisting of tree trunks and roots would also be acceptable at the Site.

Drywall or other materials containing gypsum, are not desirable fill material. However, the impracticality of the complete exclusion of such material is not possible given the nature of demolition work. Thus, de minimis quantities of these materials may at times be included in materials delivered to the Site. The NYSDEC retains the right to determine what constitutes these de minimis quanitities.

It is possible that requests to dispose of as yet unidentified materials may be received during the grading project at the Site. Upon receipt of such a request, the Steering Committee will provide a submittal to the NYSDEC describing the materials and requesting approval to accept such materials.

Preliminary evaluation indicates the following materials are acceptable at the Site for use in the cap:

i) clean fill;
ii) road construction soils in the barrier protection layer;
iii) exempt C and D materials; and
iv) compost material and properly processed vegetative matter (i.e. wood chips) for use in the layer which is to be capable of supporting vegetation.

Clean fill material will be used to backfill areas from which wastes have been removed for consolidation (where grading only cannot achieve the necessary elevations).

As sizable areas of the landfill reach the elevation of the final design grades, these areas shall be covered with the final cap. As an option, an interim cap may be placed until the area is of sufficient size for proper placement of the final cap. It is anticipated that those areas which require minimal placement of grading material shall be completed first. The remaining areas, over which more extensive thickness of fill material can be placed, shall then be completed. This procedure will accelerate complete closure of large portions of the Site while fill material placement continues in other areas of the Site. Priority to attempt to close perimeter areas and environmentally sensitive areas (i.e. Wetlands) will also be considered in planning the closure stages.

2.9 LANDFILL GAS STUDY

As part of the predesign activities at the Site, a landfill gas study will be performed. The purpose of the landfill gas study is to provide data that will assist in the design of the gas venting layer in the final cap for the Site.

The study will consist of installing six landfill gas probes in the locations shown on Figure 2.3. The six locations represent the thickest areas of unsaturated fill at the Site which are anticipated to be the areas of highest landfill gas production.

Each probe will be constructed using one-inch diameter PVC pipe materials and extend to the bottom of the fill or top of the groundwater table, whichever is less. Specific construction details are provided in the FOP in Appendix A.

Following installation of the probes, each probe will be monitored for gas pressure, organic vapor and combustibility. Monitoring will be performed on a weekly basis throughout the duration of predesign field activities or for a maximum period of two months, whichever occurs first. During the monitoring period, atmospheric pressure, temperature and precipitation records will be obtained from the Buffalo Airport meteorological station.

The data gathered by monitoring the landfill gas probes will be used to assist in the design of the gas venting layer of the final cap. If necessary, modelling may be used during the RD to aid in the design. Procedures for collecting the landfill gas data are provided in Appendix A.

3.0 REMEDIAL DESIGN ACTIVITIES

3.1 DESIGN ELEMENTS

As presented in Section 1.6, the RA includes several components or systems that must be designed, constructed and/or implemented to complete the RA for the Site. The design issues regarding each of these elements are discussed in the following subsections.

3.1.1 Site Containment

3.1.1.1 Excavation and Consolidation of Landfill Materials On Site

Based on the results of the predesign soil investigations discussed in Section 2.4, landfill materials shall be excavated and consolidated on the Site. Potential areas to be considered for excavation and consolidation are shown on Figure 3.1 which was developed using the RI borehole and test pit data. The fill depths in the potential areas shown in the figure are ≤10 feet. Items which will be considered in determining which areas shall be excavated and consolidated include but are not limited to:

i) available volume at the Site to accept excavated material;
ii) maintaining continuous surface water drainage without ponding;
iii) small isolated areas within the central portion of the Site that have minimal fill depth will generally not be excavated;
iv) depth of the overburden groundwater table;

v) impact of potential drum/chemical waste presence;

vi) areas where a clay/till unit is not present or where fill contacts the bedrock; and

vii) health and safety considerations.

In addition, preference will be given to perimeter areas to create a buffer zone between the landfill and the residents.

The benefits of consolidating landfill materials are:

i) provision of a buffer zone without waste presence around the perimeter of the Site to minimize the potential for off Site impact on neighboring properties;

ii) reduction in usage of valuable resources (e.g. topsoil, clean fill, drainage materials, etc.);

iii) potential use of suitable excavated fill materials in the barrier protection layer;

iv) potential use of suitable underlying clean native materials as an on-Site supply of materials for grading and/or cap/slurry wall construction;

v) reduction in the area and cost of the cap; and

vi) reduction in length and cost of the perimeter barrier containment system.

The fill in the areas to be excavated will be overexcavated 6 inches to one foot beyond the limit of visible waste presence. Thereafter, samples from the sidewalls and base of the excavation will be collected and analyzed for a Site-Specific Parameter List (SSPL) to verify waste removal to a negotiated cleanup level. The SSPL will be proposed by the Steering Committee and subject to NYSDEC concurrence. The SSPL will be submitted in conjunction with the plans for Site consolidation. It is possible that more than one SSPL will be generated based on the chemicals present within a particular area from which waste is to be excavated. The selection of a chemical (or isomer family) for placement on the SSPL will be determined considering any of the following criteria:

i) concentrations reported in the data;
ii) frequency of occurrence in the data;
iii) chemical unique to the Site;
iv) chemical stability;
v) transport properties;
vi) human health considerations; and
vii) reliable, sensitive analytical method.

In addition to the above, information regarding the background presence of the chemicals in the environment generally may be considered.

The number of samples to be collected is dependent upon the type of material present at the limits of the overexcavation. In general, fewer samples will be collected of low permeability materials (i.e. clays and tills) than of higher permeability materials (i.e. sands and gravels). The specific number of samples to be collected and analyzed for the SSPL will be developed during the RD. The soil cleanup level for each SSPL will be proposed by the Steering Committee subject to NYSDEC concurrence.

3.1.1.2 Site Grading

Site grading will initially be performed using any excavated materials from the periphery of the Site. It is expected that the volume of the peripheral materials to be excavated and consolidated, due to the potential presence of drums and health and safety considerations, will not be sufficient to complete the Site grading. Therefore, off-Site fill materials will be used for Site grading. The thickness of such imported materials may be up to several feet. In addition, fill material may be used in the gas venting layer. Exempt C&D material as defined in Part 360 and clean fill can be used above the barrier layer.

3.1.1.3 Perimeter Barrier Containment System

The perimeter barrier containment system shall encircle the consolidated Site wastes in Areas B and C. The perimeter barrier containment system may consist of either:

i) a slurry wall supplemented with an overburden groundwater collection system within the confines of the slurry wall; or

ii) a hydraulic barrier, e.g. interceptor drain, or series of extraction wells supplemented with an overburden groundwater collection system within the confines of the hydraulic barrier, if required; or

iii) a combination of a hydraulic barrier supplemented with a physical barrier in areas where a source of water (i.e. wetlands, surface water body) exterior to the hydraulic barrier exists. The physical barrier may consist of a slurry wall, an HDPE liner on the outward side of the interceptor drain, sheet piles or other performance equivalent.

As previously stated, it is anticipated that an interceptor drain will be the preferred option for the perimeter barrier system.

The goal of the perimeter barrier system is to eliminate the migration of overburden groundwater and chemicals from the Site to the non-impacted overburden and bedrock groundwater. Special conditions due to the physical location of the perimeter barrier system, i.e. installation across roadways or adjacent to wetlands, etc., may require alternate methods to provide overburden groundwater containment in some areas. If such conditions arise, alternate methods or realignments will be evaluated and a proposal will be submitted to the NYSDEC.

Data collected during the predesign soil investigation for the perimeter barrier system shall be used to develop the method of perimeter barrier system construction.

If a slurry wall is selected for the barrier system, the accelerated materials compatibility testing shall be performed and the results used to design the perimeter barrier system. It is proposed to key the slurry wall two feet into the underlying clay/till unit. In addition, soil samples collected during the predesign soil investigation for the perimeter barrier system shall be evaluated to determine if the on-Site materials (fine sands and silts) along the proposed barrier wall alignment are suitable for use in the construction of a slurry wall. If the on-Site soils are not suitable or a sufficient volume of suitable soil is not available on Site, off-Site sources shall be evaluated.

A slurry wall will require the installation of an interior groundwater collection system to remove groundwater contained by the slurry wall. This system shall consist either of overburden extraction wells or an interceptor drain system, to be based on the test results of the prototype system described in Section 2.5.

If hydraulic barrier techniques are selected as the method of construction for the perimeter barrier system, three options are available:

i) a series of overburden extraction wells; or
ii) an interceptor drain (the preferred option); or
iii) a combination of the above.

In addition, some portions of the hydraulic barrier may be supplemented with a physical barrier to sever the hydraulic pathway between the hydraulic barrier and a source of recharge (i.e. Aero Lake) exterior to the perimeter barrier to reduce the quantity of clean water collected.

During the RD, an evaluation will be performed to determine whether an overburden groundwater collection system is required within the confines of the perimeter hydraulic barrier system. This interior system may consist either of an interceptor drain or extraction wells, the design of which will be based on the test results of pumping tests of the prototype system. The process which will be used to evaluate the three options is described in Section 2.5.

It is proposed that, where possible, the wells and/or interceptor drain be installed to the upper surface of the clay or till unit. It is recognized that in specific areas, the interceptor drain may have to be installed at a shallower or greater depth to maintain gravity drainage in the drain system.

To minimize off-Site migration of chemicals through the overburden via overburden groundwater during placement of fill materials, construction of the perimeter barrier system may be initiated prior to the start of Site grading and fill material placement. The timing and feasibility of construction of the perimeter barrier system will consider the volumes of groundwater expected to be extracted by the system.

3.1.1.4 Landfill Cap

The landfill cap shall be placed over the consolidated Site wastes in Areas B and C of the Site to:

i) reduce infiltration of precipitation into the landfill waste materials;
ii) prevent erosion of landfill materials containing potentially hazardous chemicals; and
iii) eliminate direct contact with the landfill materials.

The cap shall comply with the substantive requirements of the 6 NYCRR Part 360 regulations for Solid Waste Management Facilities.

The landfill cap shall cover the consolidated Site wastes in Areas B and C and shall extend to the perimeter barrier containment system. A design schematic for the landfill cap, as presented in the ROD, is shown on Figure 3.2.

Based on a review of Figure 3.2, the following modifications will be evaluated:

i) the need for and thickness of a gas venting layer shall be further evaluated during the RD using the data collected from the predesign landfill gas study (Section 2.9) and using landfill gas generation models. If a gas venting layer is determined to be required, it is anticipated that a 6-inch layer will be sufficient to handle the expected gas generation. Due to the age of the Site, the thin layering of waste and the type of fill materials to be placed, it is expected that gas generation rates will be low.

ii) the use of compost and properly processed vegetative matter (i.e. wood chips) in the top six inches of the cap which will consist of "soils capable of supporting vegetation" rather than "topsoil" due to the limited supply of topsoil in the local area.

Pursuant to Section 2.13(r)(2)(iii) of 6 NYCRR Part 360, a 6-inch drainage layer with an overlying filter fabric is not required between the barrier layer and the barrier protection layer. To determine if the 6-inch drainage layer and overlying filter fabric is required, an evaluation of the need for these components will be performed and submitted to the NYSDEC for approval prior to modification of the cap system.

The design schematic for the modified cap is shown on Figure 3.3. Due to the size of the area to be capped, it is anticipated that the low permeability layer will consist of a geomembrane with a minimal thickness of 40-mils rather than 18 inches of clay ($K \leq 1x10^{-7}$ cm/sec) although both will be evaluated. The method of construction of the gas venting layer and low permeability layer will be developed during the RD. In addition, the use of exempt C&D material or recyclable materials to construct the gas venting layer and barrier protection layer will be evaluated.

Design of the landfill cap will consider:

i) that the eastern border of the Site will have to conform to the NYSDOT Transit Road improvement project;

ii) that the impact of the landfill cap on the wetlands/flood plains will be minimized;

iii) any height restrictions imposed by the Buffalo airport;

iv) visual impacts; and

v) the cap construction is consistent with the end use plan.

Erosion control measures shall be installed as required to limit erosion of the cap.

As stated in Section 2.8, as sizable areas of the landfill reach the elevation of the final design grades, these areas shall be covered with the final cap to accelerate complete closure of portions of the Site while fill material placement continues in other areas of the Site. As an option, some areas may be covered with an interim cap until the areas are large enough for final cap placement.

3.1.2 Groundwater Collection, Pretreatment and Discharge

Each of the identified groundwater collection, pretreatment, if required, and discharge components are described in further detail in the following subsections.

3.1.2.1 Design of Groundwater Collection,
Pretreatment and Discharge Systems

The groundwater collection, pretreatment, if required, and discharge systems shall be designed based on the results of the prototype groundwater collection system tests and of the groundwater treatability study, if required.

The groundwater collection system will consist either of:

i) the preferred option of a hydraulic perimeter barrier system to control horizontal overburden groundwater migration, supplemented by interceptor drains and/or extraction wells within the limits of the perimeter hydraulic barrier to control overburden groundwater migration to the bedrock, if required; or

ii) a network of overburden extraction wells to capture and contain overburden groundwater within the confines of a physical perimeter barrier system.

If a hydraulic barrier is used, some portions of the hydraulic barrier may be supplemented with a physical barrier to sever the hydraulic pathway between the hydraulic barrier and a source of recharge (i.e. Aero Lake) exterior to the barrier system to reduce the quantity of clean water collected.

The choice of which system will be implemented to meet the RA objective for the overburden groundwater flow regime will be based on the results of the prototype groundwater collection system testing.

If overburden extraction wells are used, the collection system design will include the number of extraction wells, the depth and location of the extraction wells and the pumping rate for each well. The design may be altered as extraction wells are installed and pump tested to optimize the number and location of the required extraction wells.

If a hydraulic barrier system is used, the collection system design will consist of:

i) an interceptor drain (preferred option);
ii) extraction wells; or
iii) a combination of the above.

If an interceptor drain is selected, the system design shall include the alignment and depth of the interceptor drain, manholes and wet well locations, and groundwater drawdown requirements to create a perimeter hydraulic barrier.

Regardless of the groundwater collection system used, discharge from the collection system to either the pretreatment system, if required, or to a discharge point to the local POTW will require the use of forcemains. The forcemains will be single walled forcemain constructed of HDPE (see Section 2.6).

During the design phase, contract documents and specifications and bid documents shall be prepared for the construction of the collection, pretreatment, if required, and discharge systems.

The design for the collection system will require some flexibility to adjust for conditions encountered in the field which could not be foreseen during the design (i.e. variability of pumping water). If extraction wells are used, they shall be pump tested as they are installed to compare actual performance to the anticipated design performance.

3.1.2.2 Handling of Groundwater Pretreatment Residuals

If pretreatment prior to discharge to POTW is required, such pretreatment may generate residuals that will require appropriate handling and disposal.

All groundwater pretreatment residuals shall be evaluated to determine appropriate handling and disposal requirements. Those residuals which are shown to be hazardous shall be transported to an appropriate facility for treatment and disposal.

Potential pretreatment residuals include:

i) sludge from metals precipitation;
ii) spent granular activated carbon;

iii) precipitates formed in the air stripper; and

iv) carbon unit and filter backwash waters.

3.1.3 Completion Criteria

The overburden groundwater collection system will be designed and operated with the goal of eliminating the outward migration of chemicals from the landfill into either the bedrock or adjacent portion of the overburden and efforts will be made to restore the overburden groundwater quality to the levels set forth in 6 NYCRR Parts 700-705. It is recognized that it may not be possible to fully restore the overburden groundwater quality. Therefore, termination of the groundwater collection and pretreatment system prior to achieving State and Federal Groundwater Quality Standards will be proposed if one of the following can be demonstrated:

i) Neither the presence of any residual chemicals on Site nor the possible migration of those chemicals off Site will pose an unacceptable risk to human health or the environment, based on the future use of the Site or adjacent properties consistent with the agreed Site/area restrictions; or

ii) A "zero-slope" has been reached with regards to the rate of remediation of the groundwater quality. In this case a review will be made of possible system modifications to attain the RAOs. If a suitable modification is found, based on the technical and legal criteria appropriate at that time, consideration will be given to implementing it.

Following termination of the groundwater collection and pretreatment, the overburden groundwater shall be monitored to demonstrate that the levels of residual chemical concentrations are within an acceptable range based on the above criteria.

3.1.4 Wetlands and Floodplains Assessments

A wetlands assessment and a floodplains assessment will be conducted to determine if a component of the remedy has the potential to significantly impact or detrimentally affect wetlands or floodplains in the vicinity of the Site.

The first stage of the wetlands assessment will be an accurate delineation and marking in the field of the boundaries of the wetlands potentially affected by the remedial actions. The wetlands delineation will be performed jointly by the NYSDEC and Steering Committee in accordance with the NYSDEC Freshwater Wetlands Mapping Technical Methods a Statement (1986). Discussions will be held with the U.S. Army Corps of Engineers and the Division of Fish and Wildlife to determine the appropriate actions required (e.g. wetlands elimination, modification or replacement) if a wetlands is adversely impacted. Since discussions will be held with the U.S. Army Corps, the U.S. Army Corps 1987 protocols for wetland delineation will also be used for guidance. The results of the assessment shall be presented in the RD. Following delineation of the wetland, a detailed assessment will be performed, consisting of the following:

i) a description of the wetlands/water resources functions at and in the vicinity of the Site;

ii) a description of the remedial action;

iii) a description of the effects of the remedial action, including the various options for the perimeter barrier systems on the wetlands/water resources functions; and

iv) a description of measures to minimize potential harm to wetlands/water resources functions.

The following procedures, which will be considered to reduce potential impacts to the wetlands, include but are not limited to:

i) enforcing seasonal restrictions on construction activities as practical;

ii) restoring surface and subsurface flow patterns;

iii) erosion and sedimentation control;

iv) prohibiting dumping in wetlands/water resources;

v) limiting size of the construction equipment, as practical;

vi) ensuring appropriate chemical concentration levels for effluent discharges to wetlands/water bodies;

vii) use of water only for dust control; and

viii) restoring the disturbed portion of the buffer zone.

The floodplain assessment will include the following:

i) a delineation of the 100 and 500-year floodplains;

ii) a description of the remedial action;

iii) a description of the effects of the remedial action, including the various options for the perimeter barrier system, on the floodplain; and

iv) a description of measures to minimize potential adverse effects on the floodplains.

Measures to minimize adverse effects on the floodplains may include but are not limited to:

i) protecting treatment units/equipment from flooding and flood damage through proper design considerations;

ii) using minimum grading requirements;

iii) maintaining floodplain vegetation to reduce sedimentation;

iv) regulating methods used for grading, filling, soil removal and replacement to reduce sedimentation;

v) topsoil protection;

vii) implementing appropriate erosion control measures; and

viii) restricting the operation of construction equipment and the placement of spoil storage areas in floodplains.

The wetlands and floodplains assessments will be submitted as part of the 30 percent design submittal (see Section 3.3.1).

3.1.5 Institutional Controls

The RA shall provide for appropriate deed restrictions on subsequent land use. The objectives of institutional controls are to:

i) limit subsurface excavation;

ii) prevent vehicular traffic except on areas designed to carry traffic; and

iii) prevent groundwater use; and

iv) prevent or preclude development or future use incompatible with the remedy.

3.1.6 Temporary/Permanent Relocation

An evaluation of temporary or permanent relocation of area residents impacted during or following Site remedial activities will be performed. This evaluation will consider the requirement of a buffer zone during performance of RA activities and following their implementation.

Criteria to be used in the evaluation of temporary relocation include, but are not limited to the following:

i) results of air monitoring results; and

ii) proximity to the area of work.

In addition, consideration will be given to temporary relocation due to continued nuisance complaints, i.e. odor.

Qualitative criteria to be used in the evaluation of permanent relocation include, but are not limited to:

i) proximity to the landfill materials; and

ii) proximity to the area of work.

Quantitative criteria will be developed and submitted for review by the NYSDEC and NYSDOH prior to initiation of RD/RA field activities.

3.1.7 Monitoring

A groundwater monitoring plan will be prepared to monitor the effectiveness of the overburden groundwater collection system. The draft groundwater monitoring plan will specify the sampling frequency, parameters, locations and protocols and shall be submitted with the prefinal design document.

The RA shall provide for groundwater monitoring to be conducted for a period of five years after completion of construction. After the initial five-year period, an assessment of the groundwater monitoring program shall be performed to determine the suitability of the monitoring program and the need for modification.

If an on-Site groundwater pretreatment plant is required to be constructed, a monitoring program shall be developed and incorporated in the Operations and Maintenance (O&M) Manual for the plant (see Section 3.3.2.7). The program shall ensure the effluent from the groundwater pretreatment plant meets discharge criteria. The program shall specify sampling frequency, parameters and protocols.

3.1.8 End Use Study

An end use study shall be performed to evaluate end uses of the Site after completion of the RA activities. This usage study will be coordinated with the local municipalities. Potential end uses could include:

i) vacant land;

ii) airport parking;

iii) a public park;

iv) public recreational facilities, e.g. baseball diamonds, golf course, nature trails; and

v) commercial development along roadways/buffer strips.

The study shall give consideration to preserving as many mature trees as practicable. The results of the study shall be incorporated in the design of the final grading plan.

3.1.9 Handling of Temporarily Stored IRM Materials

An evaluation of permanent treatment/disposal alternatives for the phenolic tars and/or any other materials temporarily stored on-site resulting from IRM activities will be performed. The evaluation will consider the volumes of such materials involved and available treatment/disposal technologies and facilities. The results of the evaluation shall be presented in the RD.

3.2 REMEDIAL DESIGN TEAM AND PROJECT MANAGEMENT

A team of senior design and management personnel will be assembled with the experience and capabilities required to effectively complete all aspects of the RD. The project organization and management structure is shown on Figure 3.4. Brief descriptions of all required roles and qualifications are listed below.

Project Management Team

Project Director

The project director's role is to direct the project team's efforts and focus them on the RD with due regard for budget and schedule. The project director will also participate in the definition of amendments to the Scope of Work that may be appropriate and the resolution of problems that may develop as the project proceeds. In addition, the project director will be the Steering Committee's primary representative of the Project with the Steering Committee and regulatory agencies. The project director shall have had many management roles on similar projects and be experienced in project representation to the Steering Committee, regulatory agencies and the general public.

Project Manager

The project manager will oversee all aspects of the project, represent the Design Firm at technical meetings where required and will be actively involved in the successful completion of the project. The project manager will coordinate office activities to ensure that all day-to-day activities are conducted in a professional and timely manner. The project manager will keep the Project Director up-to-date on the status of project activities.

Project Design Team

Project Engineer - Structural

The structural project engineer will supervise the design of all activities pertaining to the structural aspects of the design phase, required for construction of the pretreatment facilities required and the groundwater extraction systems.

Project Engineer - Construction

The construction project engineer will provide technical expertise in construction methods and direct the preparation of detailed design drawings, project specifications, cost estimates, schedules and bid packages.

Contract Specialist

The contract specialist will provide assistance to the Design Team and Project Coordinator for development of Final Design Bid Documents and bid packages and will also assist in the review and evaluations of final bids to develop a recommendation for contract award.

Health and Safety Manager

The health and safety manager will provide technical expertise in all aspects of health and safety in regards to the construction work on a CERCLA Site and will oversee staff safety training including OSHA 40-hour and 8-hour courses.

QA/QC Manager

The QA/QC manager will provide technical expertise in all aspects of quality assurance and quality control associated with the RD and will provide assistance during the development of the QAPP and associated work plans.

Treatment System Design Manager

The treatment system design manager will provide services specifically related to the groundwater treatability studies and design of the groundwater pretreatment system, if required.

3.3 DESIGN SUBMITTALS

In order to ensure NYSDEC concurrence during the remedial design process, details of the design will be submitted to the NYSDEC for review and approval at designated intervals, as discussed in the following subsections. The design submittals will be prepared in accordance with the schedule presented in Section 3.5.

3.3.1 Preliminary Design (30 Percent Design)

The preliminary design shall include the following items:

i) design criteria;
ii) results of groundwater treatability studies if required;
iii) results of any additional field data sampling and collection;
iv) results of fill materials assessments (available volume and material sources/generation rates);
v) results of evaluation of areas to be excavated and consolidated on the Site (including SSPL selected for the areas to be excavated);
vi) results of the wetlands and floodplains assessments;
vii) results of the landfill gas study;
viii) a material compatibility report if required;
ix) an erosion, sediment, runoff control plan;
x) a project delivery schedule;
xi) preliminary plans, drawings, and sketches;

xii) an outline of required specifications;

xiii) a preliminary construction schedule;

xiv) compliance with the ARARs and consistency with the ROD; and

xv) identified administrative regulatory compliance.

The preliminary design shall reflect a level of effort such that the technical requirements of the project have been addressed and outlined so that they may be reviewed to determine if the final design shall provide an operable and usable RA. Supporting data and documentation shall be provided with the design documents defining the functional aspects of the program. The scope of the technical specifications shall be outlined in a manner reflecting the final specifications. The preliminary design shall include design calculations reflecting the same percentage of completion as the designs they support. Existing conditions of the Site shall be field verified.

3.3.2 <u>Pre-Final and Final Design Documents</u>

The Pre-Final/Final design documents will be submitted to the NYSDEC in two parts. The first submission shall be at 95 percent completion of design (i.e. pre-final). The pre-final design submittal will be prepared subsequent to NYSDEC review of the 30 percent design submittal. Following NYSDEC review of the Pre-Final submission, any required revisions will be incorporated and the Final documents (100 percent complete) with drawings and specifications will be submitted to NYSDEC for review and approval.

The Pre-Final and Final design documents shall include the following items:

i) Statement of Work;
ii) design plans and specifications;
iii) a HSP;
iv) a QAPP;
v) a SOP;
vi) a CQAP;
vii) a permitting requirements plan;
viii) a construction management plan (CMP);
ix) a groundwater monitoring plan;
x) a draft operation and maintenance plan (O & M Plan); and
xi) preliminary RA Implementation Schedule.

Upon approval by the NYSDEC, the Final design documents shall be deemed to be the Remedial Design Report (RD Report). The approved Final design documents, certified and stamped by a professional engineer licensed and registered to practice in New York State, shall be resubmitted to the NYSDEC. The quality of the RD Report shall be such that it could be included in a bid package.

Components of the Final Design Submittal are further overviewed below.

3.3.2.1 Design Plans and Specifications

Clear and comprehensive design plans and specifications will be prepared which will include but not be limited to:

i) discussion of the design strategy and design basis;
ii) discussion of the technical factors of importance;
iii) description of assumptions made and detailed justification of these assumptions;
iv) discussion of the possible sources of error and references to possible operation and maintenance problems;
v) detailed drawing of the proposed design;
vi) tables listing equipment and specifications; and
vii) tables giving material balances.

3.3.2.2 Health and Safety Plan

A HSP will be developed to address the construction and monitoring activities to be performed at the Site to implement the RA. The HSP presented herein for the pre-design activities will be modified to incorporate any additional items necessary to implement the RA.

3.3.2.3 Quality Assurance Project Plan

A QAPP will be developed to address sampling and analytical activities necessary during construction of the RA and to monitor the effectiveness of the RA. The QAPP presented herein for the pre-design activities will be modified to incorporate any additional items necessary to implement the RA.

3.3.2.4 Site Operations Plan

A SOP shall be developed and implemented for operation of the Site during placement of fill materials. Information obtained from the volume assessment and waste sources and generation rates assessment shall be used to develop the SOP.

The SOP shall include the following items:

i) procedures for excavation and consolidation of landfill materials;
ii) processing and placement procedures for fill materials;
iii) sequential Site development;
iv) material acceptability criteria for various capping and grading layers;
v) surface water management;
vi) erosion control;
vii) groundwater management;
viii) Site facilities;

ix) Litter and dust control;

x) Landfill Operator duties;

xi) Final Contouring Plan; and

xii) Procedures for removal of temporarily stored wastes.

3.3.2.5 Construction Quality Assurance Plan

A Construction Quality Assurance Plan (CQAP) shall be developed, which satisfies the appropriate requirements of section 360-2.8, to ensure that the completed RA meets or exceeds all design criteria, plans and specifications. The CQAP shall include requirements for data collection during the construction of the RA to validate the completion of such construction.

The CQAP shall address the following items:

i) excavation and consolidation of landfill materials;

ii) construction of the perimeter barrier system;

iii) construction of the landfill cap;

iv) construction of the groundwater collection, pretreatment, if required, and discharge systems;

v) construction of the groundwater monitoring system; and

vi) removal of temporarily stored wastes.

The CQAP shall include the items presented in the following report sections.

Construction Quality Assurance Personnel Qualifications

The qualifications of the CQA officer and supporting inspection personnel shall be presented in the CQAP to demonstrate that they possess the training and experience necessary to fulfill their identified responsibilities.

Inspection Activities

The observations and tests that shall be used to monitor the construction and/or installation of the components of the RA shall be summarized in the CQAP. The plans shall include the scope and frequency of each type of inspection. Inspections shall verify compliance with environmental requirements and include, but not be limited to air quality and emissions monitoring records, waste disposal records (e.g. RCRA transportation manifests), etc. The inspection shall also ensure compliance with all health and safety procedures. In addition to oversight inspections, the following activities shall be conducted:

A. Preconstruction Inspection and Meeting

A preconstruction inspection and meeting shall be conducted to:

i) review methods for documenting and reporting inspection data;
ii) review methods for distributing and storing documents and reports;
iii) review work area security and safety protocols;

iv) discuss any appropriate modifications of the CQAP to ensure that Site-specific considerations are addressed; and

v) conduct a Site walk-around to verify that the design criteria, plans and specifications are understood and to review material and equipment storage locations.

The preconstruction inspection and meeting shall be documented by a designated person and minutes shall be transmitted to the Steering Committee and the NYSDEC.

B. Prefinal Inspection

Upon project construction completion, NYSDEC shall be notified for the purposes of conducting a prefinal inspection. The prefinal inspection shall include a walk-through inspection of the entire project Site. The inspection is to determine whether the project is complete and consistent with the contract documents and the NYSDEC approved RA Work Plan. Any outstanding construction items discovered during the inspection shall be identified and noted. Treatment equipment, if required, shall be operationally tested. Certification shall be made when the equipment has performed to meet the purpose and intent of the specifications. Retesting shall be completed where deficiencies are revealed. The prefinal inspection report shall outline the outstanding construction actions, actions required to resolve items, completion date for these actions, and date for final inspection.

C. Final Inspection

Upon completion of any outstanding construction items, the NYSDEC shall be notified for the purposes of conducting a final inspection. The final inspection shall include a walk-through inspection of the project Site. The prefinal inspection report shall be used as a checklist with the final inspection focusing on the outstanding construction items identified in the prefinal inspection. Confirmation shall be made that outstanding items have been resolved.

Sampling Requirements

The sampling activities, sample size, sample locations, frequency of testing, acceptance and rejection criteria, and plans for correcting problems as addressed in the project specifications shall be presented in the CQAP.

Documentation

Reporting requirements for CQA activities shall be described in detail in the CQAP. This shall include such items as daily summary reports, inspection data sheets, problem identification and corrective measures reports, design acceptance reports, and final documentation. Provisions for the final storage of all records shall be presented in the CQAP.

3.3.2.6 Permitting Requirements Plan

A plan will be developed to ensure that the substantive requirements of appropriate permits are met to address the following:

i) discharge of untreated or pretreated groundwater to a POTW;
ii) fill materials placement;
iii) air permit (if air stripping included in pretreatment system);
iv) NYSDEC and Army Corps of Engineers 404 Permit for filling within a waterway; and
v) temporary SPDES permit for discharge to Ellicott Creek of pretreated groundwater extracted during the prototype collection system pumping tests.

3.3.2.7 Draft Operations and Maintenance Plan

A draft O & M Plan will be prepared which covers both implementation and long-term maintenance of the RA. The O & M Plan shall be finalized following implementation of the RA. The plan will be composed of the following elements:

i) Description of normal O & M;
ii) Description of potential operating problems;
iii) Description of routine monitoring and laboratory testing;
iv) Description of alternate O & M to prevent undue hazard should systems fail;

v) Corrective Action Plan;

vi) Safety Plan;

vii) Description of equipment; and

viii) Records and reporting mechanisms required.

The O & M Plan will be developed in accordance with the NYSDEC memorandum entitled "Operation, Maintenance and Monitoring Manual for a Hazardous Waste Site", April 1992.

3.3.3 Correlating Plans and Specifications

Correlation between drawings and technical specifications, is a basic requirement of any set of working construction plans and specifications. Before submitting the project specifications, the following shall be completed:

i) coordinate and cross-check the specifications and drawings; and

ii) complete the proofing of the edited specifications and required cross-checking of all drawings and specifications.

These activities shall be completed prior to the 95% prefinal submittal to the NYSDEC.

3.3.4 Equipment Startup and Operator Training

Technical specifications governing pumping/treatment systems shall be prepared. They shall include contractor requirements for providing:

i) appropriate service visits by experienced personnel to supervise the installation, adjustment, startup and operation of the pumping/treatment systems; and

ii) initial training covering appropriate operational procedures that will continue after successful startup.

3.4 COMMUNITY RELATIONS SUPPORT

Community relations support will be given to NYSDEC consistent with Superfund community relations policy as stated in the "Guidance for Implementing the Superfund Program", "Community Relations in Superfund-A Handbook", and "The New York State Inactive Hazardous Waste Site Citizen Participation Plan" (dated August 30, 1988). Support will be provided until completion of construction.

3.5 RD SCHEDULE

Plan 1 presents a proposed schedule for the remedial design program. Scheduling of field activities are subject to weather considerations and may be modified as approved by the NYSDEC as the project develops.

The initiation of several activities shown in the schedule depends on NYSDEC review, comment, and approval of reports and plans. Therefore, the actual schedule of several activities may require revision, depending on the actual time required for the NYSDEC to review, comment, and approve the reports and plans, as well as the time required for any revisions that may be required by the NYSDEC.

A draft schedule for the construction, implementation and operation of the remedial systems will be included with the 95 percent design submittal. The construction, implementation and operation activities schedule will address major construction milestones, inspection activities, sampling to be performed prior to system startup and operation activities. Routine sampling for operation and maintenance purposes to be performed during system operation will be scheduled according to the O&M Plan.

4.0 REMEDIAL ACTION ACTIVITIES

Remedial Action activities involve all aspects of implementing the remedy at the Site. These activities include Contractor selection, remedial construction, operation and maintenance, long-term monitoring and testing to ensure systems are operating effectively.

4.1 REMEDIAL ACTION TEAM

The qualifications, responsibility and authority of all organizations (i.e. technical consultants, construction firms, etc.) and job categories involved in the construction of the RA will be assembled and submitted as the RA Team.

4.2 REMEDIAL ACTION SCHEDULE

The final schedule for the RA implementation will be submitted with the final design report. A preliminary schedule outlining categories is shown on Plan 1. It is noted that the schedule may require modification dependent upon the previously described studies and assessments, e.g. fill materials availability assessment.

4.3 CONSTRUCTION MANAGEMENT PLAN

Following approval of the final design report, a Construction Management Plan (CMP) will be submitted. The CMP shall be developed and will include the selection method of contractor(s) for the RA, provisions for a pre-construction conference between the parties' Project Coordinators and their contractors, and provisions for such meetings periodically during the construction of the RA. Contract and bid documents will be provided to pre-qualified contractors. A remedial contractor will be selected from the bids received.

4.4 CONSTRUCTION QUALITY ASSURANCE PLAN

The final remedy shall be constructed and operated in accordance with the Construction Quality Assurance Plan (CQAP) to ensure, with a reasonable degree of certainty, that the completed RA meets or exceeds all design criteria, plans and specifications. The CQAP shall include requirements for data collection during the construction of the RA to validate the completion of such construction. Details of what will be included in the CQAP are provided in Section 3.2.5. The CQAP will be submitted with the final design report.

4.5 REMEDIAL CONSTRUCTION

The final remedy shall be constructed and operated in accordance with the approved CQAP. A construction documentation report including daily summary reports, schedule of data submissions, design acceptance reports, photo documentation and record drawings will be submitted to summarize construction procedures. Progress reports will be prepared summarizing results of performance monitoring of the systems and other components of the final remedy. The construction documentation report will also include inspection data sheets, corrective actions summaries and final documentation for the RA.

At this time, it is envisioned that a separate contract will be established to complete the final remedy. The contract will be established for the construction of the groundwater collection/pretreatment system and perimeter barrier system, fill material placement, and landfill cap.

The selected contractor will carry out the work in accordance with the approved design and CQAP and under the supervision of a qualified engineer.

4.6 OPERATION AND MAINTENANCE

Operation and maintenance activities will be conducted in accordance with the approved Operation and Maintenance Plan (O&M). The major activities will involve the operation and maintenance of the groundwater collection system and pretreatment system, if required, and the final cap. The O&M Plan will include the post-construction groundwater monitoring program.

The O&M Plan will be submitted in draft form with the final (100 percent) design package. The O&M Plan will be finalized on completion of remedial construction. The O&M Plan is described in Section 3.3.2.7.

4.7 MONITORING AND TESTING

Long-term monitoring and testing will be conducted to monitor the effectiveness of each component of the remedy. The groundwater monitoring plan shall specify the sampling frequency, parameters, sampling locations and protocols. It is anticipated that the monitoring plan will include bedrock groundwater monitoring wells to monitor the quality of the bedrock groundwater.

The RA shall provide for groundwater monitoring to be conducted for a period of five years after completion of construction to ensure that the RA objectives have been met. After the initial five-year period, an assessment of the groundwater monitoring program shall be performed to determine the suitability of the monitoring program and the need for modification.

If an on-Site groundwater pretreatment plant is required to be constructed, a monitoring program shall be developed and incorporated in the O&M Plan to ensure the effluent from the groundwater pretreatment plant meets discharge criteria. The program shall specify sampling frequency, parameters and protocols.

5.0 REPORTING - RD/RA IMPLEMENTATION

During the implementation of RD/RA activities, reports shall be prepared to document the design, construction, operation and maintenance and monitoring of the RA. The documentation shall include, but not be limited to the following:

i) Monthly progress reports;
ii) O & M Plan;
iii) Preliminary, Prefinal and Final Design Documents;
iv) Draft Final RA Report; and
v) Semi-annual reports for O & M activities.

Monthly progress reports shall be submitted to NYSDEC during the design and construction phase containing:

i) A description and estimate of the percentage of the RD/RA completed;
ii) Summaries of all findings and sampling during the reporting period;
iii) Summaries of all changes made in the RD/RA during the reporting period, indicating NYSDEC approval of those changes;
iv) Summaries of all contacts with representatives of the local community, and public interest groups during the reporting period;
v) Summaries of problems encountered during the reporting period;
vi) Actions taken or being taken to rectify the problems;
vii) Changes in personnel during the reporting period;
viii) Projected work for the next reporting period; and

ix) Copies of daily reports, inspection reports, laboratory/monitoring data, etc.

The Draft Final RA Report shall fully describe the construction of the RA and include the record engineering drawings of the RA depicting the remedy as constructed.

The Report shall be prepared at the completion of construction of the project and shall document that the project is consistent with the design specifications, and the RA is performing up to the required standards. The Report shall include, but not be limited to the following elements:

i) synopsis of the RA and certification of the design and construction;
ii) explanation of any modifications to the plans and why these were necessary for the project;
iii) listing of the criteria, established before the RA was initiated, for judging the functioning of the RA and also explaining any modification to these criteria;
iv) results of facility monitoring, indicating that the RA will meet or exceed the performance criteria; and
v) explanation of the operation and maintenance (including monitoring to be undertaken at the Site).

Semi-annual reports for O & M activities shall be submitted to the NYSDEC following completion of construction of the RA. The reports shall contain:

i) Summaries of problems encountered during the reporting period;

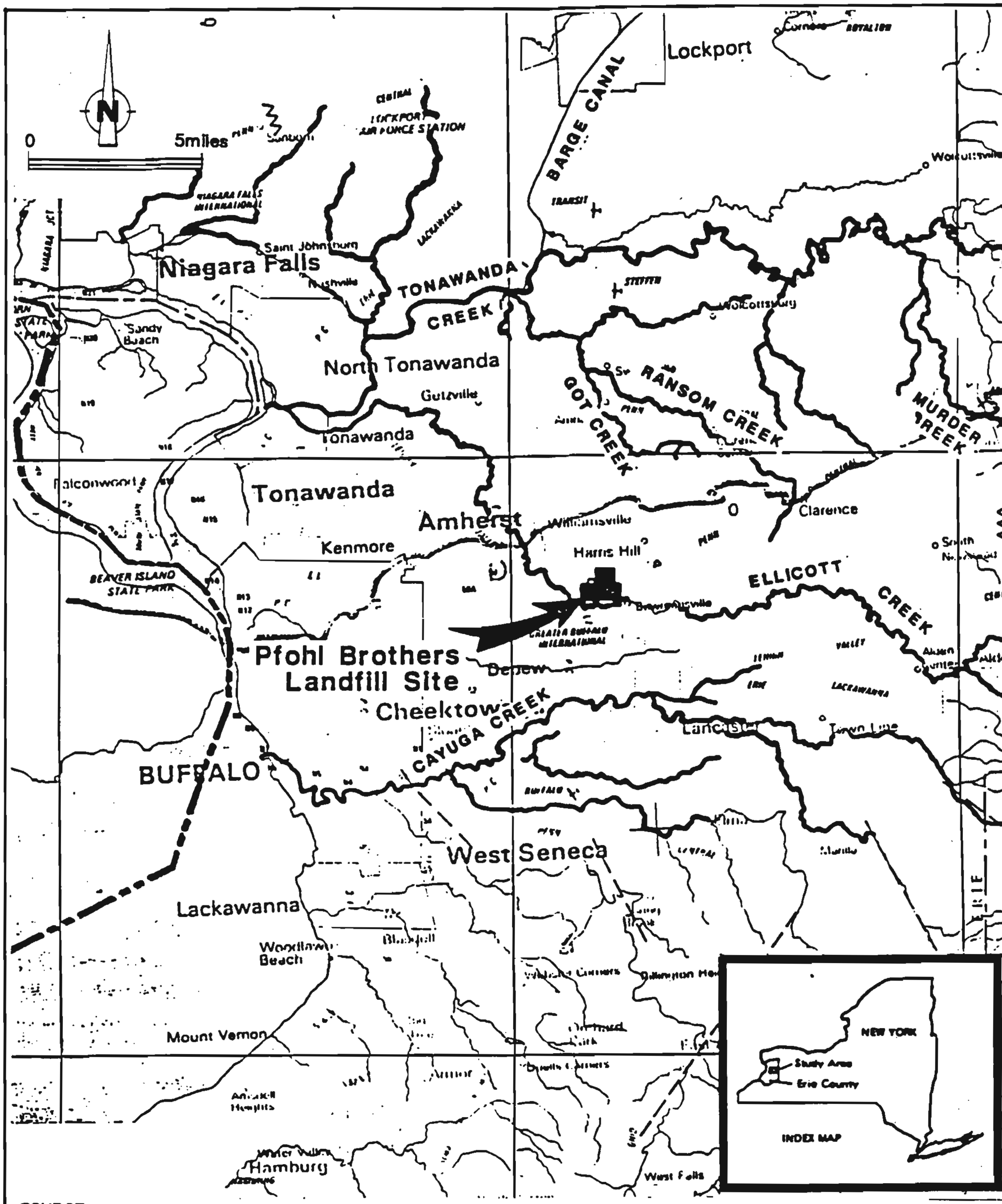
ii) action taken or being taken to rectify the problems;

iii) changes in personnel during the reporting period;

iv) projected work for the next reporting period; and

v) copies of inspection reports, laboratory/monitoring data, etc.

FIGURES



SOURCE:
FEDERAL EMERGENCY MANAGEMENT AGENCY,
1983 (MODIFIED BY CDM, 1990)

figure 1.1

SITE LOCATION

Pfohl Brothers Landfill, Cheektowaga, New York

CRA

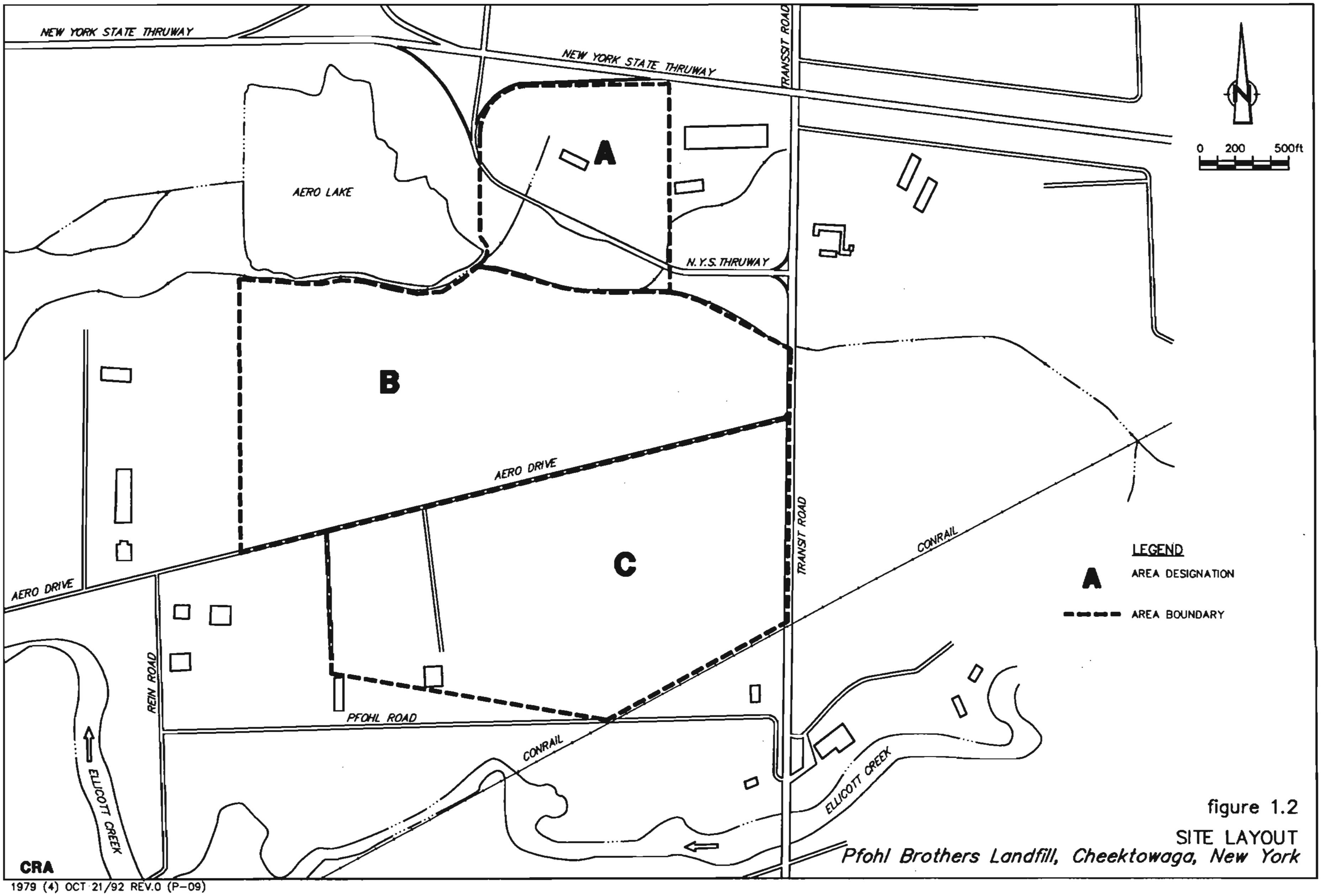


figure 1.2
SITE LAYOUT
Pfohl Brothers Landfill, Cheektowaga, New York

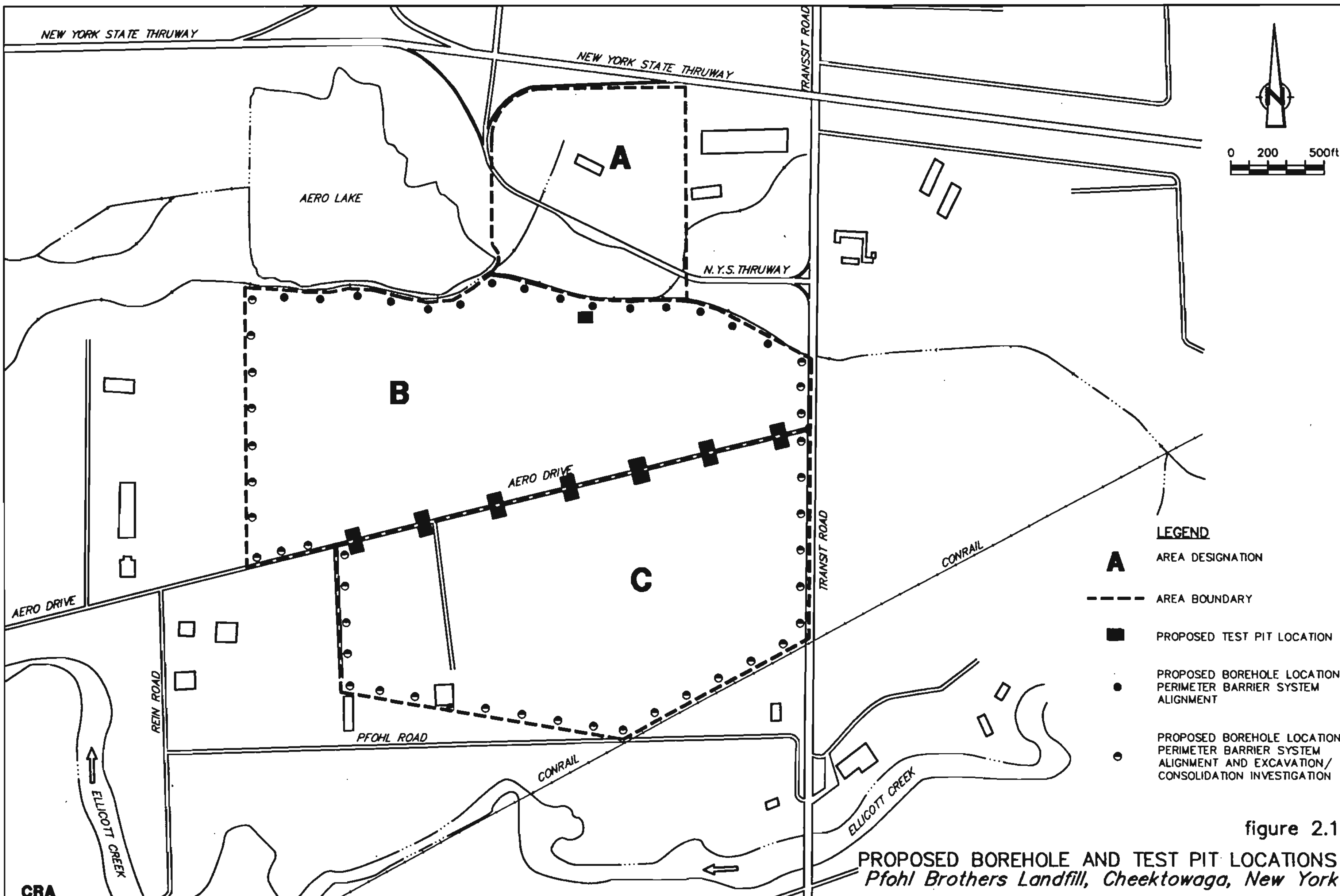


figure 2.1

PROPOSED BOREHOLE AND TEST PIT LOCATIONS
Pfohl Brothers Landfill, Cheektowaga, New York

1979 (4) OCT 21/92 REV.0 (P-10)

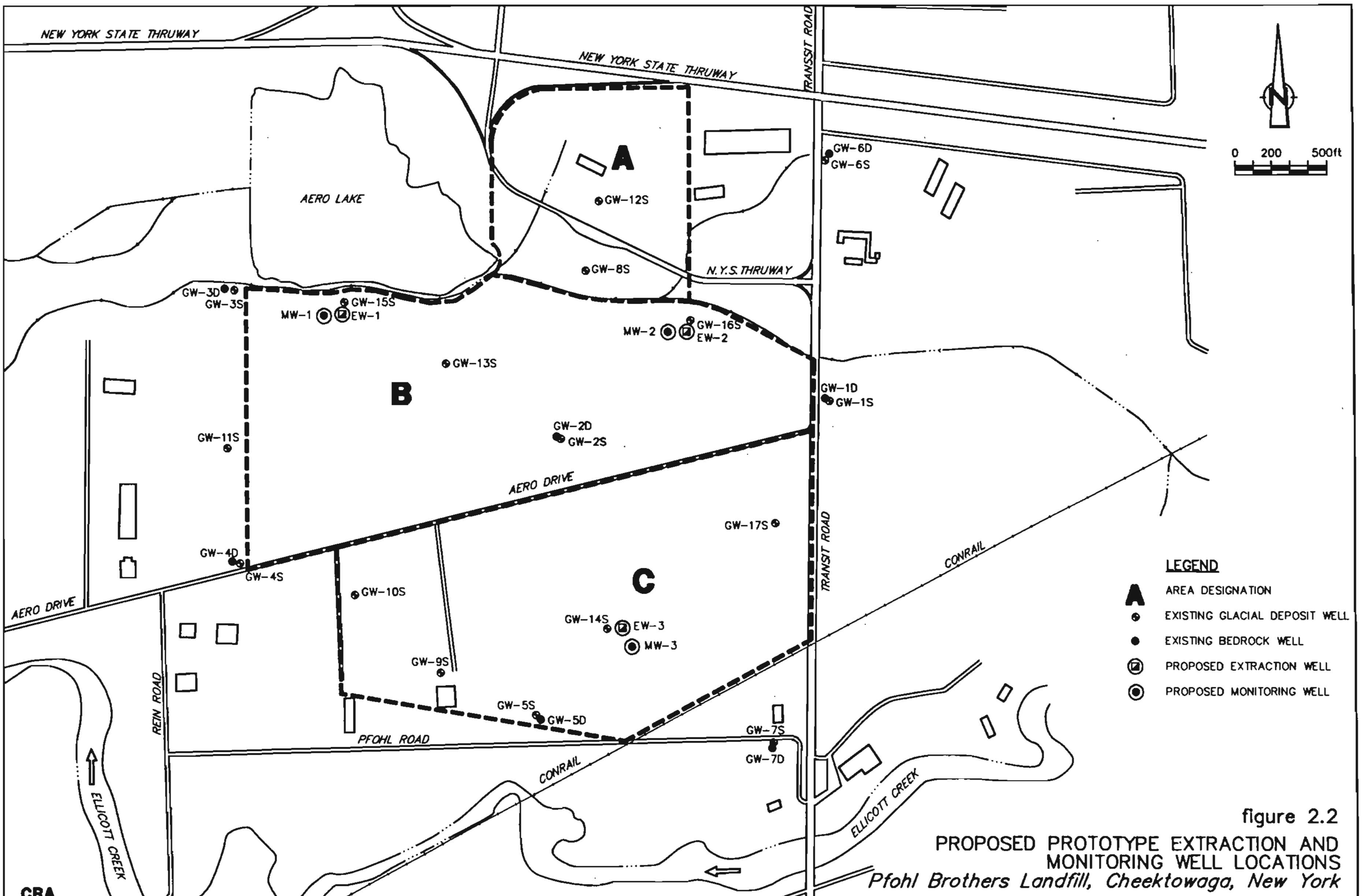


figure 2.2
PROPOSED PROTOTYPE EXTRACTION AND MONITORING WELL LOCATIONS
Pfohl Brothers Landfill, Cheektowaga, New York

1979 (4) OCT 21/92 REV.0 (P-06)

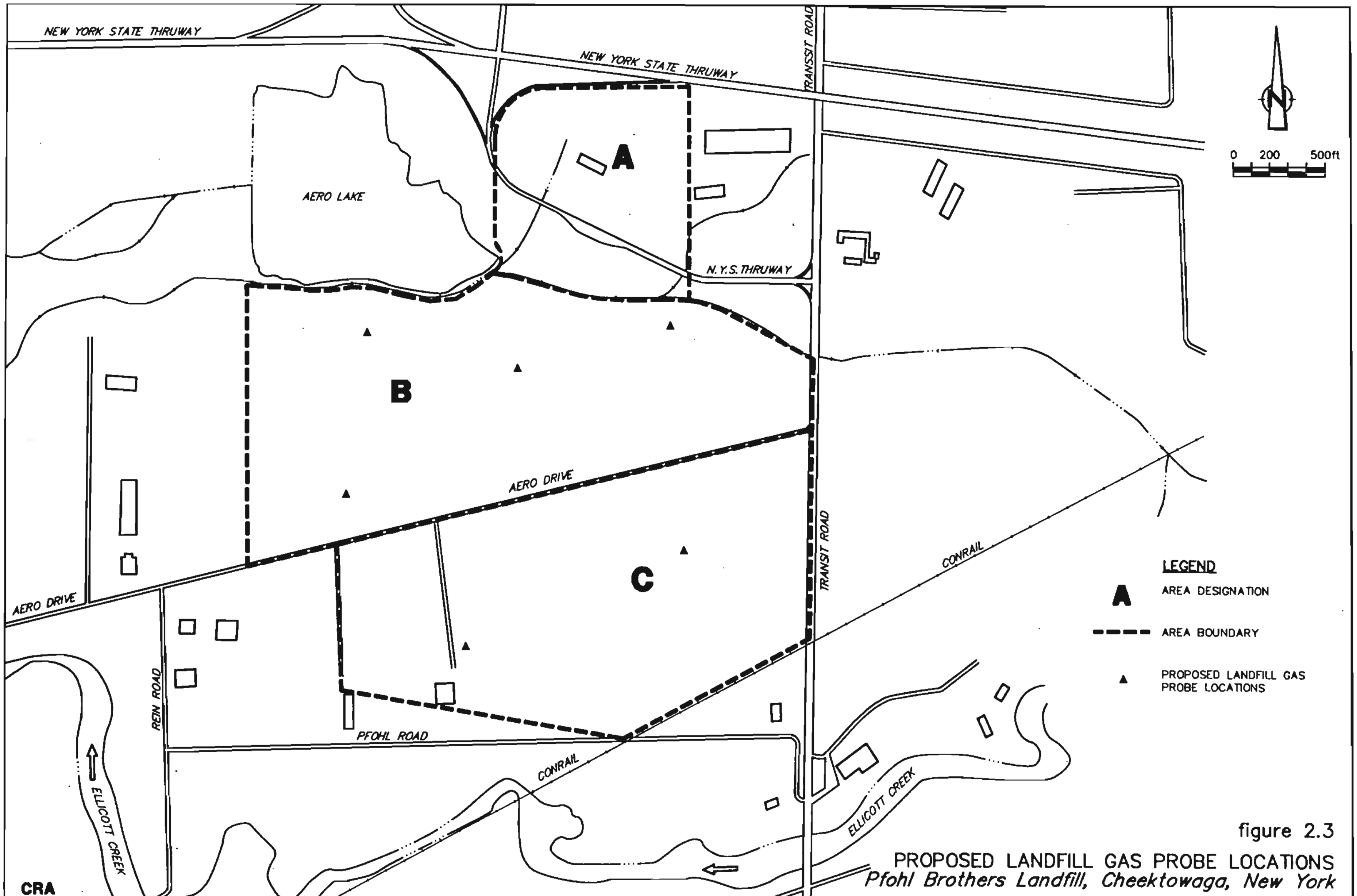


figure 2.3

PROPOSED LANDFILL GAS PROBE LOCATIONS

Pfohl Brothers Landfill, Cheektowaga, New York

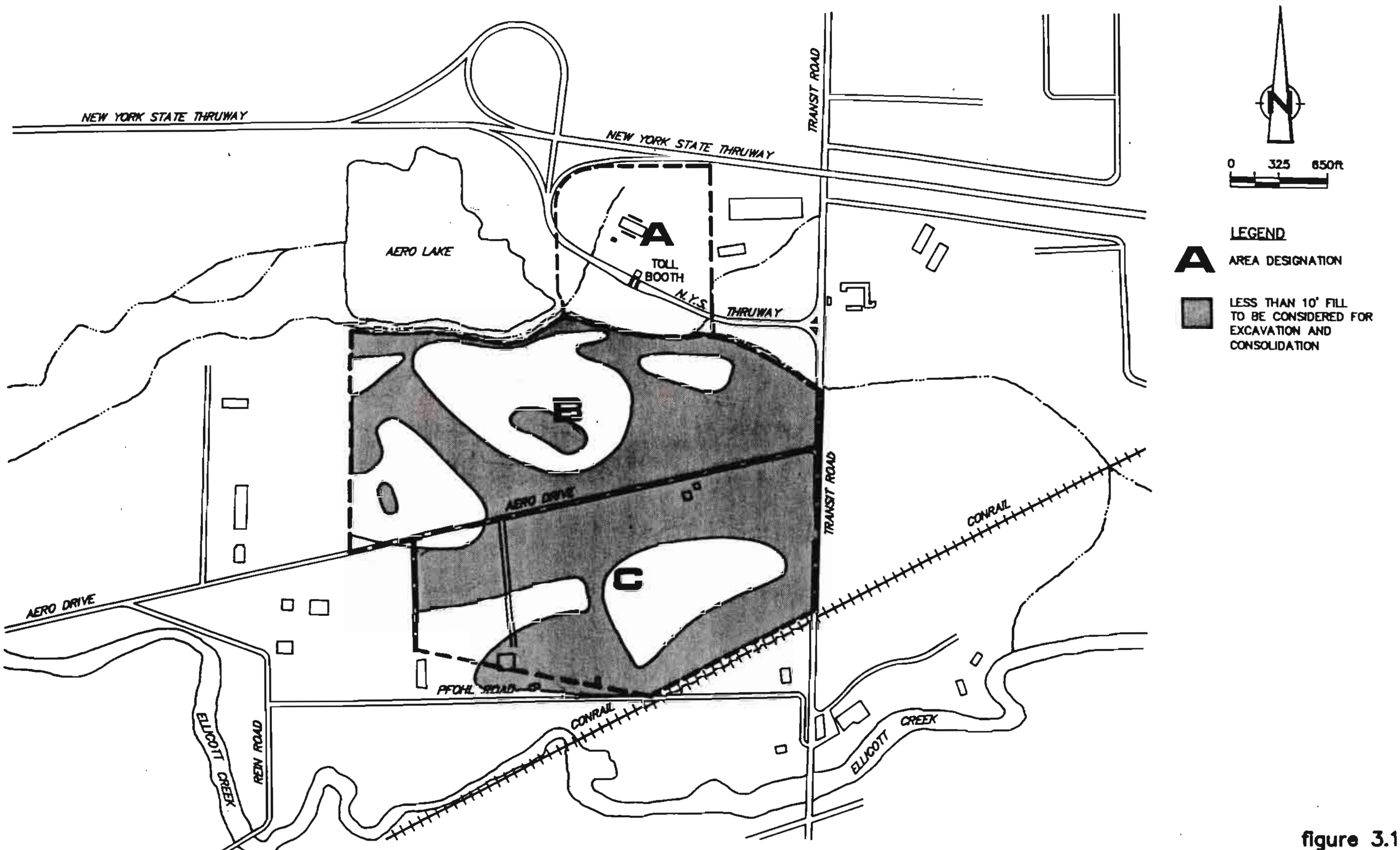
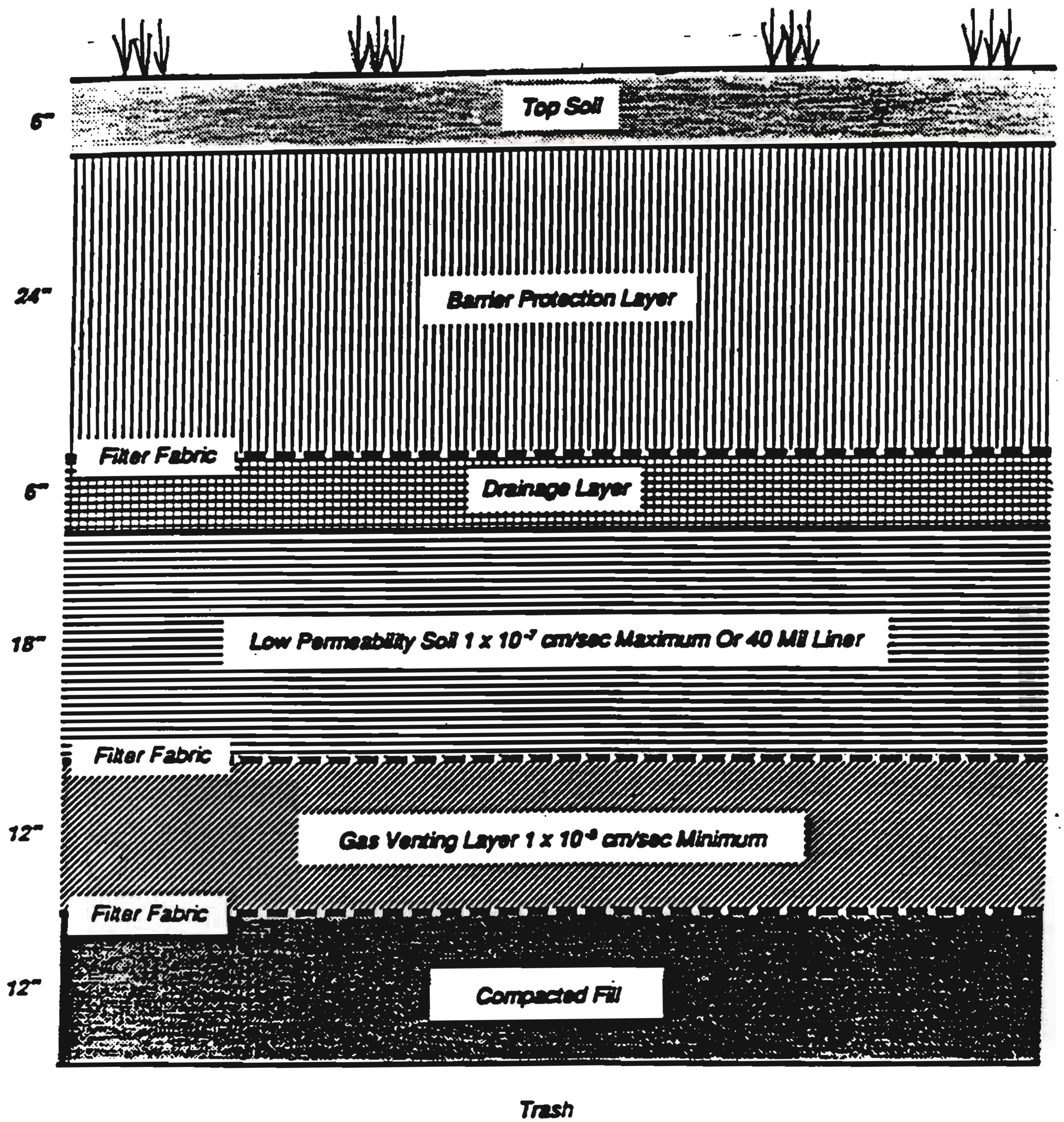


figure 3.1
POTENTIAL AREAS TO BE CONSIDERED FOR EXCAVATION AND CONSOLIDATION
Pfohl Brothers Landfill, Cheektowaga, New York

CRA

1979 (4) OCT.20/92-REV.0



NOTE:
Thickness of layers shown reflects the minimum thickness allowed by NYSDEC.

Not To Scale

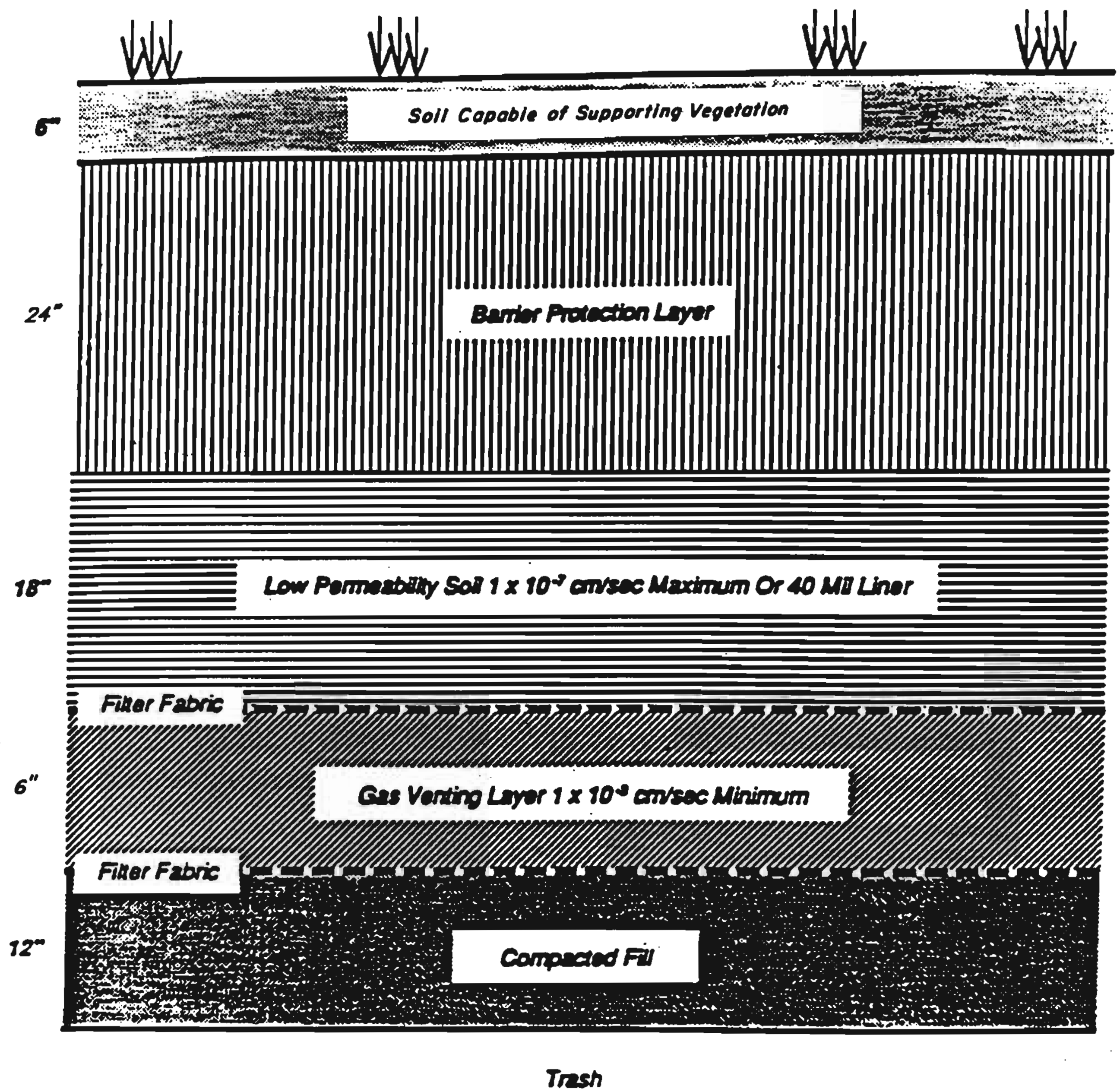
SOURCE: CDM, DRAFT FEASIBILITY STUDY
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK.

figure 3.2

DESIGN SCHEMATIC FOR NYSDEC LANDFILL CAP
Pfohl Brothers Landfill, Cheektowaga, New York

CRA

1979 (4) OCT.20/92–REV.0



Not To Scale

NOTE: TO BE EVALUATED

figure 3.3

DESIGN SCHEMATIC FOR MODIFIED LANDFILL CAP

Pfohl Brothers Landfill, Cheektowaga, New York

CRA

1979 (4) OCT.20/92–REV.

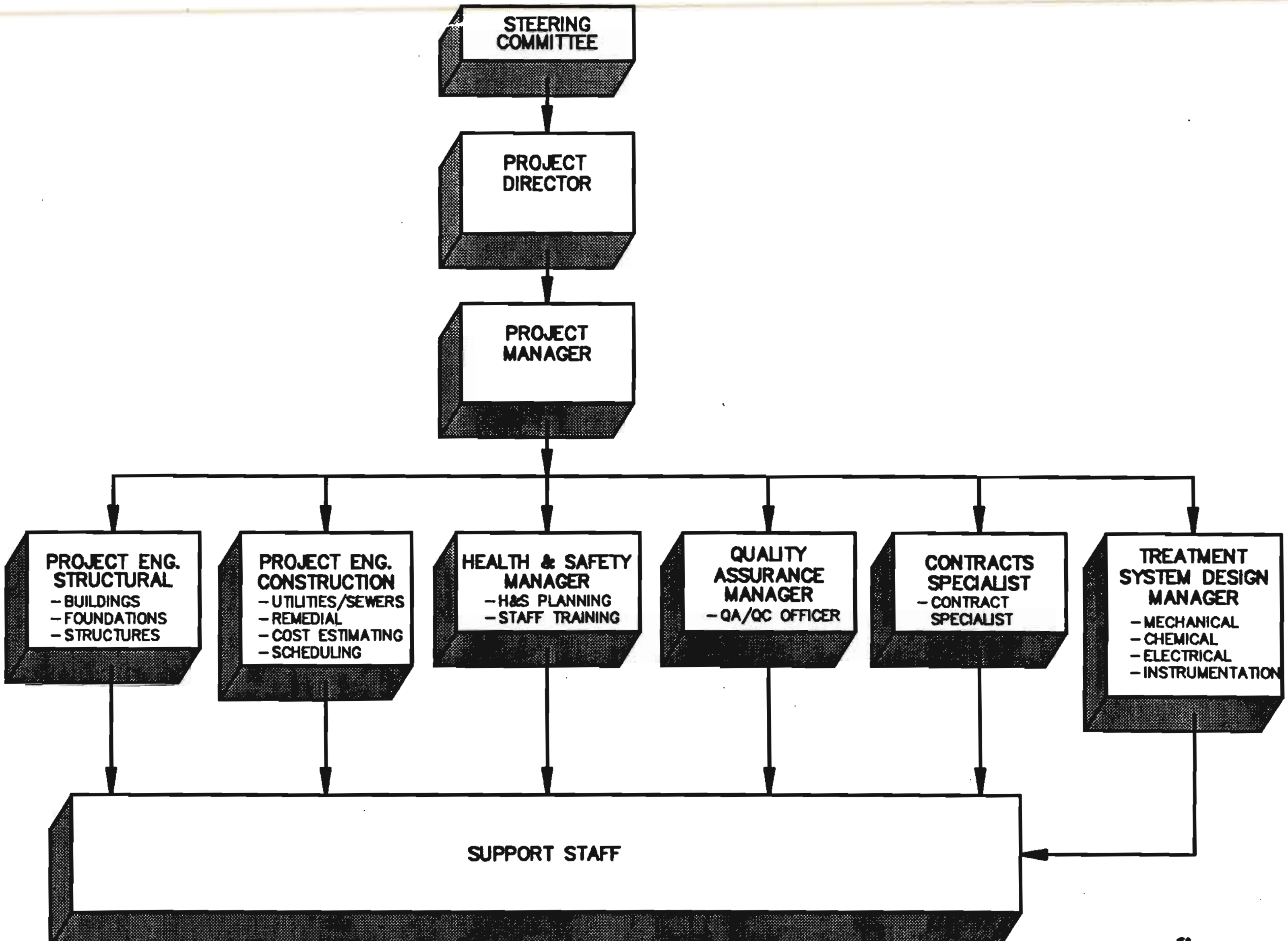


figure 3.4

PROJECT ORGANIZATION AND MANAGEMENT STRUCTURE
REMEDIAL DESIGN ACTIVITIES
Pfohl Brothers Landfill, Cheektowaga, New York

CRA

1979 (4) OCT 30/92 REV.0 (S-04)

TABLES

TABLE 2.1

GROUNDWATER ANALYTICAL PARAMETERS
48-HOUR PUMPING TEST

All Samples (Time 0 hr, 24 hr, 48 hrs)	TCL	- volatiles
		- semi-volatiles
	TAL	- metals

48 hour Sample Only

- PCBs
- Total Organic Carbon (TOC)
- Biological Oxygen Demand (BOD)
- Chemical Oxygen Demand (COD)
- Iron (total and soluble)
- Manganese (total and soluble)
- Total Suspended Solids (TSS)
- Total Dissolved Solids (TDS)
- pH
- Alkalinity
- Hardness
- Turbidity
- Calcium
- Sulphate (SO4 -2)
- Pesticides
- Tetra to Octa PCDD/PCDFs
- Gross Alpha and Beta Radioactivity

TABLE 2.2

PHASE I: TRENCHING SLURRY TEST MIXES

Sample #	*Bentonite Type*	
BW-1	1	3.5% bentonite tap water
BW-2	1	5% bentonite tap water
BW-3	1	6.5% bentonite tap water
BW-4	1	3.5% bentonite Site groundwater
BW-5	1	5% bentonite Site groundwater
BW-6	1	6.5% bentonite Site groundwater
BW-7	2	3.5% bentonite tap water
BW-8	2	5% bentonite tap water
BW-9	2	6.5% bentonite tap water
BW-10	2	3.5% bentonite Site groundwater
BW-11	2	5% bentonite Site groundwater
BW-12	2	6.5% bentonite Site groundwater
BW-13	3	3.5% bentonite tap water
BW-14	3	5% bentonite tap water
BW-15	3	6.5% bentonite tap water

TABLE 2.2

PHASE I: TRENCHING SLURRY TEST MIXES

Sample #	*Bentonite Type*	
BW-16	3	3.5% bentonite Site groundwater
BW-17	3	5% bentonite Site groundwater
BW-18	3	6.5% bentonite Site groundwater
BW-19	4	3.5% bentonite tap water
BW-20	4	5% bentonite tap water
BW-21	4	6.5% bentonite tap water
BW-22	4	3.5% bentonite Site groundwater
BW-23	4	5% bentonite Site groundwater
BW-24	4	6.5% bentonite Site groundwater

Notes:

1. BW denotes bentonite-water slurry mix.

Bentonite Type:
1 N.L. Baroid - untreated
2 N.L. Baroid - treated
3 American Colloid - untreated
4 American Colloid - treated

TABLE 2.3

PHASE II: SB TEST MIXES

Sample #	
SB-1	Phase I best bentonite % 25% fines
SB-2	Best Phase I bentonite % + 1% dry bentonite 25% fines
SB-3	Best Phase I bentonite % + 2% dry bentonite 25% fines
SB-4	2nd Best Phase I bentonite % 25% fines
SB-5	2nd Best Phase I bentonite % + 1% dry bentonite 25% fines
SB-6	2nd Best Phase I bentonite % + 2% dry bentonite 25% fines
Control	0% bentonite 0% fines addition to native soil

Notes:

1.) The specified fines will consist of naturally occurring fines and supplemental fines (as required).

2.) The balance of the samples composition will be native soils and tap water such that the mixtures achieve a required slump between 4 and 6 inches.

3.) The percentages to be evaluated are based upon experience and review of the scientific literature. Should the testing of any phase of the program indicate that other mixture percentages need to be evaluated, they will be undertaken.

APPENDICES

A

APPENDIX A

FIELD OPERATIONS PLAN

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ATTACHMENTS

A.1.0 <u>INTRODUCTION</u>

The purpose of this Field Operations Plan (FOP) is to outline the protocols that will be implemented to perform all field activities associated with the predesign portion of the RD/RA for the Pfohl Brothers Landfill Site (Site). Procedures and protocols outlined in the FOP will be performed in conjunction with those presented in the Health and Safety Plan (HSP) (Appendix B) and the Quality Assurance Project Plan (QAPP) (Appendix C). The predesign activities that have a field activity component are:

i) predesign soil investigations;
ii) install and pump test prototype groundwater collection system;
iii) predesign landfill gas study;
iv) materials compatibility study; and
v) groundwater treatability studies.

The field activities that will be performed to implement the predesign components are:

i) borehole installation;
ii) test pit/trench excavation;
iii) groundwater extraction and monitoring well installation;
iv) landfill gas probe installation and monitoring;
v) soil and groundwater sampling;
vi) pumping tests of the prototype groundwater collection system; and
vii) handling of materials generated by the above activities.

Any access roads required to perform the above activities will be constructed in accordance with the design on Figure A.1. All vegetation will be chipped and spread on adjacent areas. Prior to initiation of predesign field activities, a site visit will be performed to determine the nature and extent of currently available access roads. A plan showing the location of new access roads will be prepared and submitted to the NYSDEC for concurrence.

The protocols to implement the above activities are discussed in detail in the following sections.

A.2.0 BOREHOLE INSTALLATIONS

A total of 52 boreholes to determine the depth of installation of the perimeter barrier system will be installed at the Site in the locations shown on Figure A.2. In addition 37 of the 52 boreholes will also be used to determine the areas to be excavated and consolidated. Each borehole will extend to a depth two feet below the top of the clay/till layer (confining unit) contact or to the bedrock contact if no confining unit (clay/till) is observed. Based on the RI data, the depth of the boreholes range from 8 to 28 feet.

The drilling area for each borehole will be lined with 6-mil polyethylene overlain by 3⁄4 inch plywood or steel plates to contain all drill cuttings. A typical drill rig setup for the boring operations is shown on Figure A.3.

The borehole installation details are described as follows:

i) Collect continuous samples of the overburden material into the upper groundwater regime using 3-inch diameter split spoon samplers in advance of the augering operation (approximately eight-inch outside diameter). Upon opening the split-spoon, the soil sample will be screened with a photoionization detector. Soil samples will be stored in 500 mL wide-mouth clear glass jars for geologic record. The samples will be stored on site for a period of one year. Thereafter, the soils will be disposed on-Site. The NYSDEC will be informed 60 days prior to such disposal. If the NYSDEC requests retention of the samples, such samples will be transferred to the custody of the NYSDEC. In addition, soil samples will be collected for physical testing as described in Section A.5.2. All excess fine-grained alluvial soils (i.e. fine sands and silts) will be placed in a drum for use in the slurry compatibility testing, if required. The depth interval and volume of material placed in the drum will be recorded in a bound field book. It is estimated that approximately 50 kg of fine-grain soils will be required for the slurry compatibility testing.

ii) Every borehole will be logged as to geologic conditions encountered including soil classification (using Unified System soil specifications and classification techniques), stratigraphy, blowcounts, moisture conditions, backfill details, drilling and sampling conditions and any unusual occurrences. The geologic stratigraphy will be logged by the Site Geologist.

iii) In the event that some fill is encountered which is impenetrable with the augers, the borehole will either be abandoned and relocated or the impenetrable material will be cored or drilled through. The borehole will be abandoned in accordance with the procedures in Section A.6.1.

iv) Each borehole will extend to a depth of two feet below the top of the clay/till unit or to bedrock where no clay/till unit is present.

v) Upon completion of the augering operation, each borehole shall be backfilled with drill cuttings and excess soils from split-spoon samples in accordance with Section A.6.1. If a borehole extends to bedrock or the bottom confining unit is penetrated, the bottom 3± feet of the borehole will be grouted with bentonite/cement grout using positive displacement techniques.

A.3.0 TEST PIT AND TRENCH EXCAVATION

The 37 boreholes presented in Section A.2.0 to determine the areas to be excavated and consolidated will be supplemented with a total of 15 test pits or trenches at the locations shown on Figure A.2. Each test pit/trench will extend to the depth of the fill/native material contact, to a maximum depth of 10 feet below ground surface or to the groundwater table, whichever is encountered first.

The test pit/trench excavation protocols are described as follows:

i) A backhoe or other suitable excavation equipment shall be used to expose the fill/native surface. The native soils will be screened with a photoionization detector.

ii) In areas where the fill contact is observed to be less than four feet below ground surface and the fill is unsaturated, the test pit will be elongated into a trench to determine the variance in fill thickness with respect to distance from either Aero Drive or from the Site boundary. The length of the trench will be determined by the Site Representative based on conditions observed, however, the trench shall not extend more than ten feet unless indicated by the Site Representative.

iii) Soil samples will be collected for each two-foot depth increment directly from the backhoe bucket by scraping the exterior soils to expose soils that have not contacted overlying soils during excavation. The samples will be stored in 500 mL wide-mouth clear glass jars for geologic record and will be stored on Site for a period of one year. Thereafter, the soils will be disposed of on-Site pursuant to the notification procedures in Section A.2.0. In addition, soil samples will be collected for physical testing as described in Section A.5.2.

iv) The geologic stratigraphy of the native soils encountered will be visually examined and logged using the Unified Soil Classification System. A photographic record will be maintained for each test pit/trench. The dimensions of the excavations will be recorded along with any other relevant field conditions. The geologic stratigraphy will be logged by the Site Geologist.

v) Excavated soils will be stockpiled on 6-mil polyethylene sheeting.

vi) Each test pit/trench will be backfilled with the stockpiled soils in the reverse order from which they were removed. Soils will be placed in compacted, 12-inch lifts. The surface of the excavation will be restored to match pre-excavation conditions.

vii) Surface waters will be directed away from the excavation using temporary berms or other appropriate techniques.

viii) Any groundwater collected as a result of the test pit/trench excavations will be handled in accordance with Section A.6.2.

A.4.0 WELL AND LANDFILL GAS PROBE INSTALLATIONS

As part of the predesign activities for the RD, three prototype groundwater extraction wells and three hydraulic monitoring wells will be installed at the Site in the locations shown on Figure A.4. Six landfill gas probes will be installed at the locations shown on Figure A.7.

The monitoring and extraction wells are to be installed in the immediate vicinity of existing wells GW-14S, GW-15S and GW-16S. The wells will be installed to approximately the same depth as the existing wells or to the top of the confining layer, whichever provides the thickest saturated zone. To assist in the installation of the new wells, the stratigraphic and instrumentation logs for GW-14S, GW-15S and GW-16S are presented in Attachment A-1.

The installation protocols for the extraction and monitoring wells and the landfill gas probes are provided in the following subsections.

A.4.1 EXTRACTION WELLS

The extraction wells will be installed using the following procedures:

i) The depth of each extraction well will be based upon the depth of the screened interval of the adjacent existing monitoring well as follows:

Extraction Well	*Adjacent Monitoring Well*	*Installation Depth (ft)*
EW-1	GW-15S	13
EW-2	GW-16S	15
EW-3	GW-14S	15

ii) Continuous split spoon samples of the overburden material above the confining unit will be collected in advance of the augering operation (approximately 12-inch outside diameter). Soil samples will be stored in 500 mL wide-mouth clear glass jars for geologic record. The samples will be stored on site for a period of one year. Thereafter, the soils will be disposed of on-Site pursuant to the notification procedure in Section A.2.0.

iii) Every borehole will be logged as to geologic conditions encountered including soil classification (using Unified System soil specifications and classification techniques), stratigraphy, blowcounts, moisture conditions, well installation and backfill details, drilling and sampling conditions and any unusual occurrences. The geologic stratigraphy will be logged by the Site Geologist.

iv) In the event that some fill is encountered which is impenetrable with the augers, the borehole will either be abandoned pursuant to the procedures in Section A.6.1 and relocated or the impenetrable material will be cored or drilled through.

v) Upon completion of augering operations, the well will be inserted through the hollow stem augers. The well shall consist of:

a. stainless steel well screen
   - 6-inch diameter
   - #10 slot
   - 5-foot length

b. black steel riser pipe
   - 6-inch diameter
   - 2-foot stick up above ground surface (optional-flush mount)
   - dry flush joint assembly or welded joints

c. lockable cap and lock.

vi) Backfill the well as the augers are removed. The backfill shall consist of:

a. #4 Quartzite sandpack around the well screen over the saturated interval with a minimum 1 foot of sandpack above the top of the screen.

b. 2± foot bentonite plug over the sandpack. The plug will be wetted and allowed to swell prior to grout injection.

c. Grout the remaining annular space with cement (containing 3 percent bentonite for shrinkage) using positive placement techniques.

A schematic of a completed extraction well is shown on Figure A.5.

Prior to installation of the extraction wells, each casing and screen will be cleaned with an Alconox detergent high pressure wash. Equipment and well construction materials will be protected from all forms of solvent and grease contact between final rinse and actual use at the well site.

A.4.2 MONITORING WELLS

The three monitoring wells will be installed using the same procedures as the extraction wells except for the following:

i) An eight-inch outside diameter hollow stem auger will be used.

ii) Each monitoring well shall consist of:

a. stainless steel well screen
   - 2-inch diameter
   - #10 slot
   - 5-foot length

b. black steel riser pipe
   - 2-inch diameter
   - 2-foot stick up above ground surface (optional-flush mount)
   - dry joint assembly will be used

c. lockable cap and lock.

A schematic of a completed monitoring well is shown on Figure A.6.

A.4.3 LANDFILL GAS PROBES

The six landfill gas probes will be installed in the locations shown on Figure A.7. The probes will be installed using the same procedures as the extraction wells except for the following:

i) No samples for physical testing will be collected.

ii) Each probe will extend to the base of the fill or to the top of the groundwater table whichever is shallower.

iii) A six-inch outside diameter hollow stem auger will be used.

iv) Each probe shall consist of:

a. PVC perforated pipe
   - 1-inch diameter
   - varying length based on depth to native material to within four feet of the ground surface
   - 1/8-inch diameter holes spaced every 1 inch. Vertically off-set by 90 degrees
   - wrapped in fiber glass cloth

b. PVC riser pipe

- 1-inch diameter
- 2-foot stick up above ground surface

v) The quartzite sand pack will extend from the bottom of the borehole to three feet below ground surface. The first foot of the remaining three feet will be filled with bentonite pellets. The bentonite will be hydrated and allowed to swell prior to placement of cement/bentonite grout in the remaining two feet.

A schematic of a complete landfill gas probe is shown on Figure A.8.

In order to minimize air infiltration during monitoring and also to obtain accurate pressure readings, the top end of the probe will be fitted with a stopcock and hose barb connection assembly as shown on Figure A.9.

A.5.0 SAMPLING PROCEDURES

The sample collection activities to be performed will require the collection of samples for both physical testing and chemical analysis. A summary of the sample collection activities is presented on Table A.1. Details of the sample collection procedures are presented in the following report sections.

A.5.1 GENERAL SAMPLING PROTOCOLS

The following protocols will be employed during all sampling throughout this program:

1. All sampling instruments and equipment will be cleaned in accordance with the protocols presented in Section A.7 prior to sampling at each location.

2. A new pair of disposable latex gloves will be used at each location to be sampled for chemical analyses. Additional glove changes will be undertaken as conditions warrant.

3. All sampling generated wastes such as gloves, tyveks, etc. will be collected and contained for on-Site disposal.

4. All samples collected for off-Site chemical analysis will be iced in laboratory supplied coolers after collection and labeling. Any

remaining space will be filled with packing to cushion the containers within the shipment coolers. Each cooler will be sealed with a transportation security seal containing the sampler's initials. The cooler will then be sealed with packing tape.

All samples will be delivered to the off-Site laboratory by commercial courier or Contractor personnel, within 24 hours following sample collection or as noted.

5. Samples will remain under the control of the Steering Committee's Site Representative until relinquished to the laboratory or commercial courier under a chain-of-custody (see QAPP, Appendix C).

6. Samples shall always be returned to locked storage at the end of each day. Samples shall not be stored overnight in areas other than a secured storage area.

Additional protocols specific to each sampling method are presented in the following sections.

A.5.2 SOIL SAMPLING

The soil samples will be tested for physical parameters only. Subsurface soil sampling will be conducted according to the following protocols:

1. Prior to drilling/excavating the initial location, the drilling rig, backhoe and all downhole equipment will be cleaned according to the protocol established in Section A.7. For all subsequent borehole locations (at which wells are not to be installed), gas probe locations and test pits/trenches, cleaning of the drilling rig, backhoe and downhole equipment will not be performed unless chemical presence on the equipment is observed. At the borehole location at which wells are to be installed, cleaning will be performed according to the protocol presented in Section A.7.

2. Prior to use at each sampling location and/or interval, split-spoon samplers and all other instruments used in collecting soil samples for physical testing will be cleaned according to the protocol presented in Section A.7.

3. Soil samples retained for geologic records will be collected and stored in new, clean 500 mL wide-mouth clear glass containers.

4. Subsurface soils will be collected from the 52 perimeter boreholes and from the test pits/trenches for grain size distribution analysis and moisture content analysis. Representative soil samples will be collected from each borehole of the native materials. Samples from each different geologic layer of substantial thickness within these boreholes as determined by the Site Geologist will be submitted for analysis. Undisturbed samples of the clay/till material from every second borehole exhibiting clay/till as the confining unit will also be submitted for permeability and Atterburg limit testing. The sample for

permeability and Atterburg limit testing will be collected using a Shelby Tube. In addition, a sample of the fine-grain soils from approximately every fifth borehole (i.e. 10 samples total) will also be submitted for permeability testing. A sample of the native material underlying the fill in each test pit/trench, if exposed, will be submitted for grain-size analysis and moisture content. A summary of the samples to be collected is presented in Table A.1.

5. Soil samples will be labeled noting the location, depth interval, date, time and sampler's initials. A hard-cover bound field book will be maintained to record all soil samples and sampling events.

6. All samples will be delivered to the laboratory by commercial courier or on-Site personnel.

7. Split spoon soil samples will be collected using a 3-inch diameter 24-inch long carbon steel split spoon. The sample will be screened with a photoionization detector upon opening and the readings recorded in a bound field book.

8. All excess fine-grained soils (i.e. fine sands and silts) from the borehole split spoons will be placed in a drum for use in the slurry compatibility testing, if required. The depth interval and volume of material placed in the drum will be recorded in a bound field book.

A.5.3 <u>EXTRACTION WELL SAMPLING</u>

Groundwater samples will be collected from each prototype extraction well on three occasions. Once after the first 10 minutes of the step test, and after 24 hours and at the end (48 hours) of each constant rate pumping test. All samples will be analyzed for the TCL and TAL parameters. The last sample collected at each well (48-hour sample) will be analyzed for the additional parameters listed in Table A.2. In addition, 10 gallons of groundwater will be collected in two-gallon clean glass bottles from each extraction well at the end of each 48-hour pumping test for use in the groundwater treatability study, if required (Appendix E).

Extraction well sampling will be carried out according to the following protocols:

1. A new pair of disposable latex gloves will be used for sampling each well. Additional glove changes will be undertaken as conditions warrant.

2. Samples will be collected via a sampling port installed in the discharge line at the well head. Samples will be collected by filling the sample glassware directly from the flowing stream of the sampling port. The flow rate from the sampling port will be adjusted such that minimal aeration occurs in the discharge from the sampling port.

3. Sufficient groundwater will be collected for chemical analysis and for use in the treatability study. Specific conductivity, temperature, turbidity and pH will be measured in the field.

4. QA/QC samples will be collected in accordance with the schedule presented on Table A.3. Duplicate samples will be collected concurrently with the original samples, therefore, sampling equipment will not be decontaminated before the collection of the duplicate. Field blanks will be collected using only deionized demonstrated analyte free water supplied by the lab.

5. Samples will be labeled noting the well locations, sampling dates and times and sampler's initials. A hard cover bound field book will be maintained to record all groundwater samples and sampling events.

6. Sample containers will be prepared using washing procedures that meet or exceed the requirements of the specified methods. Sample containers will be shipped to the Site in sealed containers from a single lot of prepared bottles.

A.5.4 MONITORING WELL PURGING

Monitoring well GW-2S will be sampled during the same time period that the prototype extraction wells are being tested. The well will be sampled for the full list of parameters presented on Table A.2. In addition, a ten-gallon sample will be collected for use in the treatability study

(Appendix E). Prior to sampling, the well will be purged in accordance with the following protocols, prior to sampling for the treatability study:

1. All personnel involved in purging or sampling must wear protective clothing including Tyvek coveralls, rubber boots and rubber gloves.

2. Water levels in the well will be measured to $\pm$0.01 foot prior to purging.

3. The objective of purging is to ensure that a sufficient volume of water is extracted prior to sampling to ensure that the sample is representative of the actual groundwater conditions.

   A minimum of three well volumes of water will be removed when possible. After each well volume is removed, a sample will be collected and analyzed for temperature, pH and conductivity. Field measurements of pH (using a Fisher Model MDL-107 pH meter or equivalent), conductivity and temperature (using a YSI Model 33 SCT meter or equivalent) will be taken during well purging. Calibration of field instruments will be undertaken as described in the QAPP (Appendix C). Purging will continue until a maximum of five well volumes have been removed or until three consecutive and consistent readings of conductivity, temperature, and pH are obtained. Conductivity temperature and pH readings will be considered consistent if all three values are within 10 percent of the average value or within $\pm$1 pH unit of the average value. If the above criteria have not been met after the maximum five well volumes have been removed, a decision will be made by the NYSDEC and the Steering Committee's field representatives regarding sampling of the well.

4. If recharge is insufficient to conduct the purging protocol described in 3. above, the well will be pumped/bailed to dryness on three consecutive days prior to sampling.

5. Acceptable methods of water extraction during purging include bailers, peristaltic pumps, bladder pumps, Waterra pumps, centrifugal and submersible pumps.

6. All water extraction equipment will be cleaned in accordance with the protocols presented in Section A.7.

7. All purge water will be collected and stored for later disposal as described in Section A.6.2.

A.5.5 MONITORING WELL SAMPLING

Following well purging, sampling of monitoring well MW-2S will be carried out according to the following protocols:

1. Sampling will be done as soon after purging as possible.

2. A new pair of disposable latex gloves will be used for sampling the well. Additional glove changes will be undertaken as conditions warrant.

3. The monitoring well will be sampled using either a bottom filling bailer with a stainless steel leader attached to a nylon or polypropylene rope or using a suitable sample pump. Sampling bailers will be constructed of either teflon or stainless steel and a new length of rope will be used at each well. Suitable sampling pumps include peristaltic pumps (for the semi-volatiles) and bladder pumps. If peristaltic pumps are used, the volatile portion will be collected using a bottom loading bailer prior to collection of the semi-volatile sample portion.

   Prior to use, the bailer or pump will be cleaned as specified by Section A.7.

4. Sufficient groundwater will be collected for chemical analysis and for use in the treatability study. QA/QC sample requirements are provided on Table A.3 and discussed in Section A.5.3, item 4. Ten gallons of groundwater will be collected in two-gallon clean glass bottles.

   Sample containers will be prepared using washing procedures that meet or exceed the requirements of the specified methods as specified in Section C.5.0 of the QAPP (Appendix C). Sample containers will be shipped to the site in sealed containers from a single lot of prepared bottles.

5. Samples will be labeled noting the well location, date, time and sampler's initials. A hard-cover bound field book will be maintained to record all groundwater samples and sampling events.

A.5.6 LANDFILL GAS PROBE MONITORING

The six landfill gas probes will be monitored on a weekly basis during predesign field activities or for a maximum two month period, whichever occurs first. All monitoring will be conducted in the field using portable instruments. Each probe will be monitored for gas pressure, combustibility, organic vapors and water levels within the probe using the following protocols:

1. Landfill gas pressure will be measured using a Dwyer Magnahelic Pressure Gauge or performance equivalent. The pressure gauge will be connected to the gas probe's hose barb via the equipments flexible hose extension. The stopcock on the gas probe will be placed in the open position prior to the measuring and recording of data and placed in the closed position when complete. An airtight seal between the hose barb of the gas probe and the flexible hose extension of the pressure gauge will be ensured prior to measurement. The pressure gauge will be operated in accordance with the manufacturer's instructions.

2. Combustible gases will be measured using an oxygen/combustible gas detector. The entire stopcock and barb assembly will be unthreaded

from the one-inch adapter and the detector held immediately contiguous to the open top of the riser.

3. Organic vapors will be measured using a photoionization detector utilizing the same procedure as in 2.

4. Groundwater levels in the landfill gas probes will be monitored to ensure that a rise in the groundwater level has not saturated the monitoring interval of the probe. Groundwater levels will be monitored using a standard electronic water level indicator. To record water levels within the gas probe, the entire stopcock and hose barb assembly will be unthreaded form the one-inch diameter male adapter. Upon completion of the water level measurements, the stopcock and hose barb assembly will be threaded back on to the riser pipe.

5. The various measurements described above will be performed in the following order:
   - Obtain pressure reading;
   - Obtain combustible gases reading;
   - Obtain organic vapors reading and record the steady-state (continuous) gas reading; and
   - Obtain the water level, if any, within the probe.

6. The stopcock on the gas probe is to be left in the closed position subsequent to the completion of monitoring.

7. All measurements will be recorded in the field book along with monitoring date and time so that the data obtained can be cross-referenced with atmospheric data obtained from the Buffalo Airport meteorological station.

8. Each instrument will be calibrated on a daily basis in accordance with the manufacturer's specifications.

A.5.7 SAMPLE CONTAINERS, PRESERVATION, PACKAGING AND SHIPPING

Required sample containers, sample preservation methods and maximum sample holding times are summarized in Table A.4.

Aqueous samples submitted for VOC analyses will be preserved with 1:1 HCL to pH <2. 1:1 HCL will be prepared from ultra-pure HCL and analyte-free water. The sample pH will be confirmed with pH paper after preservation.

Aqueous samples submitted for metals analyses will be preserved with ultra-pure NHO3 to pH <2. The sample pH will be confirmed with pH paper after preservation.

Aqueous samples submitted for cyanide analysis will be preserved with NaOH to a pH >12. The sample pH will be confirmed with pH paper after preservation.

Aqueous samples submitted for COD and TOC analysis will be preserved with H_2SO_4 to a pH <2. The sample pH will be confirmed with pH paper after preservation.

A.5.8 TESTING OF THE PROTOTYPE GROUNDWATER COLLECTION SYSTEM

The objective of the pumping tests is to provide sufficient hydraulic and water quality data for the detailed design of the groundwater extraction system and sizing of the groundwater pretreatment system, if required. Specifically, the tests will provide data for the following:

i) determination of overburden hydraulic characteristics to assist in the design of the overburden groundwater collection system;
ii) determination of zones of capture; and
iii) determination of overburden groundwater quality to evaluate the alternatives of direct discharge to the local POTW (the preferred alternative) or pretreatment prior to discharge to the local POTW.

Pumping tests will be performed on the installed prototype extraction wells. Prior to the tests, groundwater levels will be monitored for a 48-hour period of time at the wells presented on Table A.5 to establish static water levels. The tests will include step-drawdown tests and a constant-rate pumping test.

A step-drawdown test will be conducted in advance of the constant-rate pumping test. The results of the step-drawdown test and water treatment considerations will be used to determine the pumping rate for the constant-rate test. The step-drawdown test will consist of pumping the well at three different increasing flow rates each for a period of one hour. Pumping at the three different rates will be performed in succession over a three hour period, if practical. A review of the existing data indicates that preliminary pumping rates for the step drawdown test of 4, 8 and 12 gallons per minute (gpm) are appropriate. Upon completion of the step-drawdown test, the drawdown data will be plotted on semi-logarithmic graph paper. The slope of the drawdown curves will be examined to determine the highest pumping rate the well would be expected to maintain for a 48-hour period.

The constant-rate pumping test will be conducted on each prototype extraction well for 48 hours at the maximum pumping rate determined from the results of the step-drawdown test consistent with the practicality of available water treatment (maximum allowable pumping rate will not exceed 25 gpm). Water levels will be measured in the prototype extraction well and in the nearby monitoring wells during the test. The observation wells to be monitored during the constant-rate pumping test are shown on Figure A.4 listed on Table A.5. In the event that steady state conditions have not occurred within the 48 hours of the test, consideration will be given to extending the test for up to 24 hours as mutually agreed by the field representatives of the Steering Committee and NYSDEC.

Water level measurements in the prototype extraction wells and the observation wells will be obtained by means of pressure transducers and dataloggers. These dataloggers will provide continuous groundwater level data. The water levels in the observations wells will be confirmed at four hour intervals during the first 12 hours of the test and every eight hours thereafter using manual water level indicators. The water levels in the pumping well will be confirmed at hourly intervals. The water level indicators will be cleaned between measurements in different observation wells. The pumping test flow rate will be continuously recorded using a flow meter with a flow totalizer.

Following termination of pumping, water levels in the prototype extraction well and monitoring wells will be monitored for a period of six hours or until 80 percent of recovery is achieved, whichever is longer, to assess recovery.

Data from the constant-rate pumping test will be used to calculate overburden hydraulic parameters (transmissivity, storativity) at the prototype extraction well locations and to evaluate the extent of the capture zone. The drawdown and recovery data will be reduced and analyzed by the methods of Theis (1935) and/or Cooper and Jacobs (1946), and/or Neuman (1975) as appropriate.

The hydraulic parameters determined from the testing program will be assessed along with all previously collected data to conceptualize the overburden for evaluation of a groundwater extraction system by means of two-dimensional steady-state horizontal groundwater flow model (FLOWPATH, Franz and Guiger, 1992). FLOWPATH is a finite difference numerical model using the block-centered finite difference scheme. This model can simulate two-dimensional steady state groundwater flow in confined and unconfined aquifers. The model can incorporate heterogeneous aquifer characteristics, boundary conditions, infiltration and extraction/injection wells. This model is also capable of performing particle tracking which can be used to delineate extraction well capture zones.

All water generated during pumping will be handled in accordance with the protocols presented in Section A.6.2.

Monitoring of groundwater quality with time will be accomplished by sampling the effluent from each prototype extraction well 24 and 48 hours after the start of the 48-hour pumping test. A groundwater sample also will be collected from each prototype extraction well 10 minutes after initiation of the step-test. In addition, a sample will be collected from well GW-2S due to the detection of halogenated hydrocarbons at this well at elevated concentrations (21,040 µg/L). This class of compounds was not detected at elevated concentrations in wells GW-14S, GW-15S and GW-16S. A sampling and analysis summary is provided on Table A.1. The protocols presented in the QAPP (Appendix C) and the HSP (Appendix B) will be followed during sample collection and analysis.

All samples collected from the prototype extraction wells will be analyzed for the TCL and TAL parameters. In addition, the last sample collected from each test extraction well (48-hour sample) and the sample collected from well GW-2S will be analyzed for additional parameters to provide data necessary for evaluation of design of various treatment systems, if required (see Appendix E). These parameters are presented in Table A.2.

At the completion of each 48-hour pumping test, an additional ten gallons of water will be collected from each extraction well for use in the groundwater treatability studies, if required, discussed in Section 2.7. An additional ten gallon sample will also be collected from well GW-2S.

A.6.0 HANDLING OF MATERIALS GENERATED DURING PRE-DESIGN ACTIVITIES

A.6.1 SOLIDS

Borehole drill cuttings and excess soils from split-spoon samples not retained for geologic samples generated during the predesign soil investigations shall be replaced in the borehole in the order from which they were removed pursuant to "NYSDEC Technical and Administrative Guidance Memorandum (TAGM)" - Disposal of Drill Cuttings dated November 1989. The final six inches of the borehole shall be backfilled with material consistent with the surrounding surface. Excess materials which cannot be replaced within the borehole shall be spread on Site in the immediate vicinity of the borehole.

Excavated soils from the test pits/trenches will be placed back in the excavation in the reverse order from which they were removed. If drums are encountered, they will be handled pursuant to the procedures presented in Section A.6.3. Spilled contents from the drums and materials immediately contiguous to the drums that have been visually impacted by the spilled drum contents will be visually segregated and placed in containers for appropriate disposal.

Personal Protective Equipment (PPE) generated during the predesign activities will be containerized in 55-gallon drums and temporarily staged on the existing IRM staging pad for on-Site disposal.

A.6.2 GROUNDWATER

To the extent practical, all groundwater extracted during predesign activities shall be discharged to the POTW without pretreatment. Prior to discharge to the POTW, influent restrictions shall be reviewed with the Erie County Sewer Authority. If discharge to the POTW without pretreatment is not possible, discharge to Ellicott Creek after on-Site pretreatment (i.e. bag filter and activated granular carbon) will be evaluated. If discharge of predesign treated groundwater to Ellicott Creek is not possible, alternate treatment and/or discharge options, i.e. transport to and treatment at an appropriate facility, shall be evaluated.

A.6.3 DRUM AND CONTAINERIZED WASTE HANDLING PROTOCOLS

A.6.3.1 General

During predesign activities, it is possible that buried drums or drum parts may be encountered. If drums or drum parts are encountered, the following protocols will be implemented.

This section applies to all activities involved in the handling of drums or drum parts from the point of excavation to placement in the existing IRM Encapsulation Cell or to storage at the existing IRM staging pad. The drums may have or do contain potentially hazardous waste materials in either solid or liquid state. The procedures described within this section specify the minimum requirements that will be implemented to minimize the potential for migration of waste constituents to the surrounding environment, and exposure to the workers and surrounding population.

The handling and transport of drummed waste will be, at all times, conducted in a controlled and safe manner which will minimize damage to structurally sound drums, repacks or overpacks and prevent the release of the contents. Section A.6.3.2 addresses drum handling procedures and equipment to be used.

A.6.3.2 Equipment

a) Safety Equipment

During the handling of drums, safety apparel and equipment as specified in the HSP, will be worn or used at all times. In particular, level B protection which includes Self-Contained Breathing Apparatus (SCBA) will be worn at all times while handling drums or containers whose contents are unknown.

b) Handling Equipment

All handling, moving and transporting of drums will be performed with mechanical equipment whenever possible. Drums shall be moved by grappler, non-metallic slings, within a backhoe bucket or front-end loader or by other means that will minimize damage to drums and release of contents therefrom. Movement or handling by personnel may be required in the event that mechanical means cannot be properly or safely employed due to drum breakage or leakage.

All handling and transport equipment will be equipped with Class ABC fire extinguishers and shall comply with 29 CFR § 1910.157 and SCBA if deemed necessary by the Site Safety Officer.

All equipment used for the handling and transport of drums or containers will be regularly maintained.

Prior to removal from the Site, equipment will be decontaminated within the equipment decontamination facility.

A.6.3.3 Drum Handling

a) Working Groups

During excavation activities, a team of personnel specifically trained in the handling of containerized waste will be designated to perform this task. This team will contain no fewer than two people. During the handling of containerized waste, visual contact will be maintained between members of the working team at all times. All team members will be able to communicate with ease between themselves and will comply with HSP requirements. All communications will be transmitted via hand signals (during activities requiring SCBA) or verbal (during all other activities) in accordance with 29 CFR § 1910.120(j)(5)(iv) with the exception of heavy equipment operations. Heavy equipment operators will be in radio communication with the field crew supervisor.

b) Point-of-Excavation Handling

As containerized waste is encountered, and prior to physically handling a drum, a visual description of the drum, labeling information (if available and legible) and the condition of the drum or container as it appears in the excavation will be recorded prior to being placed in overpack drums.

If, during this inspection, an open or leaking drum or container is observed to contain liquids, the liquids will be pumped or bailed into a repack drum prior to removing the drum or container from the excavation. Portable pumps, if used, will be intrinsically safe. If an open drum or container is identified to contain solids, the drum or container will be carefully removed from the excavation. If the container is neither open nor leaking, the container will be carefully removed from the excavation and examined for structural and hydraulic integrity. Drums that cannot be moved without rupture, leakage or spillage will be emptied, into a DOT approved 85-gallon salvage drum using a portable hand pump (for liquid wastes) or a hand shovel (for sludges). All intact drums with contents will be overpacked into DOT approved 85-gallon salvage drums prior to removal to the staging facility. Drums shall be removed from the excavation by grappler, non-metallic slings, within the backhoe bucket or by other means that will minimize damage to drums and release of contents therefrom. Free liquids from leaking drums will be collected using an absorbent material.

After overpacking, the drums will be transported to the IRM drum staging area with a front-end loader or fork lift configured with a suitable carrying apparatus and placed on pallets. All drums will be oriented to permit sampling of each individual drum for waste characterization. Sufficient area to permit forklift truck access to the drums will be maintained. All overpacked containers will be opened and sampled at the staging area.

All empty drum carcasses, drum parts, lids, and associated debris will be consolidated adjacent to the excavation in a roll-off container prior to placement in the existing IRM Encapsulation Cell. Drum parts shall be removed from the excavation by grappler, non-metallic slings, within the backhoe bucket or by other means, as approved by the NYSDEC and safety protocols under OSHA.

A.7.0 EQUIPMENT CLEANING PROTOCOLS

Prior to mobilization, the drilling rig, backhoe and all associated equipment will be thoroughly cleaned using a pressurized low volume water wash or steam clean to remove oil, grease, mud and other foreign matter. In addition, before initiating drilling at each location, the augers, cutting bits, samplers, drill steel and associated downhole equipment will be thoroughly cleaned, at a designated wash station, to prevent potential cross-contamination from the previous drilling location. Prior to removal from the working area, drilling and excavation equipment will have loose mud removed and will then be driven under their own power to the decontamination facility. The equipment will be inspected by the Site Representative after cleaning and prior to initiation of drilling. Cleaning will be accomplished by flushing and wiping the components to remove all visible sediments followed by a thorough pressurized wash. Special attention will be given to the threaded sections of the drill rods and split spoon samplers.

All equipment used for the collection of samples for chemical analysis including bailers and pumps will be cleaned according to the following protocol:

- wash and scrub with low phosphate detergent
- tap water rinse
- rinse with 10 percent HNO_3, ultrapure
- tap water rinse

- an acetone only rinse or a methanol rinse followed by hexane rinse (solvents must be pesticide grade or better)
- thorough rinse with deionized demonstrated analyte free water supplied by the lab. The volume of water used must at least be five times the volume of solvent used in step e.
- air dry, and
- wrap in aluminum foil for transport

Tap water may be used from any municipal water treatment system. The use of an untreated potable water supply is not an acceptable substitute. If metals samples are not being collected, the 10 percent nitric acid (HNO_3) rinse may be omitted, and if organics samples are not being taken, the solvent rinse may be omitted.

All cleaned equipment will be placed on polyethylene sheeting or aluminum foil in order to avoid contacting a contaminated surface before use.

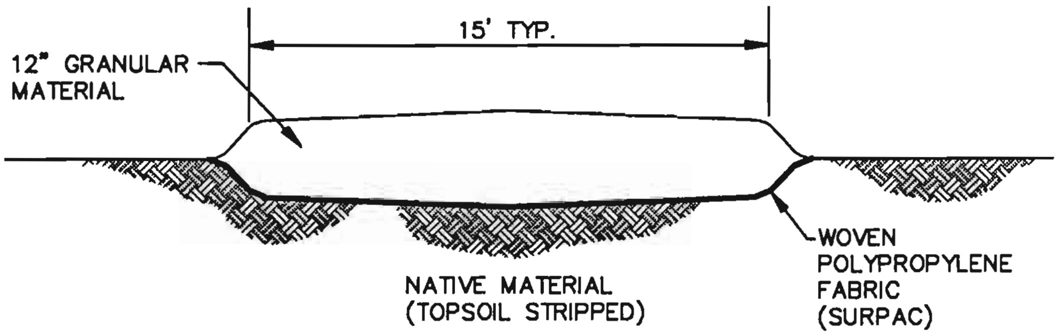
Before use and between each well, the water level measuring device will be cleaned by rinsing with detergent solution followed by a deionized water rinse. Solvent rinses will not be used because of their potential to damage the instruments.

All equipment used for the collection of samples for physical testing only, including split spoons and trowels, will be cleaned according to the following protocol:

- water wash to remove all foreign material;
- use wire brush if required to remove all adhering visible soils; and
- water wash.

All spent cleaning solvents will be kept separate from the water washes. The water washes will be treated/disposed using the procedures presented in Section A.6.2 for groundwater. The spent cleaning solvents will be analyzed to determine appropriate disposal/treatment requirements.

All decon activities will be performed at the existing IRM decon facility.



ACCESS ROAD DETAIL

N.T.S.

figure A.1

TYPICAL ACCESS ROAD PROFILE
Pfohl Brothers Landfill, Cheektowaga, New York

CRA

1979 (4) OCT 21/92 REV.0 (D-06)

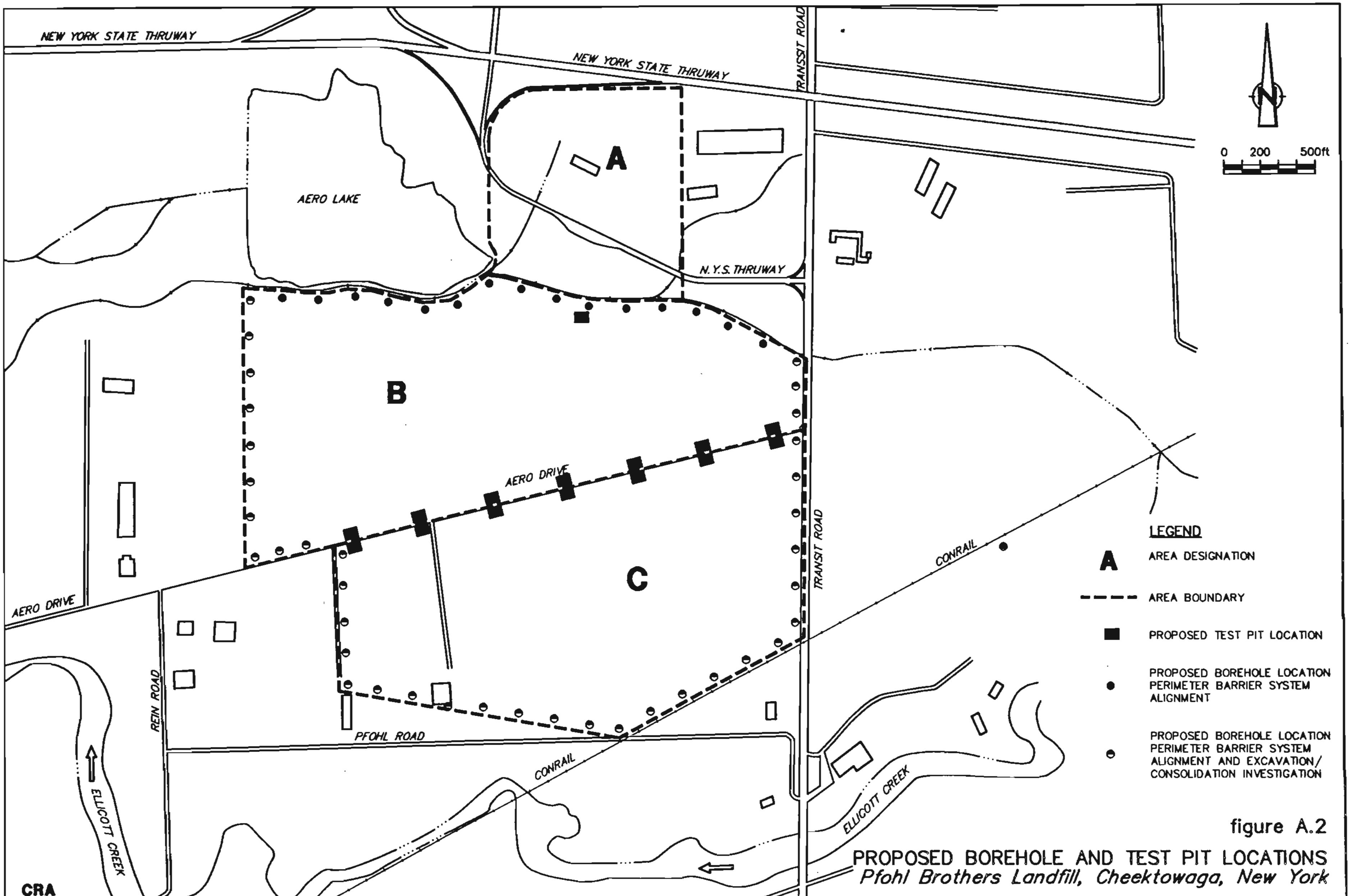
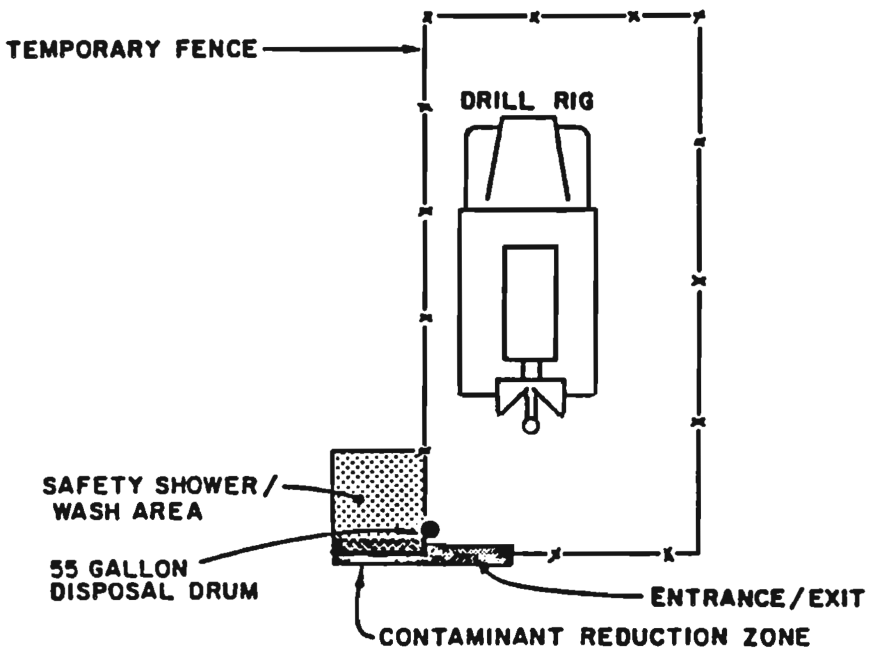


figure A.2

PROPOSED BOREHOLE AND TEST PIT LOCATIONS
Pfohl Brothers Landfill, Cheektowaga, New York

1979 (4) OCT 21/92 REV.0 (P-12)



NOTE: 1) THE SAFETY SHOWER / WASH AREA WILL BE EQUIPPED WITH:

- A PORTABLE EMERGENCY EYE WASH SHOWER UNIT
- A FIRST-AID KIT
- AN AIR PACK (SCBA)
- A FIRE EXTINGUISHER
- TOWELS / WIPE CLOTHS
- HAND WASH UNIT

2) PERSONNEL TRAFFIC AREAS WITHIN THE SURVEY SITE WILL BE COVERED WITH POLYETHYLENE SHEETING OVERLAIN BY PLYWOOD

figure A.3

TYPICAL DRILL RIG AREA SETUP

Pfohl Brothers Landfill, Cheektowaga, New York

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1979 (4) OCT 21/92 REV.1

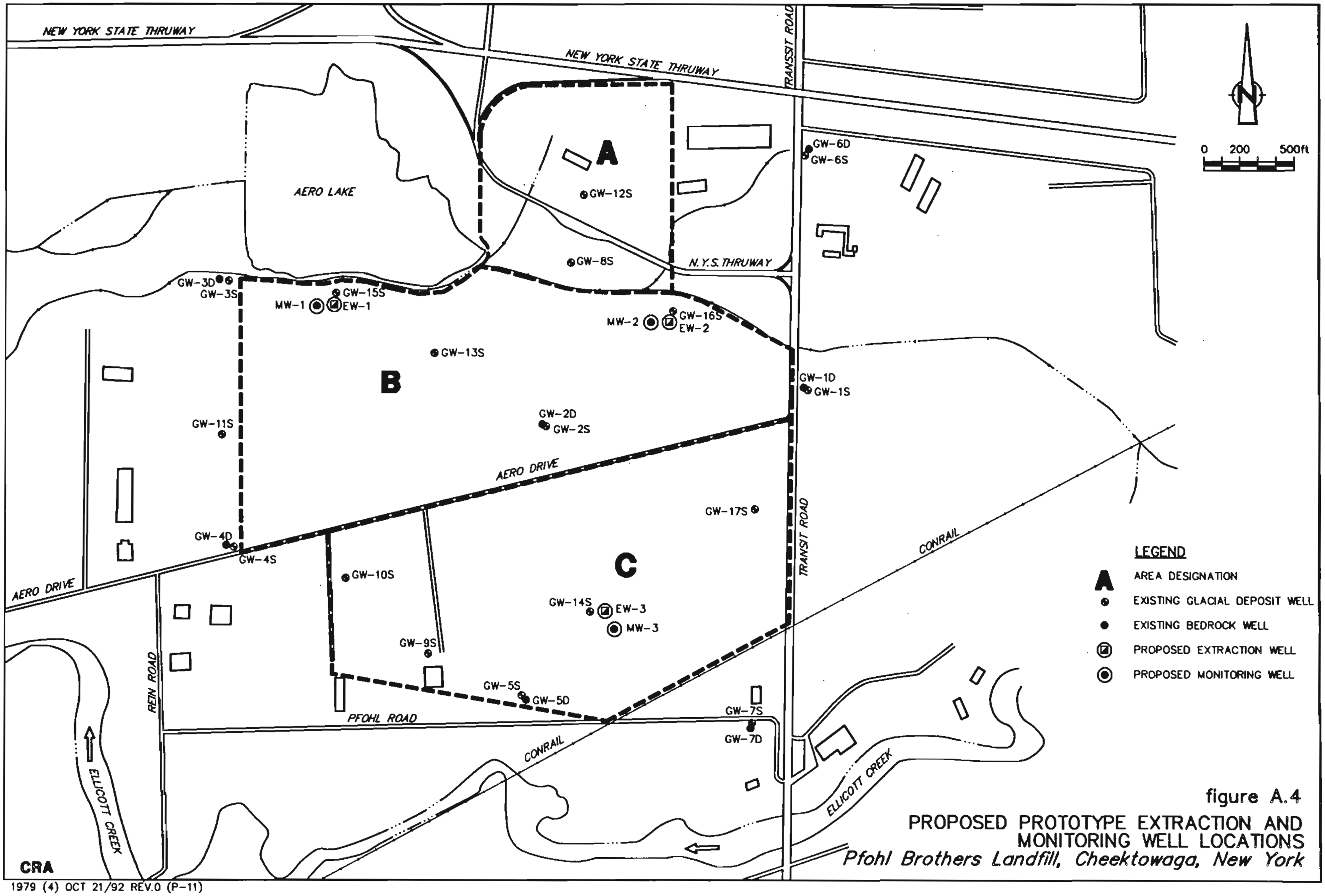

figure A.4
PROPOSED PROTOTYPE EXTRACTION AND MONITORING WELL LOCATIONS
Pfohl Brothers Landfill, Cheektowaga, New York

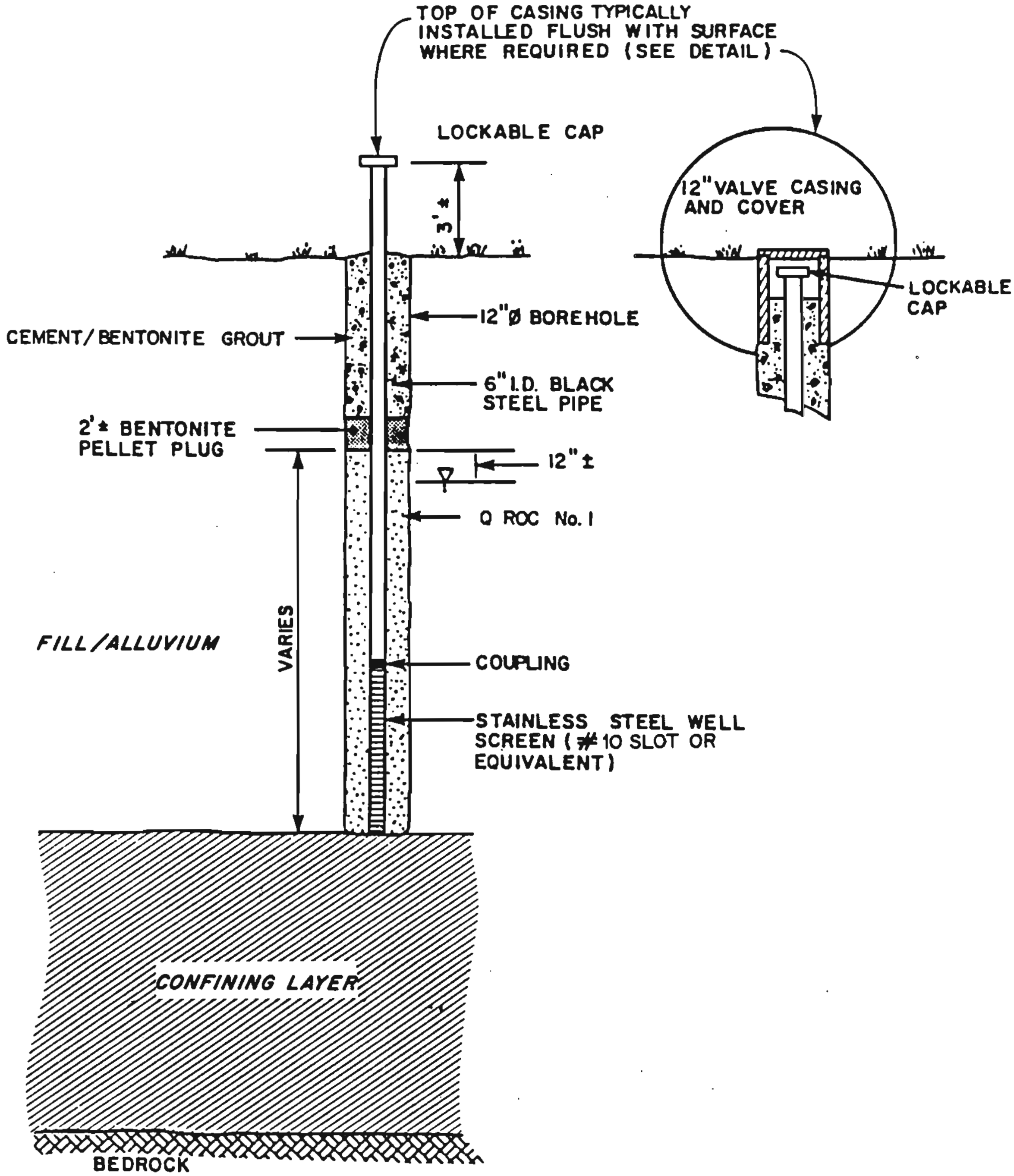

figure A.5

TYPICAL PROTOTYPE EXTRACTION WELL DETAIL

Pfohl Brothers Landfill, Cheektowaga, New York

CRA

1979 (4) OCT.20/92–REV.1

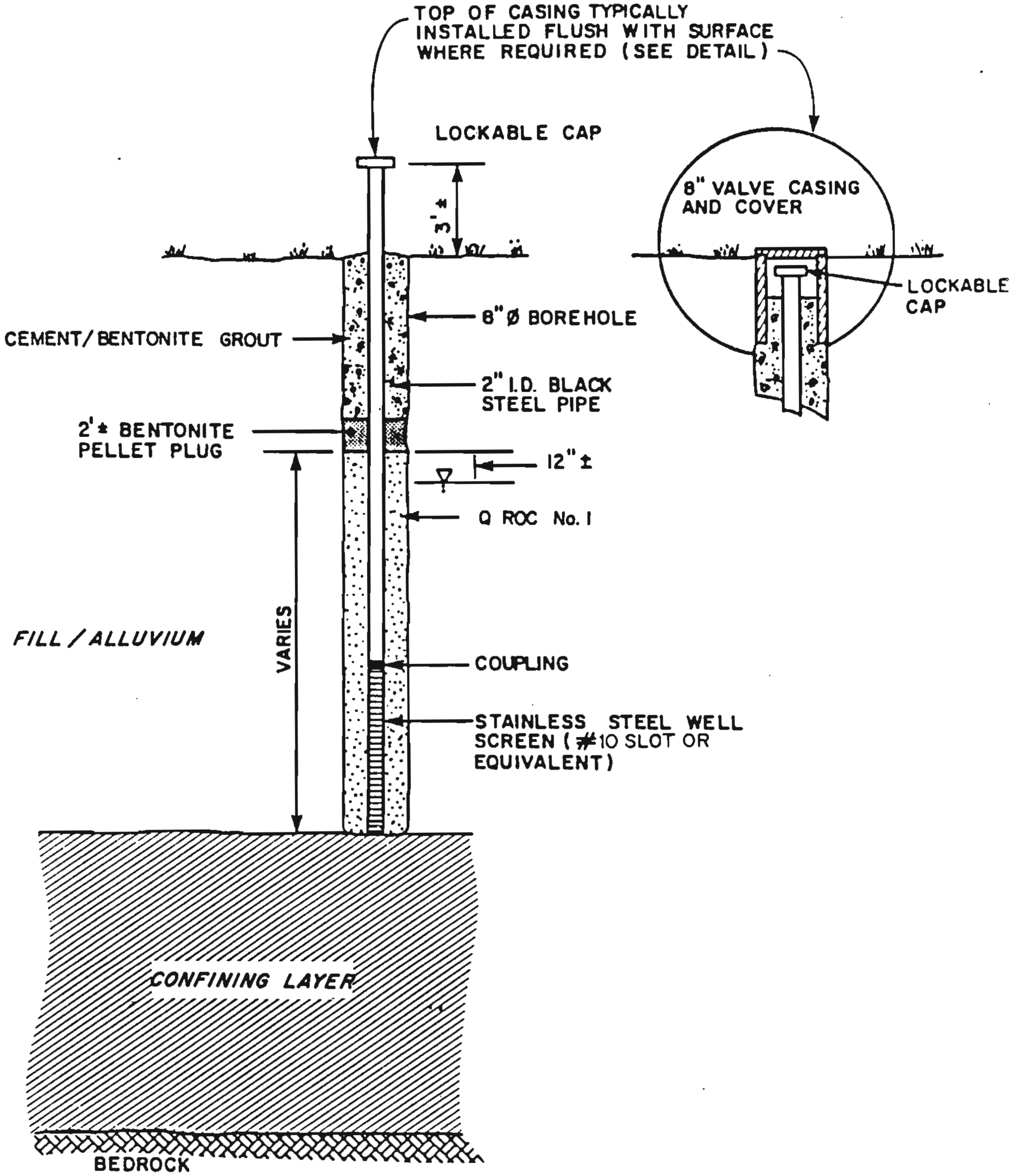

figure A.6

TYPICAL MONITORING WELL DETAIL

Pfohl Brothers Landfill, Cheektowaga, New York

CRA

1979 (4) OCT.20/92–REV.1

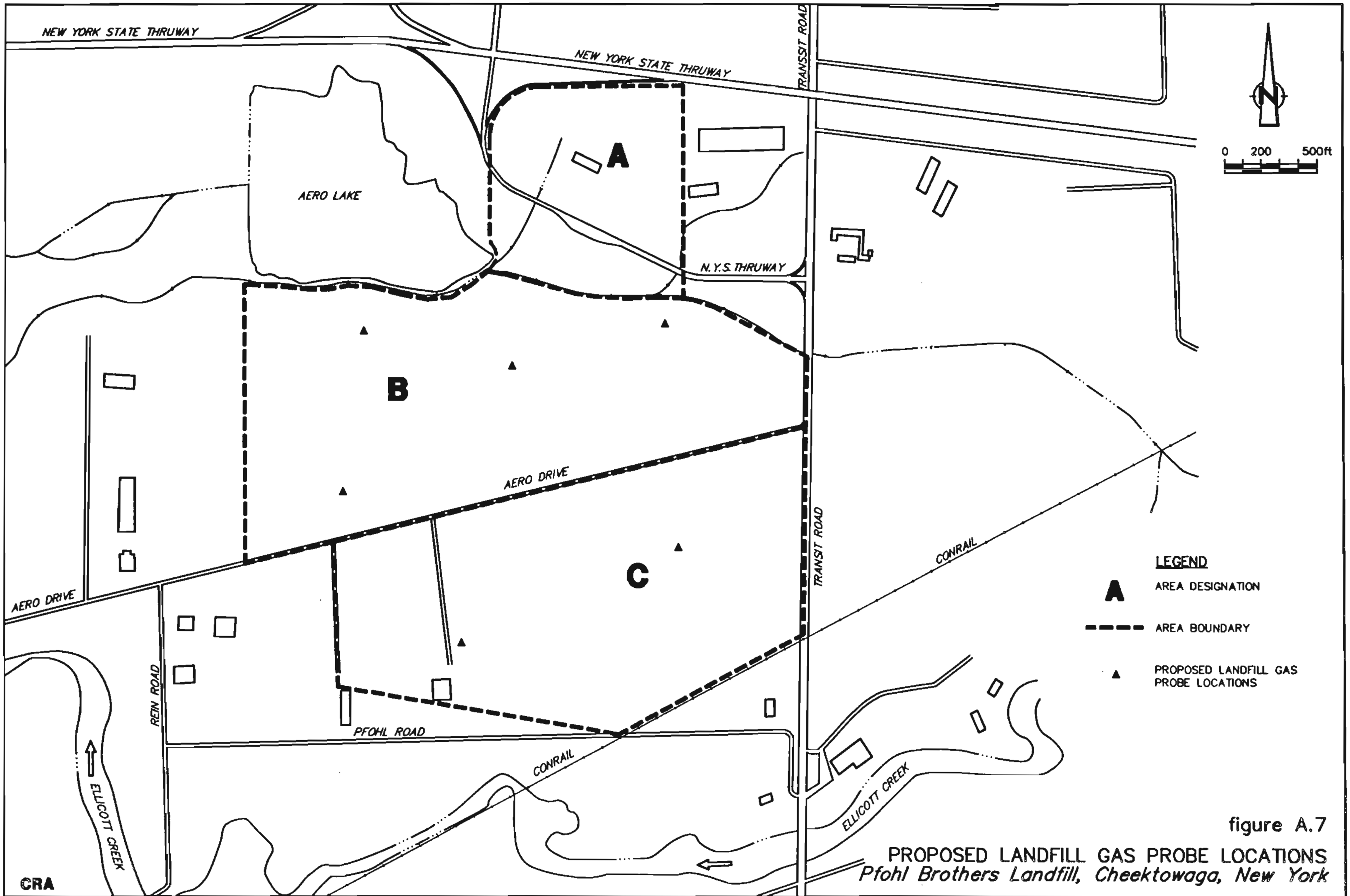

figure A.7

PROPOSED LANDFILL GAS PROBE LOCATIONS
Pfohl Brothers Landfill, Cheektowaga, New York

1979 (4) OCT 29/92 REV.0 (P-14)

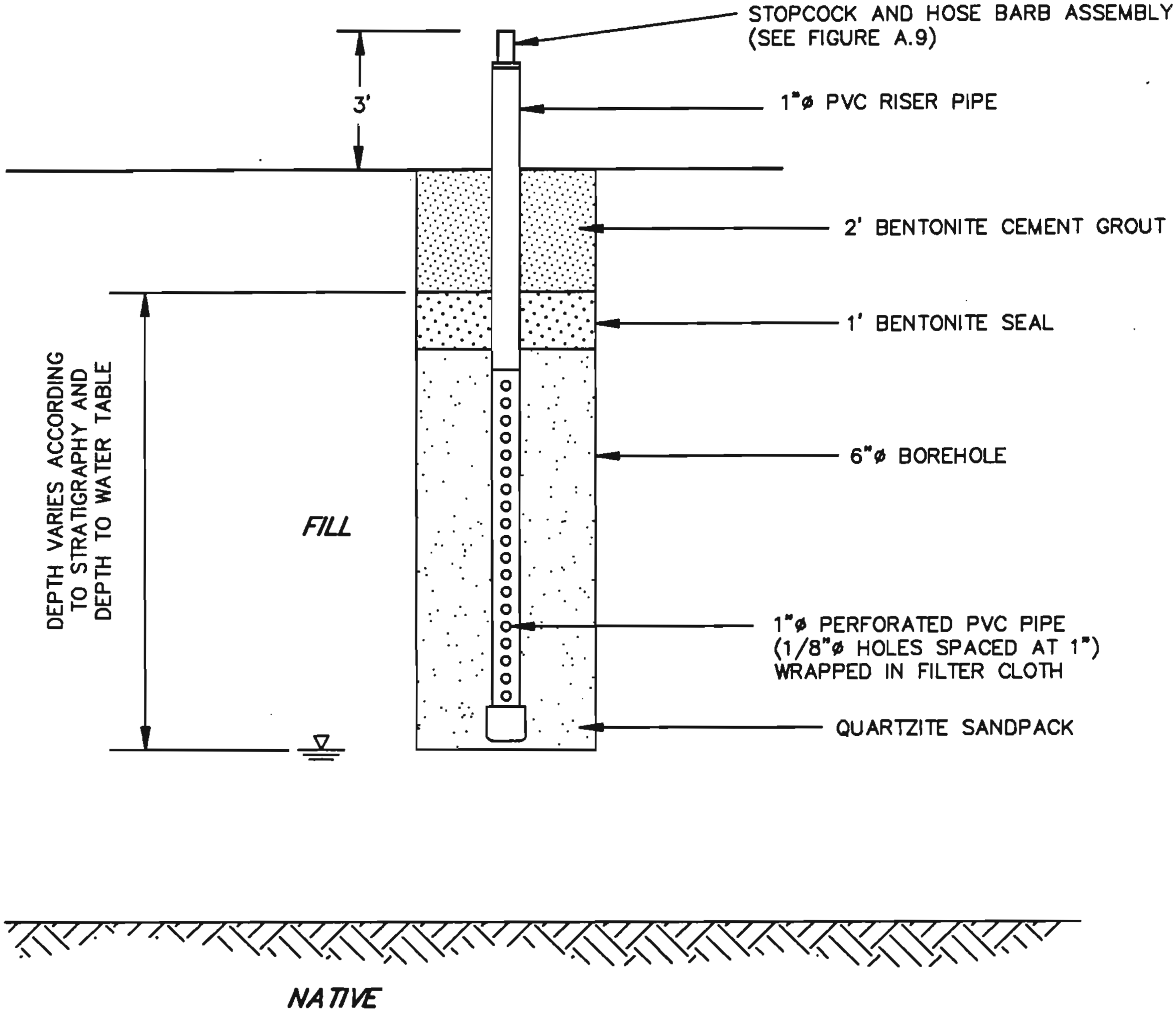

figure A.8

TYPICAL LANDFILL GAS PROBE DETAIL

Pfohl Brothers Landfill, Cheektowaga, New York

CRA

1979 (4) OCT 30/92 REV.0 (D-08)

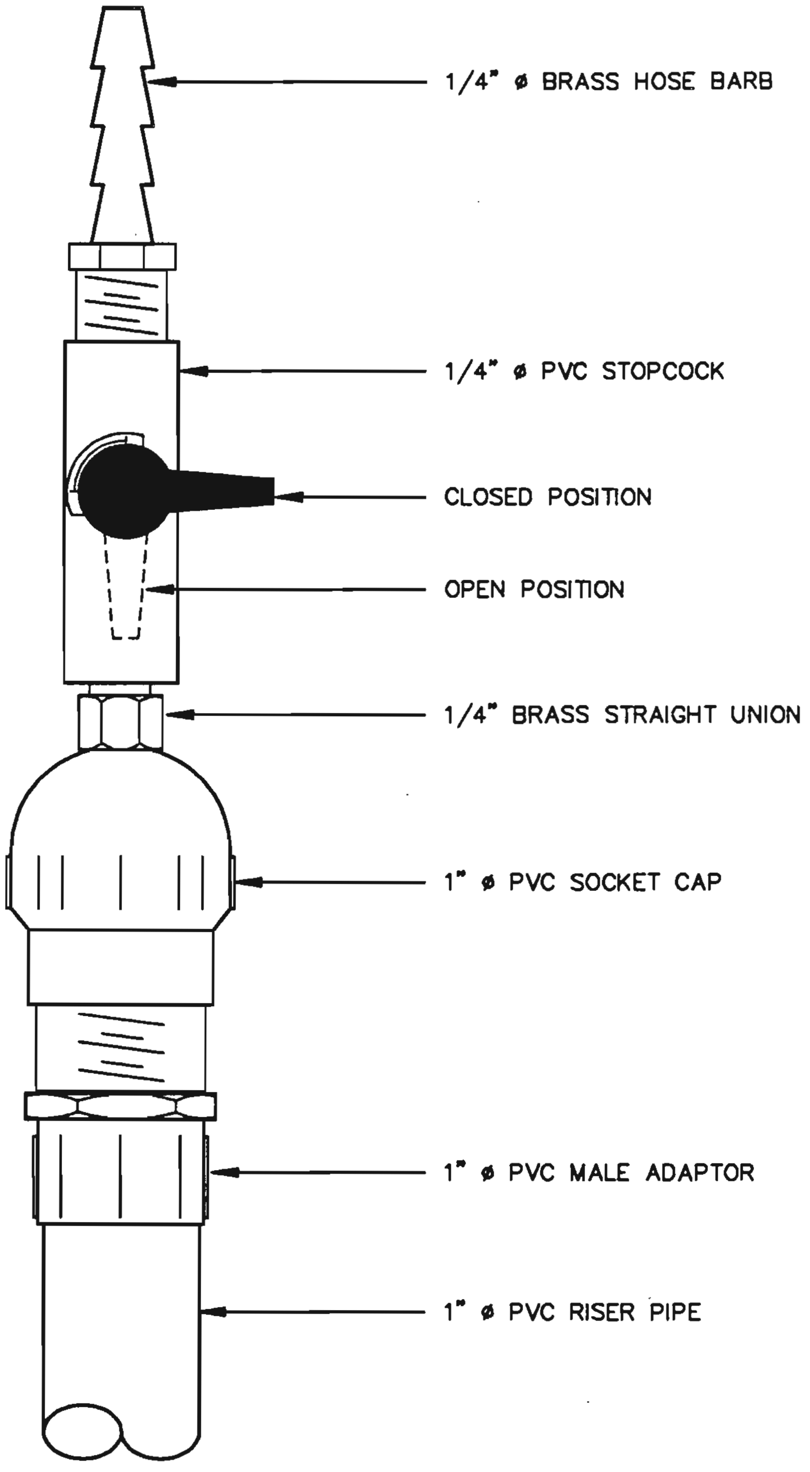

figure A.9
GAS PROBE TIP ASSEMBLY
Pfohl Brothers Landfill, Cheektowaga, New York

CRA

1979 (4) OCT 30/92 REV.0 (D-07)

TABLE A.1

SUMMARY OF SAMPLING ACTIVITIES

A.	*Physical Test*	*Test Procedure*	*Location*		*Number of Samples (1)*	*Sample Container*
	Grain Size Distribution	ASTM D422	Boreholes	Native Soils (4)	156	1 x 500 mL glass
			Test Pit/Trenches	Native Soils Underlying the Fill	14	1 x 500 mL glass
	Permeability	Constant Head ASTM 2434	Boreholes (Shelby Tubes)	Fine-Grain Clay/Till	10 (3) 26	1 x 500 mL glass Shelby Tube
	Moisture Content	ASTM D2216	Boreholes	Native Soils (4)	156	1 x 500 mL glass
			Test Pit/Trenches	Native Soils Underlying the Fill	14	1 x 500 mL glass
	Atterburg Limits	ASTM D4318	Boreholes	Clay/Till	26	1 x 500 mL glass
	slurry wall materials compatibility testing	see Appendix F	Boreholes	Native Alluvial (2)	1 Composite	1 x 55 gallon drum

Note: (1) The actual number of samples will be based on conditions encountered in the field.
(2) All excess alluvial soils (fine sand and silt) from boreholes will be composited in a 55 gallon drum.
(3) A composite sample of fine-grain native alluvial soils (i.e. fine sands and silts) will be collected from 10 selected boreholes.
(4) Assuming 3 samples from each of 52 boreholes.

TABLE A.1

SUMMARY OF SAMPLING ACTIVITIES

B.	*Sample Media*	*Sample Location*	*Sample Timing*	*Sample Volume*	*Analytical Parameters*
	Groundwater	Prototype Extraction Wells (three total)	Pumping Test Initial and 24-hour Sample	See Table A.4	TCL VOAs & Semi-VOAs TAL-Metals
			48-hour Sample	See Table A.4	See Table A.2
			Treatability Study (Collect at end of 48-hour Pumping Test)	5 x 2 gallons from each well	See Appendix E
		GW-2S	Coincident with Pumping Tests	See Table A.4	See Table A.2
			Treatability Study (After Collection of above GW-2S sample)	5 x 2 gallons	See Appendix E

TABLE A.2

GROUNDWATER ANALYTICAL PARAMETERS
48-HOUR PUMPING TEST

All Samples (Time 0 hr, 24 hr, 48 hrs)	TCL	- volatiles
		- semi-volatiles
	TAL	- metals
48 hour Sample Only	- PCBs	
	- Total Organic Carbon (TOC)	
	- Biological Oxygen Demand (BOD)	
	- Chemical Oxygen Demand (COD)	
	- Iron (total and soluble)	
	- Manganese (total and soluble)	
	- Total Suspended Solids (TSS)	
	- Total Dissolved Solids (TDS)	
	- pH	
	- Alkalinity	
	- Hardness	
	- Turbidity	
	- Calcium	
	- Sulphate (SO4-2)	
	- Pesticides	
	- Tetra to Octa PCDD/PCDFs	
	- Gross Alpha and Beta Radioactivity	

TABLE A.3

SUMMARY OF QA/QC SAMPLE REQUIREMENTS
PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, NEW YORK

RD Activity	*Sample Matrix*	*Analytical Parameters*	*Investigative Samples*	*Field Duplicates*	*Field/ Equipment (1) Blanks*	*Trip (2) Blanks*	*MS/MSD*	*Total*
Groundwater Sampling	Groundwater	TCL VOC, TCL SVOC	10	1	1	1	1	14
	Groundwater	TOC, BOD, COD, Iron (total and soluble), Manganese, (total and soluble) TSS, TDS, pH, Alkalinity, Hardness, Turbidity, PCB, Calcium, Sulfate, Pesticides, PCDD/PCDFs, Radiologicals	4	1	1	0	1	7

Notes:
(1) Field/equipment blank samples will be submitted only when non-dedicated sampling equipment is used.
(2) Trip blanks will be submitted only with aqueous samples for VOC analysis only.

TABLE A.4

SAMPLE CONTAINER, PRESERVATION AND HOLDING TIME PERIODS
PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, NEW YORK

Analyses	*Sample Containers*	*Preservation*	*Maximum Holding Time from Sample Collection(1)*	*Volume of Sample*
Groundwater				
SVOC, PCB, Pesticides	Two 1-liter amber glass bottles per analysis	Iced, 4° C	7 days from extraction 40 days after extraction for analysis	Fill to neck of bottles
VOC	Four 40-mL teflon lined septum vials	HCl to pH <2, Iced, 4° C	14 days for analysis	Fill completely, no air bubbles
Metals, Hardness	One 1-liter plastic bottle	HNO3 to pH <2, Iced, 4° C	6 months (mercury - 28 days) for analysis	Fill to shoulder of bottle
Total Cyanide	One 500-mL plastic or glass bottle	NaOH to pH>12, Iced, 4° C	14 days for analysis	Fill to shoulder of bottle
TSS, TDS	One 1-liter plastic bottle	Iced, 4° C	7 days for analysis	Fill to neck of bottles
BOD	One 125-mL sterile plastic bottle	Iced, 4° C	48 hours for incubation	Fill to neck of bottles
COD, TOC	One 1-liter plastic bottle	H2SO4 to pH<2	28 days for analysis	Fill to neck of bottles
PCDD/PCDF	Two 1-liter amber glass bottles	Iced, 4° C	30 days for extraction 45 days for analysis	Fill to neck of bottles
Sulfate	One 500-mL plastic or glass bottle	Iced, 4° C	28 days for analysis	Fill to neck of bottles
Radiologicals	One 1-liter plastic bottle	Iced, 4°C	None	Fill to neck of bottles

(1) - These are technical holding times, i.e. are based on time elapsed from time of sample collection.

TABLE A.5

TESTING OF PROTOTYPE GROUNDWATER COLLECTION SYSTEM
WELLS TO BE MONITORED (1)

Prototype Extraction Well	*Monitored Well*
EW-1	EW-1 MW-1 GW-15S
EW-2	EW-2 MW-2 GW-16S
EW-3	EW-3 MW-3 GW-14S

Note (1) All wells will be monitored continuously using pressure transducers and dataloggers.

ATTACHMENT A-1

STRATIGRAPHIC AND INSTRUMENTATION LOGS

GW-14S, GW-15S AND GW-16S

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BORING NUMBER: 14-S

Log of Boring

Project Pfohl Bros Location Job. No 897-12-RC-WELL
Date Drilled 12/4/89 – 12/5/89 Drilling Co. Rochester Drilling Co.
Total Depth 23' 9" Method Used 6 1/4" Augers
Inspector S. Alter Organic Vapor Instruments Used OVA / HNu Water Table Depth 6.5'

Depth (feet)	Samp No.	Blows per 6" lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata Change	Remarks (Time of Day)
					b.z. = breathing zone b.g. = background			
0	1	1	0'/2'	2'/.9'	OVA=0 on sample, in b.z.	Brown silty topsoil		1510
	1	2	↓	↓				Ground is very hard
1	1	3						
	1	3	↓	↓	↓	Last .1' is fill		
2	2	1	2'/4'	2'/.1'		Fill-dry. Glass, wood, soil.	Fill	
	2	1	↓	↓				
3	2	2						
	2	1	↓	↓				
4	3	1	4'/6'	2'/.3'	OVA=0 In hole,	Fill- dark brown, silty material		1520
	3	3			0 in b.z.	Hit something hard or stretchy at 5.5'		
5	3	3	↓	↓	↓			
	3	14	↓	↓	↓			
6	4	4	6'/8'	2'/.4'	OVA=0 in hole, 0 in b.z.	Fill: stained wood in spoon		1530
7	4	4	↓	↓				

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Log of Boring

Depth (feet)	Samp. No.	Blows per 6" ___ lbs.	Sample Interval	Adv./Recov.	Org. Vap. (PPM)	Sample Description	Strata Change	Remarks (Time of Day)
7	4	3	6'/8'	2'/.4'	↓			
	4	3	↓	↓	↓			
8	5	5	8'/10'	0	OVA = 550 in	Large piece of wood in spoon.		1540
	5	1			hole, b.g. in b.z.			
9	5	2			HNu @ b.g. in hole,			
	5	3	↓	↓	b.z. ↓		Fill	
10	6	5	10'/12'	2'/0	OVA = 20 in	No recovery		1550
	6	3			hole, b.g. in			
11	6	8			b.z.			
	6	20	↓	↓	↓			
12	7	6	12'/14'	2'/.3'	OVA = 10 in	Top .2' wood + fill		1605
	7	16			hole, b.g. in			
13	7	19			b.z.			
	7	20	↓	↓	↓	Bottom .1' brown clayey silt	Clayey	
14	8	16	14'/16'	2'/1.4'	OVA=68 in hole,	Top .9' brown clayey silt		OVA @ b.g. over sample
15	8	30	↓	↓	b.g. in b.z.		Silt	

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Log of Boring

Depth (feet)	Samp. No.	Blows per 6" lbs.	Sample Interval	Adv./ Recov.	Org. Vap. (PPM)	Sample Description	Strata Change	Remarks (Time of Day)
15	8	24	14'/16'	2'/1.4'	HNu @ b.g. in	Bottom .5' Very stiff brown clay		OVA @ b.g. oversample
	8	24	↓	↓	hole ↓			
16	9	12	16'/18'	2'/1.6'	OVA @ b.g. in	Reddish-brown clay, very stiff, silty	Brown	1630
	9	12	↓	↓	hole, b.z.,			
17	9	36	↓	↓	sample			Spoon stuck in hole
	9	29	↓	↓	↓		Clay	
18	10	6	18'/20'	2'/1.7'	OVA = 1 in	Very silty brown clay; elastic		1650 Sun set
	10	8	↓	↓	hole, b.g. in			
19	10	8	↓	↓	b.z.			
	10	11	↓	↓	↓			
20	11	9	20'/22'	2'/1.2'	OVA = 1 in	Very stiff, dark gray clay		1700 Water running out of spoon
	11	20	↓	↓	hole, b.g. in			May be till,
21	11	20	↓	↓	b.z., Sample			but no large particles
	11	22	↓	↓	↓		Gray clay	detected
22	12		22'/23.8'	2'/1.8'	OVA = 34 in	Dark gray clay without elastic component. Fairly stiff		12/5/89 0815
23	12	2	↓	↓	hole HNu @			

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Log of Boring

Depth (feet)	Samp. No.	Blows per 6" lbs.	Sample Interval	Adv./ Recov.	Org. Vap. (PPM)	Sample Description	Strata Change	Remarks (Time of Day)
23	12		22'/23.8'	2'/1.8'	b.g. in hole	Dark gray clay without clastic component.	Gray Clay	
	12		↓	↓	↓	Fairly stiff		
24						BEDROCK		

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Log of Boring

Project: Pfohl Bros Location: ________ Job. No: 897-12-RC-WELL

Date Drilled: 12/1/89 Drilling Co.: Rochester Drilling Co.

Total Depth: 13.5' Method Used: 6 1/4" Auger

Inspector: T. Ryan Organic Vapor Instruments Used: OVA/HNU Water Table Depth: 6'

Depth (feet)	Samp No.	Blows per 6" lbs.	Sample Interval	Adv./Recov.	Org. Vap. - PPM	Sample Description	Strata Change	Remarks (Time of Day)
0								
	1	2	0'/2'	2'/.1'		Silty organic material		0915
	1	1	↓	↓				
1	1	2	↓	↓				
	1	2	↓	↓				
2	2	2	2'/4'	2'/.4'		Topsoil with glass, trash		
	2	2	↓	↓			Fill	
3	2	3	↓	↓				
	2	3	↓	↓				
4	3	3	4'/6'	2'/.6'		4.0'-4.2' Fill material		
	3	2	↓	↓				
5	3	3	↓	↓		Brown clayey silt		
	3	4	↓	↓				
6	4	3	6'/8'	2'/.2'		Silty fill with wood and hard plastic		Wet spoon
7	4	3	↓	↓				

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Log of Boring

Depth (feet)	Samp. No.	Blows per 6" lbs.	Sample Interval	Adv./Recov.	Org. Vap. (PPM)	Sample Description	Strata Change	Remarks (Time of Day)
7	4	4	6'/8'	2'/.2'			Fill	
	4	4	↓	↓				
8	5	3	8'/10'	2'/.7'	OVA= 1010 ppm	Top 0.2' brown clay	Clay	
	5	4			@ hole, HNu @			
9	5	6			back-ground			
	5	6	↓	↓	↓			
10	6	2	10'/12'	2'/.4'	OVA = 1000 @	Wet brown clay; very silty		
	6	3			hole, HNu @			
11	6	2			back-ground		Clay	
	6	4	↓	↓	↓			
12	7	11	12'/13.5'	1.5'/0'				
	7	21						
13	7	30	↓	↓		Piece of rock in spoon tip		
						BEDROCK		

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BORING NUMBER: 16-S

Log of Boring

Project Pfohl Bros Location ______ Job. No 897-12-RC-WELL
Date Drilled 11/29/89 Drilling Co. Rochester Drilling Co.
Total Depth 16' 10" Method Used 6 1/4" Auger
Inspector T. Ryan Organic Vapor Instruments Used OVA / HNu Water Table Depth 12'

Depth (feet)	Samp No.	Blows per 6" lbs.	Sample Interval	Adv./Recov.	Org. Vap. PPM	Sample Description	Strata Change	Remarks (Time of Day)
0	NS		NS		OVA @ background	Augered to 5'.		0830
	↓		↓		@ 5' ↓	Fill material with silty top soil		Auger is dry
5	NS		NS		OVA = 60-70 ppm in hole,	Augered to 10'		0850
	↓		↓		HNu @ background			Auger is dry
10	NS		NS			Augered to 12'		Auger is dry
	↓		↓					
12	1	14	12'/14'	1.1'/2'		Brown silty sand	Silty sand	Wet spoon
	1	27						
13	1	18						
	1	20	↓	↓				
14	2	14	14'/16'	1.5'/2'	OVA = 100-150 ppm in hole,	Hard, dark brown stiff clay	Clay	0920
	2	20			HNu @ background			
15	2	30						
	2	30	↓	↓	↓			
16								

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Log of Boring

Depth (feet)	Samp. No.	Blows per 6" lbs.	Sample Interval	Adv./ Recov.	~~Org. Vap.~~ (PPM)	Sample Description	Strata Change	Remarks (Time of Day)
16	3	10	16'/17.3	1.3'/2'		16.0'-16.3' Brown clay	Clay	1000
	3	13	↓	↓		Grey brown clay		
17	3	20/4"				Bottom is till	Till	
						BEDROCK		

TOC: 702.83
TIC: 702.51

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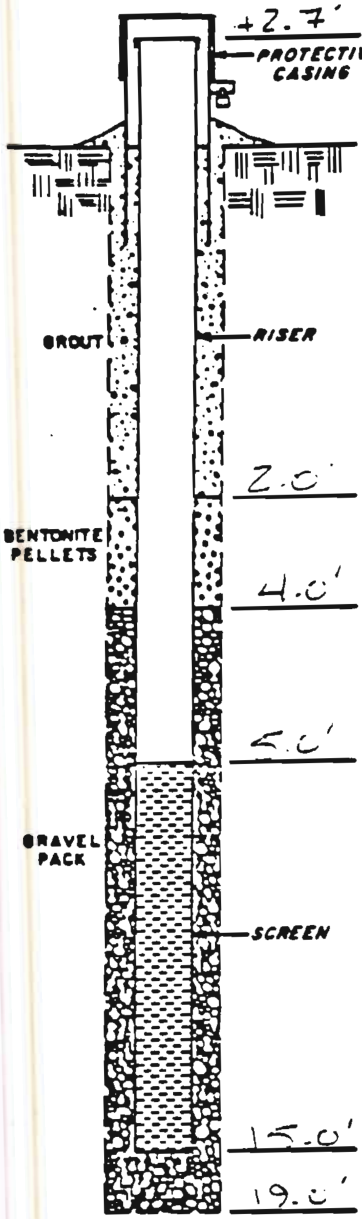
WELL CONSTRUCTION SUMMARY

Project: Peck Bros Landfill Client: NYSDEC Well No: MW-14S



DRILLING SUMMARY

Drilling Co: Rochester Drilling Co. Drillers: Art Utter

Drill Rig Make/Model: Mobile D-53

Borehole Diameters: 10" Drilling Fluid: —

Bits/Depths: 6 1/4" Hollow Stem Augers

Total Depth: 23.7' Depth to Water:

Supervisory Geologist: Andrew Downie

WELL DESIGN

Casing Material: 316 Stainless Diameter: 2" Length: 7.7'

Screen Material: Stainless Steel [illegible] Diameter: 2" Length: 10.0'

Slot Size: 0.010" Setting: 5' - 15' bgl

Filter Material: Q-Rok #4 Morie #1 Equiv Setting: 4' - 19' bgl

Seals Material: Bentonite Pellets Setting: 2' - 4' bgl

Grout: Cement/Bentonite/Water Setting: Grade - 2' bgl

Surface Casing Material: Steel Setting: +2.9' - 2.1' bgl

TIME LOG

	Started	Completed
Drilling:	12/4/89 15:00	12/5/89 0830
Installation:	12/5/89 0830	12/5/89 1030
Development:		

WELL DEVELOPMENT

Method:

Static Depth to Water:

Pumping Depth to Water:

Pumping Rate: Specific Capacity:

Volume Pumped:

TOC: 699.47
TIC: 699.26

CDM

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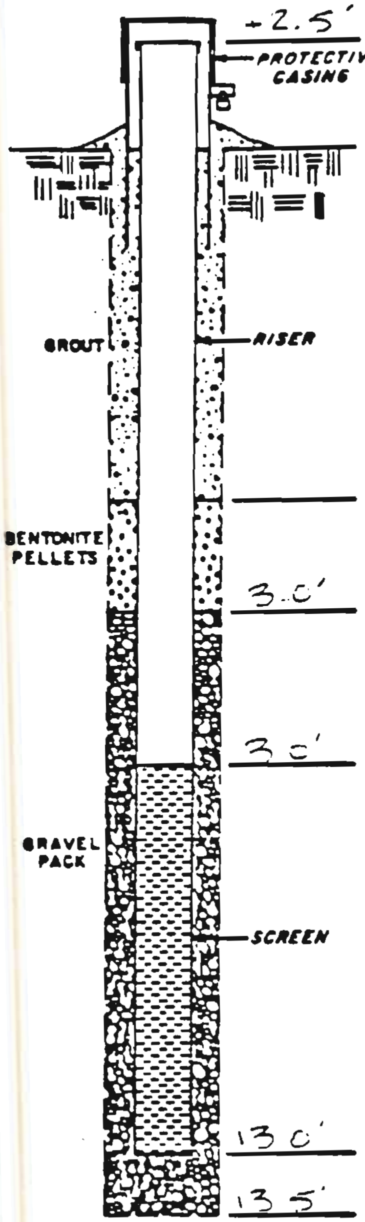
WELL CONSTRUCTION SUMMARY

Project: Pfohl Bros Landfill Client: NYSDEC Well No: MW-15S



DRILLING SUMMARY

Drilling Co: Rochester Drilling Co. Drillers: Art Utter

Drill Rig Make/Model: Mobile D-53

Borehole Diameters: 10" Drilling Fluid: —

Bits/Depths: 6 1/4" Hollow Stem Augers

Total Depth: 13.5' Depth to Water:

Supervisory Geologist: Andrew Dennie

WELL DESIGN

Casing Material:	S.S. Stainless	Diameter:	2	Length:	5.5'
Screen Material:	Stainless Continuous	Diameter:	2"	Length:	10.0'
Slot Size:	0.010"	Setting:	3' - 13' bgl		
Filter Material:	Q-Rock #4 Morie #1 Equiv	Setting:	3' - 13.5' bgl		
Seals Material:	Bentonite Pellets	Setting:	1' - 3' bgl		
Grout:	Cement/Bentonite/Water	Setting:	Grade - 1' bgl		
Surface Casing Material:	Steel	Setting:	+2.7' - 2.3 bgl		

TIME LOG

	Started	Completed
Drilling:	12/1/89 0915	12/1/89 1015
Installation:	12/1/89 1015	12/1/89 1200
Development:		

WELL DEVELOPMENT

Method:

Static Depth to Water:

Pumping Depth to Water:

Pumping Rate: Specific Capacity:

Volume Pumped:

TOC: 701.80
TIC: 701.46

CDM
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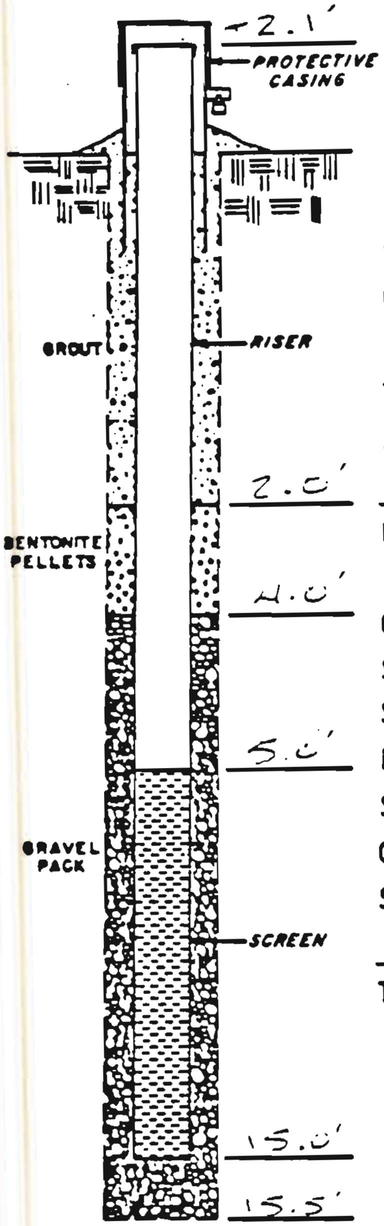
WELL CONSTRUCTION SUMMARY

Project: Peck Bros Landfill Client: NYSDEC Well No: MW - 16S



DRILLING SUMMARY

Drilling Co: Rochester Drilling Co. Drillers: Art Utter
Drill Rig Make/Model: Mobile D-53
Borehole Diameters: 10" Drilling Fluid: —
Bits/Depths: 6¼" Hollow Stem Augers
Total Depth: 17.3' Depth to Water:
Supervisory Geologist: Andrew Downie

WELL DESIGN

Casing Material: 316 Stainless Diameter: 2" Length: 7.1'
Screen Material: Stainless Continuous Diameter: 2" Length: 10.0'
Slot Size: 0.010" Setting: 5 - 15' bgl
Filter Material: Morie #1 Equiv / Q-Rock #4 Setting: 4 - 15.5' bgl
Seals Material: Bentonite Pellets Setting: 2' - 4' bgl
Grout: Cement/Bentonite/Water Setting: Grade - 2' bgl
Surface Casing Material: Steel Setting: +2.5' - 2.5' bgl

TIME LOG

	Started	Completed
Drilling:	11/29/89 0830	11/29/89 10:15
Installation:	11/29/89 1015	11/29/89 12:30
Development:		

WELL DEVELOPMENT

Method:
Static Depth to Water:
Pumping Depth to Water:
Pumping Rate: Specific Capacity:
Volume Pumped:

B

APPENDIX B

HEALTH AND SAFETY PLAN

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B.1.0 GENERAL

The predesign investigation program to be implemented to satisfy the predesign requirements for the Remedial Design (RD) and Remedial Action (RA) requirements, as presented in the Scope of Work (SOW) for the Pfohl Brothers Landfill (Site) located in Cheektowaga, New York, will involve investigations on the Site and in the immediate vicinity of the Site. The Site location is shown on Figure A.1. During these operations, personnel may come in contact with soils, groundwater, chemical waste, sludge and/or sediments which potentially contain hazardous wastes or hazardous waste constituents. To ensure that any direct contact with potentially contaminated material by Site personnel is minimized, a Site-specific Health and Safety Plan (HSP) has been developed, as presented herein. This HSP has been developed to ensure the following:

i) that Site-personnel are not adversely exposed to the compounds of concern;

ii) that public welfare and the environment are not adversely impacted by off-site migration of contaminated materials due to work activities at the Site;

iii) compliance with applicable governmental and non-governmental [America Conference of Governmental Industrial Hygienist (ACGIH)] regulations and guidelines. In particular, the amended rules of the Occupational Safety and Health Act for Subpart H of Part 1910 (Title 29

Code of Federal Regulations (CFR) Part 1910.120) will be implemented for all Site work; and

iv) initiation of proper emergency response procedures to minimize the potential for any adverse impact to Site workers, the general public or the environment.

For the purpose of the HSP all sampling and investigative activities performed on Site involving contact with potentially contaminated materials will be considered contaminated operations requiring personal protective equipment (PPE). Similar activities occurring off Site are considered non-contaminated operations requiring a modified level of PPE from that for on-Site work. A detailed description of the PPE required is presented in Section B.9.

All sampling and investigative activities at the Site will be conducted in accordance with the provisions of this Site-specific HSP. Cost and/or scheduling considerations will not be considered as justification for modifying this plant. A copy of this HSP and applicable Material Safety Data Sheets (MSDS) will be maintained on Site whenever Site activities associated with the predesign RD/RA activities occur.

B.2.0 SITE CHARACTERIZATION AND POTENTIALLY HAZARDOUS COMPOUNDS

The general categories of hazards that may be present at the Pfohl Brothers Landfill Site are described in this section. The main divisions of health hazards at this Site are chemical, physical, and environmental. Specific training will be conducted on Site prior to initiation of work activities on how to guard against these hazards. The pathways for hazardous substance dispersion at this project are (in order of likely to least likely): air/vapor dispersion, groundwater, personnel, and equipment tracking.

A Site-specific data base has been compiled for the Site, as a result of the Remedial Investigation (RI) performed by the NYSDEC. The chemicals identified during the RI of the Site are summarized in Table B.1.

B.2.1 CHEMICAL HAZARDS

Primary exposure routes for these materials include inhalation, ingestion, and skin contact. Acute effects from exposure may include irritation of the skin, eyes, nose, throat, and gastrointestinal tract. Other noted effects resulting from acute exposure are those resulting from an attack of the central nervous system or cardiopulmonary system and include dizziness, weakness, nausea, fatigue, headache and eventually may lead to unconsciousness. Chronic exposure may result in dermatitis; defatting of the skin, liver, kidneys, and brain damage; and cancer.

Personnel may be alert for symptoms of possible exposure such as unusual smells, stinging, burning eyes, nose and throat irritation, skin irritation, as well as feeling sick.

B.2.2 PHYSICAL HAZARDS

There are many physical hazards associated with this project. Hazard identification, training, adherence to work rules, and careful housekeeping can prevent many problems or accidents arising from physical hazards. The following text outlines the physical hazards associated with this project and suggested preventative measures:

- Confined Spaces - Some investigation activities may require personnel to enter confined spaces (test pits or trenches). Section B.17 provides the specific requirements for working in confined spaces.

- Bulky or Heavy Loads - Intelligent thought shall be exercised before heavy and bulky loads are lifted or handled manually by personnel. Mechanical equipment such as fork-lifts, wheel barrows, hand-trucks, loaders, and cranes shall be utilized when possible and needed. Back injuries are real, debilitating, unproductive, and costly to both employees and employers, and sometimes permanent. Back injury prevention must be given high priority on all project sites. If a load is believed to be too heavy (i.e. >60 lbs) or bulky, additional personnel or mechanical equipment will be used.

- Small Quantity Flammable Liquids - Small quantities of flammable liquids will be stored in "safety" cans and labeled according to contents.

- Heavy Equipment - Each morning before startup, all heavy equipment will be inspected to ensure all safety equipment and devices, for example backup alarms, brakes, control levers, and fire extinguishers and operational or ready for immediate use.

- Slip/Trip/Fall Hazards - Some areas may have wet surfaces which will greatly increase the possibility of inadvertent slips. Caution must be exercised when using steps and stairs due to slippery surfaces in conjunction with the fall hazard. Good housekeeping practices are essential to minimize the trip hazards.

- High Pressure Washing - Decontamination activities may require the use of high pressure washers. These devices can be hazardous if not used properly.

- Electrical Hazards - Electrical devices and equipment must be de-energized prior to working near them. All extension cords must be kept out of water, protected from crushing, and inspected regularly to ensure structural integrity. Temporary electrical circuits must be protected with ground fault circuit interrupters. Only qualified electricians are authorized to work on electrical circuits.

- Ground Personnel - All ground personnel should be constantly aware of the possibility of slips, trips, and falls due to poor and possibly slippery footing in the work areas. Before crossing either in front of or behind a piece of heavy equipment, the ground personnel will signal the equipment operator and receive conformation before moving.

- Pumping Equipment - Various types of pumps may be used for the removal of materials from ditches, ponds, lagoons, etc. The handling of pressurized hoses that could rupture and violently release liquid materials to the workers will be controlled by inspecting all hose fittings for secure connections (all cam lock fittings must be secured with wire). All employees must don splash gear including splash shields when moving or disconnecting pumps and hoses.

- Noise - Work around heavy equipment often creates excessive noise. The effects of noise can include:
  - workers being startled, annoyed, or distracted.
  - Physical damage to the ear, pain, or temporary and/or permanent hearing loss.
  - Communication interference that may increase potential hazards due to the inability to warn of danger and proper safety precautions to be taken.

If employees are subjected to noise exceeding an 8-hour time-weighted average sound level of 90 dBA (decibels on the A-weighted scale), feasible administrative or engineering controls must be utilized. In addition, whenever employee noise exposures equal or exceed and 8-hour, time-weighted average sound level of 85 dBA, employers must administer a continuing, effective hearing conservation program as described in OSHA Regulation 29 CFR Part 1910.95.

B.2.3 ENVIRONMENTAL HAZARDS

Environmental factors such as weather, wild animals, insects, and irritant plants always pose a hazard when performing outdoor tasks. The Site Safety Officer (SSO) will make every effort to alleviate these hazards should they arise.

Heat Stress and Cold Stress are other potential Site hazards which are discussed in Sections B.18 and B.19, respectively.

B.2.3.1 Radiation

The potential exists for the presence of low level radiation to be found at this Site. Background radiation levels will be established prior to any excavation. During excavation, radiation levels will be monitored at the excavation area. Readings above background but less than two (2 m Rem/hr) will require temporary suspension of excavation until the SSO in consultation with the New York State Department of Environmental Conservation (NYSDEC) Site Representative, determines a safe re-entry level. Readings above 2 m Rem/hr will be considered to present a radiation hazard, and will require discontinuation of work activities.

B.3.0 BASIS

The Occupational Safety and Health Administration (OSHA) Standards and Regulations contained in Title 29, CFR, Parts 1910 and 1926 (29 CFR 1910 and 1926), including the amended sections in 29 CFR 1910.120 and current Threshold Limit Values (TLVs) as provided by the ACGIH, provide the basis for this HSP. Some of the specifications within this section are in addition to OSHA regulations and reflect the positions of USEPA, the National Institute for Occupational Safety and Health (NIOSH) and the United States Coast Guard (USCG) regarding procedures required to ensure safe operations at potential hazardous waste sites. In addition, the following references have been used as guidance in developing the HSP:

i) CERCLA Sections 104(f) and 111(c) (6);

ii) EPA Order 1440.2 - Health and Safety Requirements for Employees Engaged in Field Activities;

iii) EPA Order 1440.1 - Respiratory Protection;

iv) EPA Occupational Health & Safety Manual

v) EPA Interim Standard Operating Safety Guide (September 1982);

vi) OSHA Standards for General Industry;

vii) NIOSH, Manual of Analytical Methods, Volumes I-VII;

viii) Threshold Limit Values (TLV) for Chemical Substances and Physical Agents in the Work Environment with Intended Changes Adopted by ACGIH;

ix) ANSI Z 88.2-1980, American National Standard, Practices for Respiratory Protection;

x) Air Sampling Instruments for Evaluation of Atmospheric Contaminants, 6th edition, 1983, American Conference of Governmental Industrial Hygienists;

xi) Appropriate health and safety statutes; and

xii) Superfund Public Health Evaluation Manual, U.S. EPA (October 1986).

The safety and health of the public and on-Site personnel and the protection of the environment will take precedence over cost and schedule considerations for all project work. Each employer will designate an on-Site individual as Site Safety Officer (SSO) during on-Site pre-design RD/RA activities. The SSO will be responsible for decisions regarding when work will be stopped or started for health or safety considerations. Each employer will develop a Site-specific HSP related to its specific activities at the Site. Each employer's Site-specific HSP will be reviewed by the Steering Committee's Consultant for completeness and compliance with the minimum standards set forth in this HSP, prior to commencing work involving contact with potentially contaminated materials at the Site.

B.4.0 RESPONSIBILITIES AND ADMINISTRATION

The SSO will supervise the implementation of the HSP and will be responsible for all decisions regarding operations and work stoppages due to health and safety considerations.

The responsibilities of the SSO will be as follows:

i) be responsible for implementation of the HSP at the initiation of Site work;

ii) conduct the initial briefing sessions for all on-Site personnel with regard to the HSP and other safety requirements to be observed during field investigation activities including:

a) potential hazards, including heat/cold stress,
b) personal hygiene principles,
c) PPE,
d) respiratory protection equipment usage, and
e) emergency procedures dealing with fire and medical situations;

iii) review and modify the HSP as more information becomes available concerning the hazardous materials involved, and review all monitoring reports;

iv) supervision and enforcement of safety equipment usage;

v) supervision and inspection of equipment cleaning;

vi) personnel training in safety equipment usage and emergency procedures;

vii) monitoring of the health and safety program under the direction of a certified industrial hygienist;

viii) suspend work activity if unsafe working conditions develop, including unsafe working conditions generated by adverse wind, rain and lightning;

ix) inform workers of the nature of chemical exposure risk as required by the "Right-to-Know" Law;

x) recommend medical examination when worker appears to require it;

xi) coordination of emergency procedures; and

xii) maintain a sign in/out log for personnel and visitors.

B.5.0 MEDICAL SURVEILLANCE

In accordance with requirements detailed in 29 CFR 1910.120 and 29 CFR 1910.134, all Site personnel who will come in contact with potentially contaminated materials will have received, within one year prior to starting field activities, medical surveillance by a licensed physician or physician's group.

Medical records for all Site personnel who will come in contact with potentially contaminated materials will be maintained by their respective employers. The medical records will detail the tests that were taken and will include a copy of the consulting physician's statement regarding the tests and the employee's suitability for work. These medical records must be available to the employee or his designated representative upon written request, as outlined in 29 CFR 1910.120, Section (f).

Each employer will ensure and certify to the SSO that its personnel involved in activities associated with potentially contaminated materials will have had all necessary medical examinations prior to commencing work within contaminated areas. Personnel not obtaining medical certification and who do not have their records up-to-date will not perform work within contaminated areas.

Interim medical surveillance will be completed if an individual exhibits poor health or high stress responses due to on-Site activity or when accidental exposure to elevated concentrations of contaminants occurs.

B.6.0 TRAINING

The SSO will require that all Site personnel who will come in contact with potentially contaminated materials complete training sessions in accordance with 29 CFR 1910.120 prior to entering the Site. This training shall consist of a minimum of 40 hours of instruction off Site and three days of actual field experience under direct supervision. Each employer will maintain documentation stating that its on-Site personnel have complied with this regulation.

Prior to commencing Site activities, all personnel will be required to attend a Site-specific initiation session. These sessions, conducted by the respective employer's SSO, will be used to instruct the Site personnel as to what the potential Site hazards are, level of PPE required, Site-specific requirements, and the basis of the HSP. At this session it will be confirmed that all on-Site personnel have the 40 hours of training required in accordance with 29 CFR 1910.120. All personnel who attend this session will sign a Training Acknowledgment Form, an example of which is presented as Attachment B-1.

B.7.0 ANTICIPATED ACTIVITY HAZARDS AND RISKS

The following subsections describe each task/operation in terms of the specific hazards associated with it. In addition, the protective measures to be implemented during completion of those operations are also identified. Table B.2 provides the appropriate level of required personal protection for all Site activities.

B.7.1 SITE PREPARATION AND CONSTRUCTION OF ACCESS ROADS

Prior to the installation of test pits/trenches and boreholes, construction of access roads may be required. Equipment to be used in this task that pose the potential for hazards may include backhoes, bulldozers, chain saws, land clearing equipment and dump trucks.

General hazards encountered during Site preparation activities include the following:

- Collisions of persons and equipment with heavy earth-moving and land clearing equipment;
- Cuts, lacerations and other injuries from access to unguarded blades or parts of chain saws, trimmers and land clearing equipment;
- Back strain from clearing vegetation for road construction, chain saws or other cutting tools.
- Irritation from dust generated from road construction.

- Eye injury and cut hazards from tree branches, wood chipping operations, and flying or protruding objects.
- Exposure to contaminated soil and dust.
- Noise from machinery.
- Biological hazards from animal bites, deer ticks and other insects.
- Injuries to feet and body parts from falling objects, such as trees, road construction material and rolling heavy equipment.
- Slips, trips and falls in holes, pits, embankments, swales, drums, debris, etc.

Hazard Prevention

1) Individuals shall stand clear of all moving equipment. Heavy equipment shall be operated in accordance with OSHA and other applicable safety standards. Vehicles shall be installed with warning devices to provide warning to nearby individuals of their approach.

2) Hard hat, gloves, safety glasses and face shield, shin protectors and safety shoes shall be worn by all individuals operating or coming in contact with moving blades or other land clearing equipment.

3) Back strain can be prevented by frequent breaks in routine. Use slow, even movements and proper lifting techniques (i.e. with the legs). Work gloves will reduce the incidence of hand injury associated with hand scything. Individuals will not lift objects above 60 lbs. without assistance.

4) Dust suppression techniques, i.e. wetting the soil with water, will reduce dust exposure. Overboots are to be worn when walking on portions of the Site which have not been covered by clean imported materials.

5) Proper vehicle and hand tool maintenance and inspection will prevent avoidable vehicle breakdown in the field. In order to minimize accidents from uneven terrain, a site surveillance shall be performed on foot to choose appropriate clear driving paths.

6) Seat belts shall be worn at all times in vehicles to equipped.

7) At a minimum, all heavy equipment shall have the safety features outlined in OSHA 20 CFR 1910/1926 Subpart O.

8) Use tick repellent; avoid encounters with animals.
Note: Tyveks will be worn in all areas where ticks may habitate.

9) Care shall be taken to survey work areas prior to performing designated activities in order to identify possible hazards due to terrain or debris.

B.7.2 INSTALLATION OF TEST PITS/TRENCHES, BOREHOLES, GAS PROBES, AND PROTOTYPE GROUNDWATER COLLECTION SYSTEM

Hazards encountered during the installation of test pits/trenches, boreholes gas probes and the prototype groundwater collection system include both chemical and physical agents, and are as follows:

- Exposure to airborne contaminants released during intrusive activities. Flammable atmospheres encountered in excavation.

- Sides of excavation cave in. Possible burying or crushing of workers due to:
  1) absence of shoring;
  2) misjudgment of stability;
  3) defective shoring, and/or ,
  4) undercut sides.

- Falling during access/egress or while monitoring or dismounting equipment, or stumbling into excavation.

- An overhead hazard from electrical lines may occur.

- Congested work area due to too many workers in a small area.

- Hazardous materials are encountered.

Hazard Prevention

1) Monitor for airborne contaminants. Allow test pits and excavation to purge and/or use personal protective equipment as described in Section B.9. Monitoring for combustible gases, oxygen, dusts, hydrogen sulfide, radiation, and volatile concentrations shall be performed. Measurements will be taken prior to start up of the activity. No work shall commence until the measurements have been taken and the SSO gives his/her approval.

2) Wear protective equipment as required by this HSP or developed by the SSO during the progress of work.

3) Keep all areas wet to ensure dust suppression. This can be accomplished naturally from the intrusion of groundwater.

4) Provide adequate shoring or sloping of side of the excavation. Regularly inspect trenches for changing conditions. Adhere to OSHA 29 CFR Part 1926 Subpart P excavations, trenching and shoring and if the excavation is to be entered, adhere to all confined space entry provisions (see Attachment B-2).

5) Provide ramps or ladders to trenches to allow safe access and egress. The spacing of ramps and ladders in excavations are to be spaced in accordance with OSHA regulations, providing that no more than 25 feet of lateral travel is necessary.

6) Trucks, piping and equipment should be kept far enough away from the edge of all excavations to prevent instability.

7) Provide an adequate barrier around open pits. Materials from the pit must be placed 2 feet from the edge to prevent cave ins and instability of the pit.

8) To prevent overexertion, limit manual lifting and emphasize mechanical means where practical. No one will lift in excess of 60 lbs. without assistance.

9) Maintain ample work room between workers.

10) When working near overhead power lines, the boom and cables of equipment should be kept away from all electric wires, regardless of their voltage.

11) For lines rated 50 kv or below, minimum clearance between the lines and any part of the crane must be 10 feet.

12) For lines rated over 50 kv, minimum clearance between the lines and any part of the crane must be either 10 feet plus 0.4 inch for each 1 kv over 50 kv, or twice the length of the line insulator, but never less than 10 feet.

B.7.3 SAMPLE COLLECTION ACTIVITIES (SOIL AND GROUNDWATER), GROUNDWATER TREATABILITY STUDY, PUMPING TESTS OF PROTOTYPE WELLS, MONITORING GAS PROBES, AND MATERIALS COMPATIBILITY STUDY

Hazards generally associated with these activities include:

- Slip, trip and fall hazards.
- Contact with or inhalation of contaminants, potentially in high concentrations in sampling media.
- Back strain and muscle fatigue due to lifting, shoveling and auguring techniques.
- Contact with or inhalation of decontamination solutions.

Hazard Prevention

1) To minimize exposure to chemical contaminants, a thorough review of suspected contaminants shall be completed and implementation of an adequate protection program.

2) Proper lifting (pre-lift weight assessment, use of legs, multiple personnel) techniques will prevent back strain. Use slow easy motions when shoveling, auguring, digging and moving pumps or hoses to decrease muscle strain. When lifting objects greater than 60 lbs., use assistance or mechanical lifting devices.

3) First aid equipment shall be available based on MSDS requirements.

4) Review the contaminants suspected to be on site and perform air monitoring as required. Shut down drill rig and/or divert exhaust fumes.

5) All chains, lines, and cables shall be inspected daily for weak spots, frays, etc.

6) Ear muffs and ear plugs effectively reduce noise levels.

7) Hard hats shall be worn at all times when working around a drill rig. Secure loose clothing. Check boom prior to approaching drill rig.

8) The rig mast shall not be erected within 10 feet of an overhead electrical line until the line is de-energized, grounded or shielded.

9) A thorough underground utilities search shall be conducted before the commencement of a drilling project.

10) All high pressure lines shall be checked prior to and during use.

B.7.4 DECONTAMINATION ACTIVITIES

Hazards generally associated with these activities include:

- Slip, trip, fall hazards.
- Potential personal injuries.

- Potential contact with contaminated soil, sediment and water, waste materials and cleaning solvents.
- Potential vapor emissions.
- Hazards presented by the use of specialized decontamination equipment (i.e. steam cleaning unit).

<u>Hazard Prevention</u>

1) To minimize exposure to Site contaminants or cleaning solvents, wear appropriate personal protection as specified in this HSP.

2) Proper lifting techniques will prevent back strain.

3) Perform any air monitoring as required.

4) Review the standard operating procedure for any specialized cleaning equipment.

B.8.0 WORK AREAS

All Site work zones will be clearly laid out and identified in the field prior to initiation of all Site work activities. The establishment of Site work zone boundaries may be modified by the SSO and/or Site Coordinator. The purpose of establishing these work zones is to limit access to potentially contaminated areas or areas which may cause physical injury to individuals and to prevent the migration of potentially hazardous materials into adjacent non-contaminated areas. These designated work zones are described as follows:

i) Exclusion Zone (EZ) - this zone will include all areas where potentially contaminated soils, sediments, waters or waste material are located, excavated, removed, transferred, stored, or disposed of and all areas where contaminated equipment or personnel travel including the decontamination area. Specifically, the EZ will include all areas in which soil/wastes will be excavated or handled during installation of test pits/trenches, boreholes and the prototype groundwater collection system. Figure B.2 depicts the typical Site controls. Sufficient area will be provided for efficient movement of personnel and equipment as well as contaminant control. The EZ will be delineated in the field with fencing, flagging or warning barriers. Access to the EZ will be restricted to personnel who are wearing the proper PPE, have received and passed the required medical examination and have undergone the required health and safety training. A log of entry to and exit from the EZ will be maintained for the purpose of stress monitoring and determining exposure times;

ii) Contamination Reduction Zone (CRZ) - this zone lies immediately upwind of the EZ and occurs at the interface of the EZ and Support Zone (SZ) and will provide for the transfer of construction materials, personnel and equipment, a place for donning and disposing of PPE, the storing of emergency first aid equipment and supplemental safety supplies. Access to the CRZ will be restricted to personnel who have received and passed the required medical examination and have undergone the required health and safety training; and

iii) Support Zone (SZ) - this area is comprised of the remainder of the designated work area at the Site and is defined as being an area outside the zone of significant air, soil or surface water contamination. The SZ will be clearly delineated and procedures will be implemented to prevent active or passive contamination from the other work zones. The function of the SZ includes:

a) an entry area for personnel, material and equipment to the CRZ,
b) an exit for decontaminated personnel, materials and equipment from the CRZ,
c) a storage area for clean safety and work equipment; and
d) an area for eating, drinking and smoking.

B.9.0 PERSONAL PROTECTIVE EQUIPMENT(PPE)

The SSO will require that all personnel are equipped with PPE appropriate for the nature of work being completed. The SSO will require that all safety equipment and protective clothing are kept clean, well-maintained and that their integrity is intact.

Safety equipment and apparel as required for general work on Site will be Level D and/or Level C, or Level B protective equipment if air monitoring results indicate the need as discussed in Section B.12 or if any drum removal activities where the contents of the drum are unknown take place. The level of required personal protection as well as the anticipated hazards/risks for the anticipated predesign RD/RA field investigation activities are presented in Table B.2.

Level B PPE which will be used on Site consists of the following:

i) supplied-air respirator (MSHA/NIOSH approved). Respirators may be positive pressure-demand, self-contained breathing apparatus (SCBA) or positive pressure-demand, airline respirator (with escape bottle for Immediate Danger to Life and Health (IDLH) or potential for IDLH atmosphere);

ii) chemical-resistant clothing (overalls and long-sleeved jacket; hooded one or two-piece chemical-splash suit; disposable chemical-resistant; one-piece suits);

iii) long cotton underwear or long-sleeved shirt and pants;

iv) gloves (outer), chemical-resistant;

v) gloves (inner), chemical-resistant;

vi) boots (outer), chemical-resistant, steel toe and shank;

vii) boot covers (outer), chemical-resistant (disposable);

viii) hard hat (face shield); and

ix) 2-way radio communications (intrinsically safe).

Level C PPE which will be used on Site consists of the following:

i) air-purifying respirator, half-face or full-face (MSHA/NIOSH approved), equipped with organic vapor/acid gas (OV/AG) cartridge with a high efficiency particulate air (HEPA) filter;

ii) chemical-resistant clothing (coveralls; hooded one-piece or two-piece chemical splash suit; chemical-resistant hood and apron; disposable chemical-resistant coveralls);

iii) long cotton underwear or long-sleeved shirt and pants;

iv) gloves (outer), chemical-resistant;

v) gloves (inner), chemical-resistant;

vi) boots (outer), chemical-resistant, steel toe and shank;

vii) boot covers (outer), chemical-resistant (disposable);

viii) hard hat (face shield);

ix) escape mask; and

x) 2-way radio communications (intrinsically safe).

Level D PPE which will be used on-Site consists of the following:

i) coveralls;
ii) gloves;
iii) boots/shoes (leather or chemical-resistant) with steel toe and shank;
iv) safety glasses; and
v) hard hat.

All personnel entering the Site will be required to be in Level D PPE. Additional protective equipment usage guidelines to be implemented include:

i) prescription eyeglasses in use on the Site will be safety glasses;

ii) contact lenses will not be permitted;

iii) all disposable or reusable nitrile, latex and/or cotton gloves worn on the Site will be changed, decontaminated or discarded at the end of each day;

iv) during periods of respirator usage, respirator cartridges and filters will be changed daily, or upon breakthrough, whichever occurs first;

v) on-Site personnel who have not passed a respirator fit test will not be permitted to enter or work in the EZ. Personnel will not be permitted to have beards, or long sideburns or mustaches as these interfere with a proper fit of the respirator;

vi) all PPE worn on Site will be decontaminated or discarded at the end of each work day;

vii) duct tape will be used to ensure that disposable coveralls and gloves are tightly secured when personnel are working within the EZ; and

vii) no watches, rings or other accessories will be permitted during drilling and sampling activities.

B.9.1 REASSESSMENT OF PROTECTION PROGRAM

The Level of Protection provided by PPE selection shall be upgraded or downgraded based upon a change in site conditions. The reevaluation process will be ongoing during the project. The SSO will decide when a change in PPE is warranted.

When a significant change occurs, the hazards will be reassessed. Some indicators of the need for reassessment are:

- Commencement of a new work phase, such as the start of work that begins on a different portion of the site.
- Change in job tasks during a work phase.
- Change of season/weather.
- When temperature extremes or individual medical considerations limit the effectiveness of PPE.
- Contaminants other than those previously identified are encountered.
- Change in ambient levels of contaminants.

B.10.0 RESPIRATORY PROTECTION PROGRAM

Prior to arriving at the Site, all on-Site personnel will have received training in the use of both air purifying and supplied air respiratory protection, and have been fit tested for, either half- or full-facepiece respirators. All on-Site personnel will be required to comply with their employer specific written respiratory protection program developed in accordance with OSHA 29 CFR 1910.134. Respiratory protection will be required during all ground invasive activities to ensure worker protection from potentially contaminated particulates.

An appropriate photoionization detector will be used in a survey mode to determine if organic vapors are present. A background reading will be established prior to commencing work activities at each monitoring well, sampling location or work area.

Action levels to determine the level of respiratory protection necessary during investigative activities are based on the concentration of unknown organic vapors measured within the breathing zone. The action levels and appropriate respiratory protection for Site activities are as follows:

Sustained Organic Vapor Reading Above Background Within Breathing Zone	*Action Taken*
0 or background	half- or full-facepiece air purifying respirator available
1 - 5 ppm	half- or full-face air purifying respirator, Level C PPE
5 - 50 ppm	supplied air respirator Level B PPE
>50 ppm	shut down activities, implement additional engineering controls or remedial action

However, if the ambient concentrations of organic vapors are due to identifiable substances, the level of respiratory protection may be altered by the SSO.

Periodic air monitoring data may be obtained to correlate with total organic vapor readings from which the level of respiratory protection may be adjusted.

In the event that drums are encountered where the contents of the drum are unknown, all excavation personnel will be required to wear Level B, supplied air respiratory protection equipment as discussed in Section B.9 of this HSP.

Excavation or sampling personnel who are required to handle drums of unknown content will be using supplied air respiratory protection until the contents and associated respiratory hazards of the drum are determined. Subsequent handling of characterized drums may be performed in Level C, respiratory protection if so determined by the SSO.

B.11.0 PERSONAL HYGIENE

The SSO will require that all personnel performing or supervising work within the EZ observe and adhere to the personal hygiene-related provisions of this section.

On-Site personnel found to be disregarding the personal hygiene-related provisions of this HSP will, at the discretion of the SSO, be barred from the Site.

Each employer will ensure that the following equipment/facilities are available for the personal hygiene of its on-Site personnel:

i) suitable disposable outerwear, gloves, respiratory protection and footwear on a daily basis for the use of its on-Site personnel;

ii) disposal containers for used disposable outerwear; and

iii) potable water and a suitable sanitation facility.

The SSO also will enforce the following regulations for personnel actively participating in the on-Site RD/RA activities:

i) on-Site personnel will wear appropriate PPE when in the EZ;

ii) used disposable outerwear will not be reused if deemed to be unsuitable to provide the necessary protection, and when removed, will be placed inside disposal containers provided for that purpose;

iii) smoking, eating and drinking will be prohibited within the EZ and the CRZ. These activities will be permitted only within the area of the SZ; and

iv) on-Site personnel will thoroughly cleanse their hands, face, neck area and other exposed areas before smoking, eating, drinking or using toilets and before leaving the Site.

v) A buddy system will be used. Hand signals will be established to maintain communication visual contact will be maintained between buddies on Site when performing hazardous duties.

B.12.0 AIR MONITORING

During the progress of the predesign investigative RD/RA activities, periodic monitoring of particulate levels, organic vapors, combustibles and radiation will be taken by the SSO or his designee. Monitoring for particulates only will be required during those work activities which potentially may lead to contaminant excursions from the Site (i.e. ground invasive activities). Monitoring for radiation will be conducted during all ground invasive activities.

Air monitoring for SVOCs and PCBs is not included in this HSP. Air monitoring data collected by OHM during performance of the IRM in 1992 will be reviewed to determine if air monitoring for SVOCs and PCBs is required for RD/RA field activities. Should the review indicate that air monitoring for SVOCs and PCBs is required, the HSP will be revised accordingly to include such monitoring.

The following air monitoring instrumentation will be used for this purpose:

i) a photoionization detector;
ii) a real time digital particulate monitor;
iii) an oxygen/combustible gas detector; and
iv) a radiation dose survey meter.

All monitoring equipment will be calibrated on a daily basis in accordance with the manufacturer's guidelines, and such calibrations will be recorded in the Site daily log book. Results of all daily air monitoring also will be recorded in the Site daily log book.

Air monitoring will be conducted in the breathing zone of workers in the EZ and at the downwind perimeter of the Site continuously or as deemed necessary by the SSO based on Site-specific conditions. Background measurements immediately upwind of the EZ will be taken before activities commence. Work activities generating particulate levels in excess of 150 $\mu g/m^3$ at the downwind Site perimeter, will temporarily be halted until alternate work methods or engineering controls are in place to maintain particulate levels below 150 $\mu g/m^3$ at the downwind Site perimeter. Specific details of the air monitoring to be conducted are provided in Section 12.1.

Respiratory action levels for organic vapors are discussed in Section B.10.0.

Immediately upon identifying sustained elevated levels of organic vapors (greater than 50 parts per million), the air monitoring results will be reported to the SSO, and work activities will be shut down. The SSO or his designee will determine the cause of the sustained elevated levels of organic vapors, and alternate work methods or engineering controls will be implemented to rectify the release of elevated concentrations of organic vapors. Personal protection levels may be increased if engineering controls do not rectify the elevated levels.

Table B.3 outlines the air monitoring action levels for this Site.

B.12.1 COMMUNITY AIR MONITORING PLAN

Real time air monitoring, for volatile organic compounds and particulate levels will be performed by a technician at the perimeter of the exclusion zone. Real time air monitoring will be conducted during ground invasive activities and any other activity which may potentially create an airborne hazard.

Community air monitoring will be conducted in accordance with the following:

i) volatile organic compounds will be monitored at the downwind perimeter of the exclusion zone on a continuous basis. If total organic vapor levels exceed 5 ppm above background, work activities will be halted and monitoring continued under the provisions of the Vapor Emission Response Plan (Section 12.1.1). All monitoring readings will be recorded and available for the NYSDEC and NYSDOH to review; and

ii) particulates will be continuously monitored upwind, downwind and within the work area at temporary particulate monitoring stations by a technician moving from location to location. If the downwind particulate level is 150 $\mu g/m^3$ greater than the upwind particulate level, then work will temporarily be shut down and dust suppression techniques will be employed. All monitoring readings will be recorded and available for the NYSDEC and NYSDOH to review.

B.12.1.1 Vapor Emission Response Plan

If the ambient air concentration of organic vapors exceeds 5 ppm above background at the downwind perimeter of the exclusion zone, activities will be halted and monitoring continued. If the organic vapor level decreases below 5 ppm above background, work activities can resume. If the organic vapor levels are greater than 5 ppm over background but less than 25 ppm over background at the downwind perimeter of the exclusion zone activities can resume provided:

i) the organic vapor level 200 feet downwind of the work area or half the distance to the nearest residential or commercial structure, whichever is less, is below 5 ppm over background; and
ii) continuous air monitoring is continued.

If the organic vapor level is above 25 ppm at the downwind perimeter of the exclusion zone activities will be shutdown. When work shutdown occurs, downwind air monitoring as directed by the SSO will be implemented to ensure that vapor emission does not impact the nearest residential or commercial structure at levels exceeding those specified in Section 12.1.2 (Major Vapor Emission).

B.12.1.2 Major Vapor Emission

If any organic vapor levels greater than 5 ppm over background are identified 200 feet downwind from the work area or half the distance to the nearest residential or commercial property, whichever is less, all work activities must be halted.

If, following the cessation of work activities, or as the result of an emergency, organic levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial property from the work area, then the air quality will be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20-foot zone).

If efforts to abate the emission source are unsuccessful and if organic vapor levels are approaching 5 ppm above background and persist for more than 30 minutes in the 20 foot zone, then the Major Vapor Emission Response Plan (Section B.12.1.3) will automatically be placed into effect. However, the Major Vapor Emission Response Plan will be immediately placed into effect if organic vapor levels are greater than 10 ppm above background.

B.12.1.3 Major Vapor Emission Response Plan

Upon activation, the following activities will be undertaken:

i) all emergency response contacts as listed in the HSP will be notified;

ii) the local police authorities will immediately be contacted by the SSO and advised of the situation; and

iii) frequent air monitoring will be conducted at 30-minute intervals within the 20-foot zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the SSO.

B.13.0 COMMUNICATIONS

Emergency numbers including police, fire, ambulance, hospital and appropriate Regulatory Agencies are presented in Table B.4 and will be prominently posted near the telephone(s).

A route map to the nearest emergency medical facility is presented in Figure B.3 and will be posted in each vehicle. Prior to initiating Site activities, the emergency medical facility will be notified of Site activities to ensure preparedness to respond to any Site-related injuries.

Directions to hospital:

St. Joseph's Intercommunity Hospital - West on Aero Drive to Holtz Road, South (left) onto Holtz Road to Genesee Street (Route 33), West (right) onto Genesee Street to Expressway (Route 33), Expressway to Harlem Road exit (Route 240). South (left) onto Harlem Road (Route 240) to hospital entrance.

B.14.0 EMERGENCY AND FIRST AID EQUIPMENT

Emergency safety equipment will be available for use by Site personnel and will be located and maintained on Site. The safety equipment will include, but is not limited to, the following:

i) portable emergency eye wash;
ii) two 20-pound ABC type dry chemical fire extinguishers;
iii) approved first-aid kit for a minimum of 10 personnel;
iv) fire blanket;
v) two SCBA units;
vi) portable air horn.

B.15.0 EMERGENCY RESPONSE PLAN

An Emergency Response Coordinator, will be identified, through whom all information and coordination of efforts will occur. Prior to commencing work involving the handling of potentially hazardous material, a coordination meeting will be held with the appropriate authorities to review this plan. This plan is intended to provide a safe and immediate response to an emergency situation. This plan will be maintained by the Emergency Response Coordinator.

B.15.1 SPILL CONTROL AND RESPONSE PLAN

B.15.1.1 Scope

During all active work at the Site involving the transport and handling of excavated drums or other wastes, an on-Site and off-Site Spill Control and Response Plan will be in effect. This plan, as presented herein, will provide contingency measures for potential releases of material from drummed or other wastes handled on Site.

B.15.1.2 Spill Response Equipment

The following equipment will be available on Site and used for any unexpected spills:

i) sand, clean fill or other non-combustible absorbent;

ii) 85-gallon DOT approved overpack drums (5 adjacent to the drum staging area and the active excavation area, total of 10);

iii) front end loader and/or backhoe; and

iv) shovels.

Hand tools which are used will generally be discarded with the waste material unless it is determined appropriate to decontaminate the tools. If tools are decontaminated, they will receive a detergent wash in addition to steam cleaning or hot water washing.

B.15.1.3 <u>On-Site Contingency Plan</u>

In the event that a release of a hazardous waste occurs on Site beyond the limit of excavations and working areas, the following protocols will be implemented:

i) Notification of Release: If human health or the environment are threatened, then the National Response Centre (NRC) and NYSDEC will be notified as soon as possible. Appropriate local authorities (police, fire department, traffic control, etc.) will also be notified. NRC will be notified of any release of reportable quantities including all releases which threaten human health or the environment. NYSDEC will determine if other releases require notification to the NRC. In any event, the NYSDEC on-Site Representative will receive the initial notification of a hazardous materials release.

ii) Decontamination Procedures: Decontamination procedures may be required after cleanup to eliminate traces of the substance spilled or to reduce it to an acceptable level. Complete cleanup many require removal of affected soils. Personnel decontamination will include showers and cleansing or disposing of clothing and equipment as appropriate. All contaminated materials including solvents, clothes, soil, and other materials that cannot be decontaminated will be properly containerized, labeled, and placed in the staging area for proper disposal.

iii) A release report will be submitted to the NYSDEC, within 24 hours of the release, summarizing the release and response action.

If a major release of material stored in a tank or container occurs on Site, the following actions will immediately be taken:

i) Notify the Engineer and SSO;
ii) Take immediate measures to control and contain the release within the Site boundaries;
iii) Keep unnecessary personnel away, isolate the area of release, and deny entry;
iv) Do not allow anyone to touch released material;
v) Stay upwind; keep out of low areas; and
vi) Keep combustibles away from the released material.

An employee alarm system to signify a major release or an emergency will consist of three short blasts using an air horn. An air horn will be immediately available to all personnel handling drums. An air horn will always be maintained at the staging area and at active excavation areas during active work hours.

Upon implementing these procedures, air monitoring, to identify the level of protection required, will be performed following the procedures for a spill presented in Section B.12.0.

Releases from drums containing solid wastes will be placed into approved containers and covered. Each container will be labeled as to contents. Solid spills from haulage units will be placed back into haulage units.

In the event that a drum or container of liquid is spilled on Site outside of the excavation area, the drum handling team will immediately respond to the spill. The spilled liquids will be confined to the immediate area of the spill and the liquids will be pumped, with the use of a portable hand pump, into a repack drum. The spilled liquids will be confined by diking around the spill with native material or with an inert absorbent. Any residual liquids which cannot be pumped will be absorbed with a sufficient quantity of inert absorbent to ensure that no free liquids remain. If the spill occurred on soil, the visibly affected soil will be excavated to limits based on a visual determination of spill contamination with the concurrence of the NYSDEC on-Site Representative. The absorbent and excavated material will be drummed and placed in the drum debris.

Liquids spilled within excavations will be pumped, with the use of a portable hand pump, into a repack drum. Soil/fill adjacent to the spill area will be placed to absorb any residual liquid. Materials underlying the spill zone will be treated as contaminated materials based on a visual determination of spill contamination. This material will be excavated, drummed and staged in the drum/debris staging area.

The need to conduct post-cleanup sampling and the analytical requirements for sampling native soil in which a release occurs outside of contaminated areas will be determined and agreed to by the NYSDEC. If required, samples will be collected over the immediate area of the spill. Existing analytical data for the released materials will be used to determine the analytes of concern.

B.15.1.4 Off-Site Contingency Plan

Only authorized transporters will be used for the transportation of hazardous materials. If a release of material from a transport vehicle occurs while in transit, the following actions will be taken to reduce potential migration of the waste material:

i) Immediately notify the Contractor, who will in turn notify the Engineer, and the NYSDEC;

ii) Take immediate measures within the capabilities of the transport driver to control the release, if necessary;

iii) Contain and eliminate the release, if possible;

iv) The driver must remain within a safe distance of the vehicle, and will keep unnecessary people away, isolate the area of the release and deny entry to unauthorized personnel;

v) Stay upwind, keeping out of low areas, and do not allow contact with the released material;

vi) Contact the appropriate local authorities (police, fire department, traffic control, etc.) and local hazardous materials response unit; and,

vii) Other actions, as advised by the spill response team.

Upon implementing these procedures, the same action to clean up the release will be implemented as described in Section B.15.1.3.

B.15.2 MEDICAL OR FIRE EMERGENCY RESPONSE PLAN

In the event of serious injury to on-Site personnel or contact with a hazardous material, the following protocol will be followed:

i) activate Site Alarm (three short blasts on air horn);

ii) notify the SSO;

iii) contact the designated hospital and describe the injury;

iv) decontaminate personnel if possible, and administer appropriate first aid. If personnel cannot be decontaminated, alert hospital to possible problems of contamination; and

v) transport personnel to the medical facility along a predefined route.

In the event of a significant release of toxic or hazardous vapors, the source of such vapors shall be immediately isolated, the material identified, and the SSO notified. If possible, the source of the vapors shall be controlled. All personnel shall utilize SCBA during such operations. Continuous air monitoring of the area shall commence. Appropriate regulatory and emergency agencies will be notified of the situation. A list of the phone numbers for each agency is presented in Table B.4 which will be prominently posted near each telephone.

B.16.0 EQUIPMENT AND PERSONNEL DECONTAMINATION

During the performance of the predesign field investigative program, procedures will be implemented to reduce the amount of contact of both personnel and equipment with the waste constituents. These procedures include the following:

i) proper work practices that would lead to minimal direct contact with potentially contaminated material (e.g. avoid contact in areas of obvious contamination, remote sampling and handling procedures, etc.);

ii) use of disposable equipment and clothing as much as practicable; and

iii) encase source of contaminants (with plastic sheeting).

All equipment leaving the EZ which came in contact with potentially contaminated material will be decontaminated, as specified in the Field Operations Plan (FOP). It is assumed that the decontamination facilities constructed for the IRM will be available for use during the predesign field activities.

Personnel decontamination will take place at the exit from the EZ and will, as a minimum, consist of a glove wash with detergent and removal of gloves, disposable suit and hard hat.

All personnel will remove their protective clothing and wash their hands, face, neck area and other exposed areas before entering the lunch and break areas to eat, drink, smoke or use the toilet facilities.

B.16.1 PERSONNEL DECONTAMINATION PROCEDURES-LEVEL B

Decontamination will follow these steps in the order listed:

Decontamination will follow these steps in the order listed:

- Deposit any site used equipment in a segregated area prior to entering the contamination reduction zone. This segregation reduces the possibility of cross contamination.

- At the perimeter of the exclusion zone, acid suits or splash protection and breathing apparatus tanks and hoses (if worn) will be damp-wiped or wet sprayed to remove any gross contamination. This effort will eliminate any exposure to support personnel and workers themselves during the desuiting process.

- Robar/Tingley boots will be scrubbed with a detergent-water solution. The boots will then be removed and placed on a rack for drying.

- Hard hats will be removed and hung up. On a daily basis, these will be scrubbed with detergent-water solution.

- Outer gloves will be cleaned and removed, and depending on condition, will be discarded (if damaged or uncleanable).

- Disconnect and remove supplied air breathing apparatus. The initial five phases of decontamination should eliminate the airborne hazard at this point.

- Splash gear will be removed, cleaned, and hung up to dry (if worn).

- Tyvek or Saranex suits will be removed and discarded.

- Vinyl booties will be removed and discarded.

- Sample gloves will be removed and discarded.

- Personnel will then wash their hands, arms, neck, and face.

B.16.1.1 Personnel Decontamination Procedures-Level C and Level D

- Deposit any site used equipment in a segregated area prior to entering the contamination reduction zone. This segregation reduces the possibility of cross contamination.

- At the perimeter of the exclusion zone, rain gear or splash protection (if worn) will be damp-wiped or wet sprayed to remove any adhered particulates or corrosive liquids. The effort will eliminate any exposure to support personnel and workers themselves during the PPE doffing process.

- Robar/Tingley boots will be scrubbed with a detergent-water solution. The boots will then be removed and placed on a rack for drying.
- Hard hats will be removed and hung up. On a daily basis, these will be scrubbed with detergent-water solution.
- Outer gloves will be cleaned and removed, and depending on condition, will be disposed in the solid waste stream (if damaged or uncleanable).
- Splash gear will be removed, cleaned, and hung up to dry (if worn).
- Tyvek or Saranex suits will be disposed in the solid waste stream.
- Respirators will be removed and prepared for reuse or decontaminated, if worn.
- Vinyl booties will be disposed in the solid waste stream.
- Sample gloves will be disposed in the solid waste stream.
- Personnel will wash their hands, arms, neck, and face.

B.16.2 EQUIPMENT DECONTAMINATION

B.16.2.1 Vehicles and Heavy Equipment

Any equipment and vehicles, which have entered an exclusion zone will be cleaned in accordance with the procedures presented in Section A.7.0 at the FOP.

Following this cleaning, all items will be inspected and approved by the SSO prior to removal from the site.

B.16.2.2 Sampling Equipment

Sampling equipment will be decontaminated in accordance with procedures presented in Section A.7.0 of the FOP.

B.16.2.3 Disposition of Decontamination Wastes

All equipment wastewaters and solvents used for decontamination will be handled pursuant to the procedures presented in Section A.7.0 of the FOP.

B.17.0 CONFINED SPACE ENTRY PROCEDURE

A confined space provides the potential for unusually high concentrations of contaminants, explosive atmospheres, oxygen deficient atmospheres, limited visibility and restricted movement. This Section establishes requirements for safe entry into, continued work in, and safe exit from confined spaces. Additional information regarding confined space entry can be found in 29 CFR 1926.21, 29 CFR 1910 and NIOSH 80-106. At this Site, confined spaces may be encountered during excavation activities.

B.17.1 DEFINITIONS

Confined Space: A space or work area not designed or intended for normal human occupancy, having limited means of egress and poor natural ventilation; and/or any structure, including buildings or rooms, which have limited means of egress.

Confined Space Entry Permit (CSEP): A document to be initiated by the supervisor of personnel who are to enter into or work in a confined space. The CSEP will be completed by the personnel involved in the entry and approved by the SSO before personnel will be permitted to enter the confined space. The CSEP shall be valid only for the performance of the work identified on the permit and for the location and time specified on the permit. The beginning of a new shift with change of personnel will require the issuance of a new CSEP. A copy of a CSEP is provided in Attachment B-2.

Confined Space Observer: An individual assigned to monitor the activities of personnel working within a confined space. The confined space observer monitors and provides external assistance to those inside the confined space. The confined space observer summons rescue personnel in the event of emergency and assists the rescue team.

B.17.2 GENERAL PROVISIONS

The following general provisions will apply to confined space entry:

i) when possible, confined spaces should be identified with a posted sign which reads: Caution - Confined Space;

ii) only personnel trained and knowledgeable of the requirements of these confined space entry procedures will be authorized to enter a confined space or be a confined space observer;

iii) a CSEP must be issued prior to the performance of any work within a confined space. The CSEP will become a part of the permanent and official health and safety record for the response action at the Site;

iv) natural ventilation shall be provided for the confined space prior to initial entry and for the duration of the CSEP. Positive/forced mechanical ventilation may be required. However, care should be taken to not spread contamination outside of the enclosed area;

v) if flammable liquids are anticipated to be within the confined space, explosion proof equipment will be used. All equipment shall be positively grounded;

vi) the contents of any confined space shall, where necessary and where possible, be removed prior to entry. All sources of ignition must be disconnected and/or removed prior to entry;

vii) hand tools used in confined spaces shall be in good repair, explosion proof and spark proof, and selected according to intended use. Where possible, pneumatic power tools are to be used;

viii) hand-held lights and other illumination utilized in confined spaces shall be equipped with guards to prevent contact with the bulb and must be explosion proof;

ix) compressed gas cylinders, except cylinders used for self-contained breathing apparatus, shall not be taken into confined spaces. Gas hoses shall be removed from the space and the supply turned off at the cylinder valve when personnel exit from the confined space;

x) if a confined space requires respiratory equipment or where rescue may be difficult, safety belts, body harnesses, extraction equipment and lifelines will be used. The outside observer shall be provided with the same equipment as those working within the confined space;

xi) a ladder or extraction device is required in all confined spaces deeper than the employee's shoulders. The ladder shall be secured and not removed until all employees have existed the confined space;

xii) only SCBA or NIOSH approved airline respirators equipped with a 5-minute emergency air supply (egress bottle) shall be used in untested confined spaces or in any confined space with conditions determined immediately dangerous to life and health;

xiii) where air-moving equipment is used to provide ventilation, chemicals shall be removed from the vicinity to prevent their introduction into the confined space;

xiv) vehicles shall not be left running near confined space work or near air-moving equipment being used for confined space ventilation;

xv) smoking in confined spaces will be prohibited at all times; and

xvi) any deviation from these confined space entry procedures requires the prior permission of the SSO.

B.17.3 PROCEDURE FOR CONFINED SPACE ENTRY

The SSO and confined space entry personnel shall adhere to the following confined space entry procedures:

i) evaluate the job to be done and identify the potential hazards before a job in a confined space is scheduled;

ii) ensure that all process piping, mechanical and electrical equipment, etc., have been disconnected, purged, blanked-off or locked and tagged as necessary;

iii) if possible, ensure removal of any standing fluids that may produce toxic or air displacing gases, vapors or dust;

iv) initiate a CSEP in concurrence with the SSO or designated alternative;

v) ensure that any hot work (welding, burning, open flames or spark producing operation) that is to be performed in the confined space has been approved by the SSO and is indicated on the CSEP;

vi) ensure that the confined space is ventilated before starting work in the confined space and for the duration of the time that the work is to be performed in the confined space;

vii) ensure that the personnel who enter the confined space and the confined space observer helper are familiar with the contents and requirements of this instruction and the CSEP;

viii) ensure remote atmospheric testing of the confined space prior to and during employee entry and before validation/revalidation of a CSEP to ensure the following requirements:

a) oxygen content between 19.5 percent - 23.0 percent,

b) no concentration of combustible gas in the space. Sampling will be done throughout the confined space and specifically at the lowest point in the space,

c) the absence of other atmospheric contaminants if the space has previously contained toxic, corrosive or irritant material, and

d) if remote testing is not possible, Level B PPE is required for confined space entry;

ix) designate whether hot or cold work will be allowed. If all tests are satisfactory, complete the CSEP listing any safety precautions, protective equipment or other requirements; and

x) ensure that a copy of the CSEP is posted at the work Site, a copy is filed with the work supervisor and a copy is furnished to the SSO.

The CSEP shall be considered void if work in the confined space does not start within one hour after the tests in Item viii) above are performed or if significant changes within the confined space atmosphere or job scope occurs.

The CSEP posted at the work Site shall be removed at the completion of the job or the end of the shift, whichever is first.

B.17.4 CONFINED SPACE OBSERVER

The duties of the confined space observer are as follows:

i) while personnel are inside the confined space, a confined space observer will monitor the activities and provide external assistance to those in the confined space. The observer will not have other duties which may take his attention away from the work or require him to leave the vicinity of the confined space at any time while personnel are in the confined space;

ii) the confined space observer shall maintain at least voice contact with all personnel in the confined space. Visual contact is preferred, if possible;

iii) the confined space observer shall be instructed by his supervisor or the SSO in the method for contacting rescue personnel in the event of an emergency;

iv) if irregularities within the confined space are detected by the observer, personnel within the confined space will be ordered to exist;

v) in the event of an emergency, the confined space observer must not enter the confined space prior to contacting and receiving assistance from a helper. Prior to this time, he should attempt to remove personnel with the lifeline and to perform all other rescue functions from outside the space; and

vi) a helper shall be designated to provide assistance to the confined space observer in case the observer must enter the confined space to retrieve personnel.

B.18.0 HEAT STRESS

The combination of warm ambient temperature and protective clothing increases the potential for heat stress. In particular, heat stress can be evident as:

i) heat rash;
ii) heat cramps;
iii) heat exhaustion; and/or
iv) heat stroke.

These hazards will be discussed during daily safety meetings before commencement of work activities, when relevant. Personnel must increase consumption of water and electrolyte-containing beverages, such as Gatorade, during warm and hot weather conditions.

At a minimum, workers will break approximately every two hours for 10- to 15-minute rest periods. In addition, workers will be encouraged to take rests whenever they feel any adverse effects that may be heat related. The frequency of breaks may need to be increased upon worker recommendation to the SSO.

A work/rest schedule will be calculated based on heat stress monitoring results. Monitoring will consist of taking the radial pulse of a worker for 30 seconds immediately after exiting the work area. The frequency of monitoring the radial pulse will be as follows:

Ambient Temp.	Modified Level D PPE	Level C PPE/Level B
90°F or above	After 45 min. of work	After 15 min. of work
87.5°F - 90°F	After 60 min. of work	After 30 min. of work
82.5°F - 87.5°F	After 90 min. of work	After 60 min. of work
77.5°F - 82.5°F	After 120 min. of work	After 90 min. of work
72.5°F - 77.5°F	After 150 min. of work	After 120 min. of work

If the heart rate exceeds 110 beats per minute at the beginning of the rest period, the next work cycle will be shortened by 1/2 and the rest period will be kept the same. If the heart rate still exceeds 110 beats per minute at the next rest period, the following rest period will be increased by 1/3. The initial rest period will be at least five minutes.

Monitoring for heat stress will begin when the ambient temperature reaches or exceeds 70°F when wearing Level C or Level B PPE, or 80°F when wearing Level D PPE and humidity levels are above 50 percent.

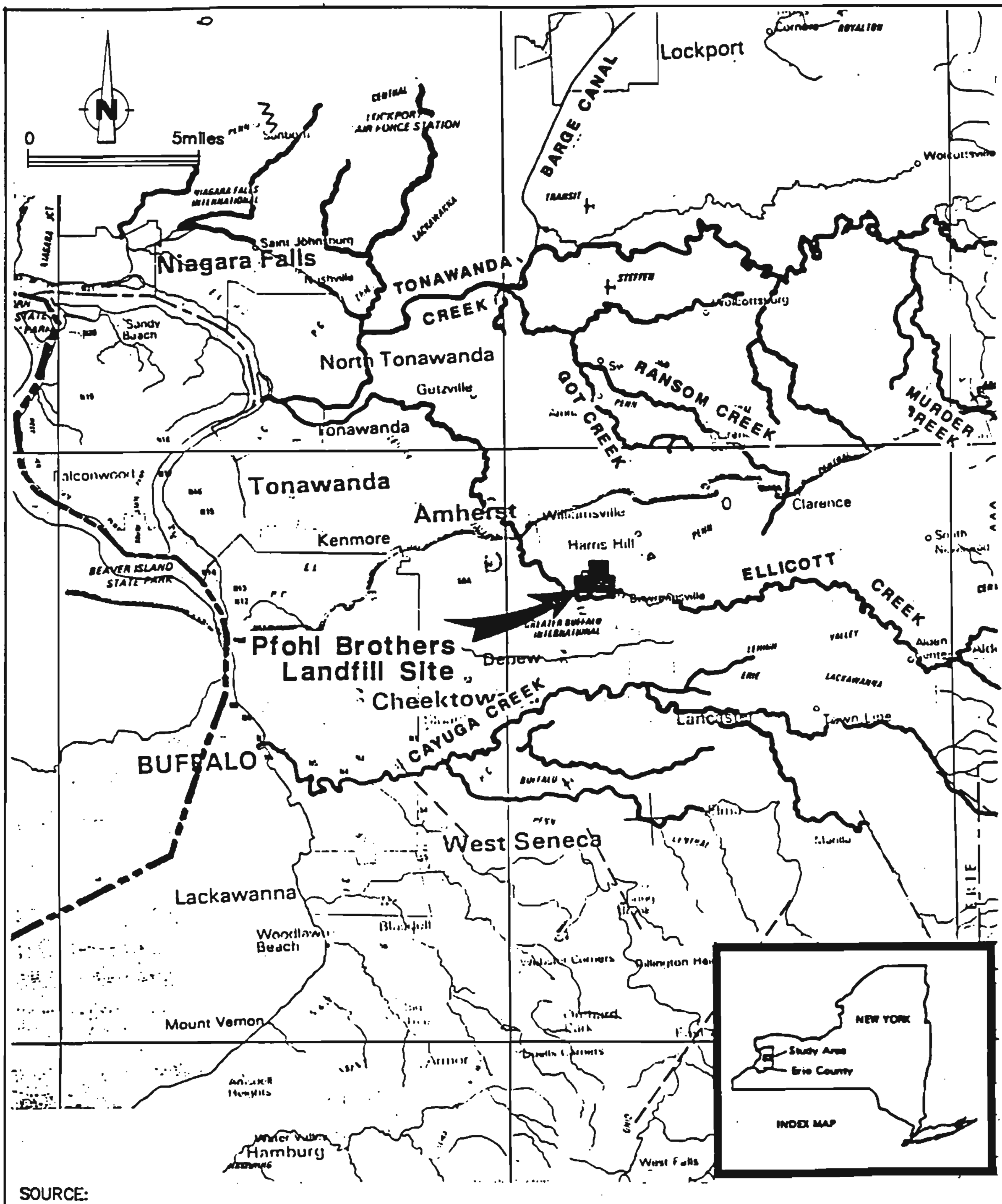
B.19.0 COLD STRESS

With outdoor work in the winter months, the potential exists for hypothermia and frostbite.

Protective clothing greatly reduces the possibility of hypothermia in workers. However, personnel will be instructed to wear warm clothing and to stop work to obtain more clothing if they become too cold. Employees must also change into dry clothes if their clothing becomes wet from perspiration or from exposure to precipitation.

In cold weather, the potential for frostbite exists, especially in body extremities. Personnel must pay particular attention to hands, feet and any exposed skin when dressing. Personnel will be advised to obtain more clothing if they begin to experience loss of sensation due to cold exposure.

Employees will be encouraged to seek heated shelter at regular intervals, depending upon the severity of ambient temperatures. Symptoms of cold stress, including heavy shivering, excessive fatigue, drowsiness, irritability or euphoria will necessitate immediate return to the heated shelter.



SOURCE:
FEDERAL EMERGENCY MANAGEMENT AGENCY, 1983 (MODIFIED BY CDM, 1990)

figure B.1

SITE LOCATION

Pfohl Brothers Landfill, Cheektowaga, New York

CRA

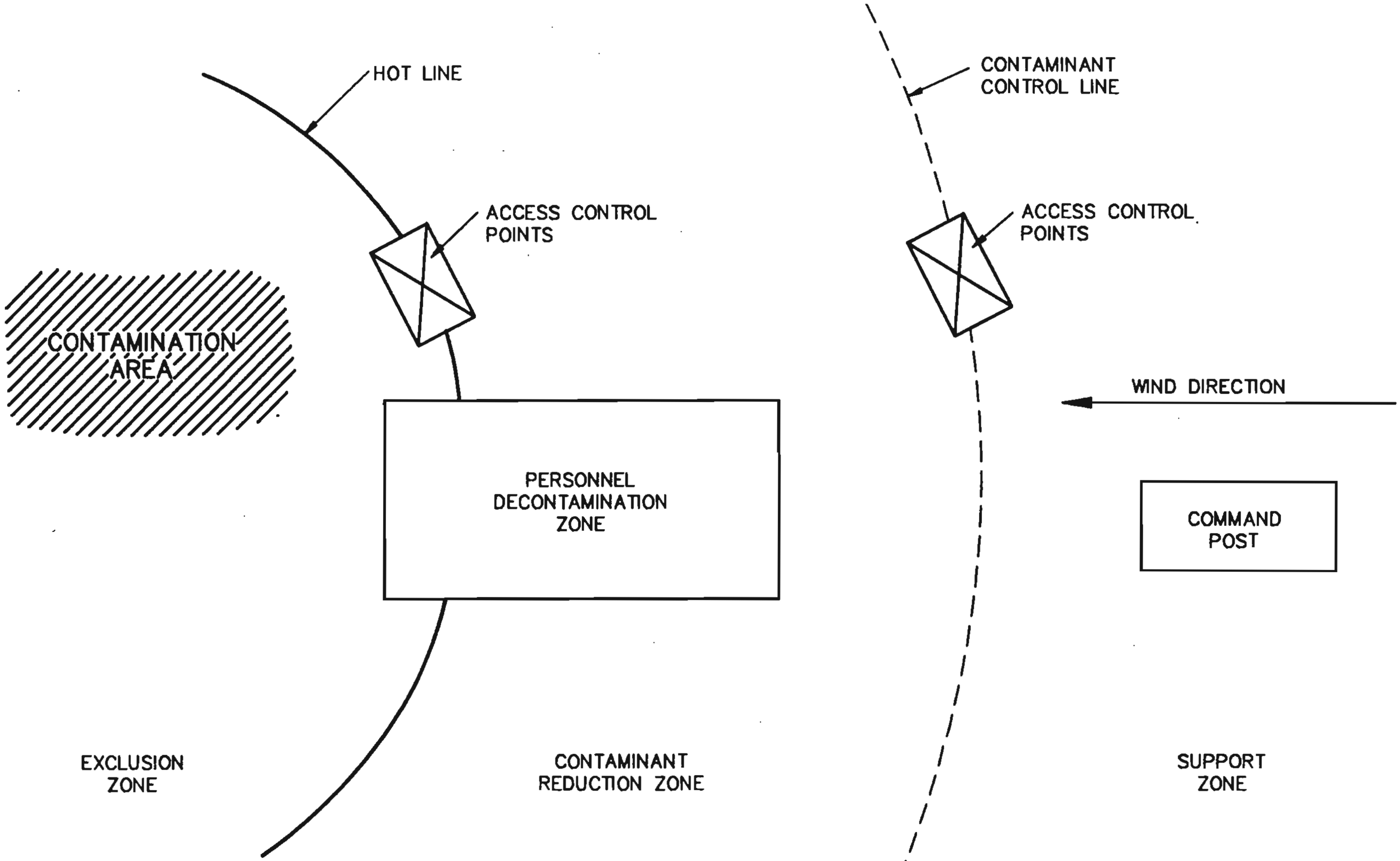


figure B.2

PFOHL BROTHERS LANDFILL
TYPICAL SITE CONTROL
Pfohl Brothers Landfill, Cheektowaga, New York

CRA

1979 (4) OCT 21/92 REV.0 (P-07)

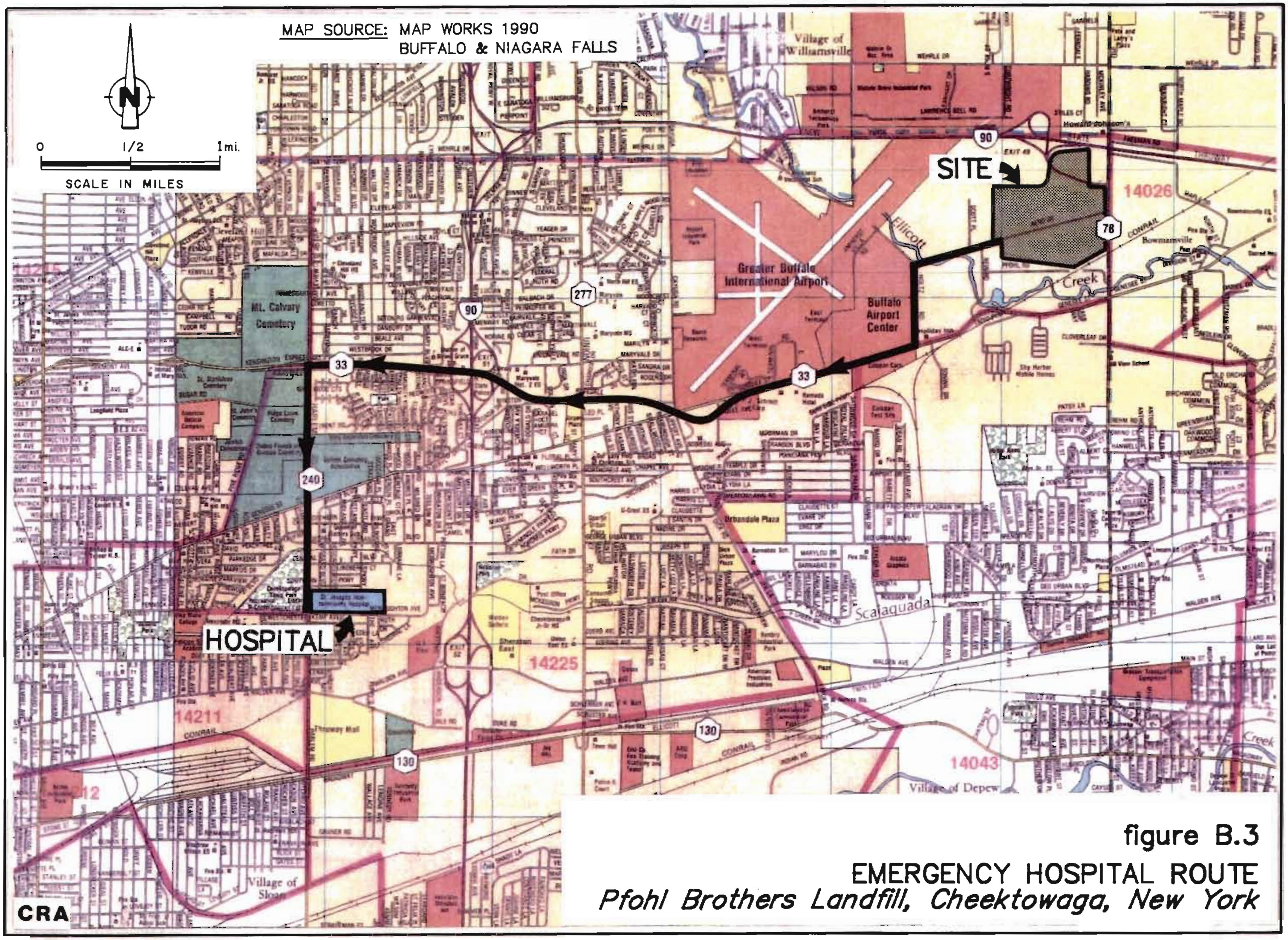


figure B.3

EMERGENCY HOSPITAL ROUTE

Pfohl Brothers Landfill, Cheektowaga, New York

1979 (4) OCT.20/92-REV.0

TABLE B.1

CHEMICALS IDENTIFIED DURING THE RI ON OR IN THE VICINITY OF THE PFOHL BROTHERS LANDFILL SITE CHEEKTOWAGA, NEW YORK

Volatile Organics	*Base Neutral and Acids*		*Pesticides and PCBs*	*Inorganics*	*Radioactive Compounds (1)*
Methylene Chloride	Phenol	Diethylphthalate	Beta-BHC	Aluminum	Radium 226
Toluene	1,3-Dichlorobenzene	Phenanthrene*	Aldrin	Arsenic	Thorium 228
Chlorobenzene	1,4-Dichlorobenzene	Anthracene	Endosulfan	Barium	Thorium 232
Ethylbenzene	1,2-Dichlorobenzene	Di-n-Butylphthalate	Dieldrin	Beryllium	Uranium 238
Total Xylenes	2-Methylphenol	Fluoranthene**	Endrin	Cadmium	
1,1-Dichloroethane	4-Methylphenol*	Pyrene*	DDD	Chromium	
1,1,1-Trichloroethane	2,4-Dimethylphenol	Benzo (a) Anthracene	PCB***	Cobalt	
1,1-Dichloroethylene	Acenaphthylene	Bis (2-ethylhexyl) Phthalate		Copper	
Chloroethane	Dibenzofuran*	Chrysene		lead	
Trans 1,2-Dichloroethylene	2-Chlorophenol	Benzo(b) Fluoranthene**		Cyanide	
		Benzo (1) Pyrene**		Manganese	
		Indeno (1,2,3-cd) Pyrene**		Mercury	
		Benzo (g,h,i) Perylene*		Nickel	
		Dioxins/Furans		Silver	
				Vanadium	
				Zinc	
				Cyanide	

Notes:

- * Lacks chronic toxicity data (USEPA, 1986a).
- ** Carcinogenic polynuclear aromatic hydrocarbons (PAHs) for which the potency factor for Benzo (a) Pyrene applies.
- *** Potency factor for polychlorinated biphenyls (PCBs) applies to sum of Aroclors.
- (1) Compounds detected above background in soil/water.

TABLE B.2

LEVEL OF REQUIRED PERSONNEL PROTECTIVE EQUIPMENT

Work Activity	*Anticipated Hazards/Risks*	*Levels of PPE Required*
Site Preparation and Construction of Access Roads	• slip/trip/fall hazards • potential personnel injuries • direct contact with contaminated soil, sediment and water • potential dust and/or vapor emissions • hazards presented by the use of heavy equipment	Level D
Installation of Test Pits/Trenches, Boreholes, Gas Probes and Prototype Groundwater Collection System	• slip/trip/fall hazards • potential personnel injuries • direct contact with contaminated soil, sediment and water • potential dust and/or vapor emissions • hazards presented by the use of heavy equipment • hazards presented by the use of specialized drum removal equipment • hazards presented by confined spaces	Level C or Level B if air monitoring results indicate the need Level B if drum removal is required
Sample Collection Activities (Soil and Groundwater, Groundwater Treatability Study, Pumping Tests of Prototype Wells, Monitoring Gas Probes, and Materials Compatibility Study	• slip/trip/fall hazards • potential personnel injuries • direct contact with contaminated soil, sediment and water • potential dust and/or vapor emissions • hazards presented by the use of specialized sampling equipment	Level C or Level B if air monitoring results indicate the need
Decontamination Activities	• slip/trip/fall hazards • potential personnel injuries • potential contact with contaminated soil, sediment and water, waset material and cleaning solvents • potential vapor emissions • hazards presented by the use of specialized decontamination equipment (i.e. steam cleaning unit)	Level C or Level B if air monitoring results indicate the need

TABLE B.3

AIR MONITORING AND AIR MONITORING ACTION LEVELS

Monitoring Device	*Action Level*	*Action*
Combustible Gas Indicator	>1% LEL 10 - 20% LEL	Limit ignition sources work with caution be prepared to cease operations
	>20% LEL for non confined spaces >10% LEL for confined spaces	Cease operations and move to a safe place. Notify SSO do not continue working until conditions are constantly below 20% LEL
Oxygen Meter <19.5% or >23.5%		Cease operations and move to a safe area and notify SSO. Do not continue working unitl oxygen levels are between 19.5% and 23.5%. Note: When oxygen levels are outside this range %LEL readings are not reliable.
Radiation Dose Survey Meter	<.5 mR/hr	Radiation dose monitoring is required for continuous full day exposures over this level
	>3x Background (.01 - .02 mR/hr)	Use Caution. Dose rate is below NRC dose limit for a normal 8-hour work day
	>2 mR/hr	Leave area. Notify SSO

TABLE B.3

AIR MONITORING AND AIR MONITORING ACTION LEVELS

Monitoring Device	*Action Level*	*Action*
Particulate Monitor	<150 µg/m3 at the downwind Site perimeter	Continue operations
	>150 µg/m3 at the downward Site perimeter	Temporarily halt work activities and implement engineering controls until levels are maintained below 150 µg/m3
Photoionization Detector	Background Readings	Continue work in Level D PPE
	1 - 5 ppm	Half or full-face air purifying respirator Level C PPE
	5 - 50 ppm	Supplied air respirator Level B PPE
	>50 ppm	Shut down activities Notify SSO Implement additional engineering controls

TABLE B.4

EMERGENCY TELEPHONE NUMBERS
PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, NEW YORK

General Emergency	911
Fire Department	911
Police Department	911
Poison Control Center	(800) 962-1253
USEPA National Response Center	(800 438-2427
Hospital (St. Josephs Intercommunity)	(716) 891-2450
NYSDEC (Albany)	(800) 457-7362
NYSDOH (Buffalo)	(716) 847-45002
State Police	(716) 655-3113

ATTACHMENT B-1

TRAINING ACKNOWLEDGEMENT FORM

PFOHL BROTHERS LANDFILL

CHEEKTOWAGA, NEW YORK

TRAINING ACKNOWLEDGMENT FORM

Please Print:

NAME: ______________________________

ADDRESS: ______________________________

SOCIAL SECURITY: ______________________________

EMPLOYER: ______________________________

PROJECT NAME/LOCATION: ______________________________

I have attended and understood the mandatory Site-specific initiation session for the above-referenced job site. This program referenced the following topics:

i) known potential hazards on Site;

ii) level of personal protection equipment required;

iii) emergency procedures for the Site; and

iv) the basics of the Site-specific Health and Safety Plan.

I further confirm that I have the required 40 hours of training to comply with 29 CFR 1910.120, have a respirator for which I have been fit tested and have been trained on the standard operating procedures of equipment I will be operating or procedures (i.e., confined spaces) which I will be participating in.

______________________________ ______________________________

Date Signature

ATTACHMENT B-2

CONFINED SPACE ENTRY PERMIT

CRA CONFINED SPACE ENTRY PERMIT

SITE NAME/LOCATION/REF. NO.: ______________________________

____

____

____

WORK ACTIVITY: ______________________________

Duration:______________ Issue Date: ____________ Time:________ Filled Out by:______________

POTENTIAL HAZARDS:
(System Generated)

____

____

____

____

____

____

____

____

(Work Generated)

____

____

____

____

____

____

____

____

CRA CONFINED SPACE ENTRY PERMIT

AIR MONITORING: PRE-ENTRY__________ PERIODIC__________ CONTINUOUS__________

DATE/TIME	*BY (INIT)*	*%O_2*	*ppm CO*	*% LEL*	*OTHER TEST TYPE*	*OTHER TEST RESULT*

ISOLATION:

Purging Required: YES NO | | PURGING CONFIRMED:

Safety Tags Required: YES | | NO | |

VENTILATION REQUIRED: YES | | NO | |

CONTINUOUS __________ OTHER __________

EMERGENCY RESCUE EQUIPMENT REQUIRED:

__________Communications Device
__________First Aid Kit
__________Stretcher/Backboard
__________Fire Extinguisher
__________SCBA
__________Winch/Hoist
__________Harness with Lifeline (type)
__________PPE (type)
__________Lighting (type)
__________Other__________

CRA CONFINED SPACE ENTRY PERMIT

PERSONAL PROTECTIVE EQUIPMENT REQUIRED:

____________________Hardhat
____________________Safety Glasses
____________________Face Shield
____________________Ear Plugs/Muff
____________________Emergency Escape Pack
____________________Lanyards

____________________Respiratory Protection (type)
____________________Coveralls
Chemical Suits
____________________Rain Suits
____________________Lifelines

____________________Gloves (type)______________________________
____________________Harnesses (type)____________________________
____________________Other___________________________________

ADDITIONAL WORK INSTRUCTIONS:

EMERGENCY CONTACT PHONE NO.____________________________

PERSONS ENTERING CONFINED SPACE (PRINT NAME)

STANDBY PERSON REQUIRED: YES:__________ NO:__________ (PRINT NAMES)

CRA CONFINED SPACE ENTRY PERMIT

I have reviewed and met the requirements of this permit and expect that this work shall be done safely. Entrants have been instructed on the proper space entry procedures, requirements and conditions.

ENTRY AUTHORIZED BY:______________________________ DATE:______________________

All work under this permit has been completed and all materials and entrants have been withdrawn from the confined space.

______________________________ ______________________________

Attendant or Entrant Date

C

APPENDIX C

QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN (QAPP)

PROJECT TITLE: REMEDIAL DESIGN/REMEDIAL ACTION (RD/RA) WORK PLAN
PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, NEW YORK

PREPARED BY: CONESTOGA-ROVERS & ASSOCIATES

Approved by:	______________________ Project Manager J. K. Kay, CRA	Date: __________
Approved by:	______________________ Project Coordinator J. Heimbuch, TEC	Date: __________
Approved by:	L. Reyes QA/QC Officer L. Reyes, CRA	Date: 1-6-93
Approved by:	______________________ Project Manager Analytical Contractor	Date: __________
Approved by:	______________________ QA/QC Officer Analytical Contractor	Date: __________
Approved by:	______________________ NYSDEC Project Manager	Date: __________
Approved by:	______________________ QA/QC Officer NYSDEC	Date: __________

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C.1.0 PROJECT DESCRIPTION

C.1.1 GENERAL

This Quality Assurance Project Plan (QAPP) provides quality assurance/quality control (QA/QC) criteria for work efforts associated with groundwater pumping tests and treatability study described in the Pfohl Brothers Landfill (Site) Remedial Design/Remedial Action (RD/RA) Work Plan. Methods for sample analysis have been selected to reflect sampling results obtained during previous Site studies and, if necessary, to facilitate in the design of a pretreatment system to remediate affected groundwater at the Site.

C.1.2 SITE HISTORY AND BACKGROUND

A detailed summary of the Site history and background is presented in RD/RA Work Plan.

C.1.3 PROJECT DESCRIPTION

The predesign portion of the RD/RA for the Site will involve the collection and analysis of groundwater samples to determine if direct discharge of the extracted groundwater to the local POTW is possible and, if not possible, for use in a groundwater treatability study. Sample collection will be performed in accordance with the Field Operations Plan (FOP) (Appendix A) and the Health and Safety Plan (HSP) (Appendix B).

Pumping tests will be performed on three prototype extraction wells. Samples will be collected for chemical analysis from each extraction well ten minutes after initiation of the step-test, 24 hours after the initiation of the 48-hour constant rate test and at the completion of the 48-hour constant rate test. In addition, a sample will be collected from existing monitoring well GW-2S for chemical analysis. In addition, at the end of each pumping test, 10-gallon samples will be collected from each extraction well and well GW-2S for chemical analysis to be performed during the treatability study as described in the treatability study work plan (Appendix E).

C.1.4 QUALITY ASSURANCE PROJECT PLAN OBJECTIVES

This document is Site-specific and has been prepared for predesign activities as part of the RD/RA for the Pfohl Brothers Landfill in Cheektowaga, New York. It has been prepared in accordance with USEPA's "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans", QAMS-005/80, 1980. Prior to deviation from the protocols outlined herein, the New York State Department of Environmental Conservation (NYSDEC) QA/QC representative for the investigation will be notified.

The objectives of this QAPP are to provide sufficiently thorough and concise descriptions of the measures to be applied during the predesign portion of the RD/RA such that the data generated will be of a known and acceptable level of precision and accuracy. This QAPP provides comprehensive information regarding the project description and personnel responsibilities, and sets forth specific procedures to be used during sampling of relevant environmental matrices, other field activities, and analyses of data.

The following QA topics are addressed in this Plan:

i) data quality objectives (DQOs) for measurement of data, including precision, accuracy, completeness, representativeness and comparability;

ii) project organization and responsibility;

iii) sampling procedures;

iv) sample custody;

v) analytical procedures;

vi) calibration procedures, references and frequency;

viii internal QC checks and frequency;

viii) QA performance audits, system audits and frequency;

ix) QA reports to management;

x) preventative maintenance procedures and scheduling;

xi) specific procedures to be used to routinely assess data precision, representativeness, comparability, accuracy and completeness;

xii) data validation; and

xiii) corrective action.

C.2.0 PROJECT MANAGEMENT

The project management structure for QA/QC activities associated with predesign activities is discussed below along with a brief description of the duties of the key personnel is presented below.

Project Director

- provides overall project management
- ensures professional services by the Design Firm are cost effective and of highest quality
- ensures all resources of the Design Firm are available on an as-required basis
- participates in key technical negotiations with NYSDEC
- provides managerial and technical guidance to the Design Firm's Project Manager.

Project Manager

- provides day-to-day project management
- provides managerial guidance to the Design Firm's technical group
- acts as liaison with NYSDEC and the PRPs as appropriate
- prepares and reviews reports
- conducts preliminary chemical data interpretation and assessment
- conducts field audits
- responsible for overall project completion in accordance with the approved RD/RA Work Plan.

QA/QC Officer - Analytical Activities

- overviews and reviews laboratory activities
- determines laboratory data corrective action
- performs analytical data validation and assessment
- reviews laboratory QA/QC
- assists in preparation and review of final report
- provides technical representation for analytical activities.

QA/QC Officer - Field Activities

- provides immediate supervision of all on-site activities
- provides field management of sample collection and field QA/QC
- assists in preparation and review of final report
- provides technical representation for field activities
- is responsible for maintenance of the field equipment
- the individual designated to be the field QA/QC officer will be specified prior to commencement of field activities.

Laboratory - Project Manager, Analytical Contractor

- ensures resources of laboratory are available on an as-required basis
- coordinates laboratory analyses
- supervises laboratory's in-house chain of custody
- schedules analyses of samples
- oversees review of data
- oversees preparation of analytical reports
- approves final analytical reports.

Laboratory - Quality Assurance/Quality Control Officer, Analytical Contractor

- overviews laboratory QA/QC
- overviews QA/QC documentation
- conducts detailed data review
- decides laboratory corrective actions, if required
- provides technical representation for laboratory QA/QC procedures.

Laboratory - Sample Custodian - Analytical Contractor

- receives and inspects the sample containers
- records the condition of the sample containers
- signs appropriate documents
- verifies chain of custody and their correctness
- notifies laboratory Project Manager and laboratory QA/QC Officer of sample receipt and inspection
- assigns a unique laboratory identification number correlated to the field sample identification number, and enters each into the sample receiving log
- initiates transfer of samples to the appropriate lab sections with assistance from the laboratory project manager
- controls and monitors access to and storage of samples and extracts.

The analytical laboratory chosen to perform the analyses will be certified by the New York State Department of Health (NYSDOH) through the environmental laboratory approval program for the appropriate categories of analysis.

C.3.0 DATA QUALITY OBJECTIVES

C.3.1 OBJECTIVES

The overall objectives of this investigation are the following:

i) to determine, based on pumping tests, the design items that will be associated with a perimeter barrier system (a drain tile system, extraction well system, or combination of both);

ii) to determine if the quality of the extracted groundwater meets the discharge criteria of the local publicly-owned treatment works (POTW); and

iii) if the results of groundwater quality analyses indicate that discharge to the POTW is not feasible, a treatability study will be performed to determine the pretreatment necessary prior to discharge to the POTW.

To achieve these project objectives, Data Quality Objectives (DQOs) have been established in order to develop an analytical database of sufficient quality to support conclusions made as a result of this investigation. Therefore, requirements for data quality parameters such as detection limits, accuracy, precision, sample representativeness, data comparability and data completeness are specified in the following sections of this document.

DQOs are quantitative and qualitative statements specifying the quality of the environmental data required to support the decision-making process. DQOs define the total uncertainty in the data that is acceptable for each specific activity during the investigation. This uncertainty includes both sampling error and analytical error. Ideally, zero uncertainty is the intent, however, the variables associated with the process (field and laboratory) inherently contribute to the uncertainty of the data. It is the overall objective to keep the total uncertainty within an acceptable range that will not hinder the intended use of the data.

As previously discussed, the data generated during the field activities will be used to design the selected remedy at the Site. Consequently, the data use category consists of Engineering Design.

Analytical support equivalent to Level III, as described in the USEPA guidance document entitled, "Data Quality Objectives for Remedial Response Activities", USEPA 540/G-87/1003, will achieve the DQOs described above. This level implies the use of protocols defined in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", EPA SW-846, 3rd edition, November 1986 (SW-846) and "Methods for Chemical Analysis of Water and Wastes", EPA 600/4-79-020, revised March 1983 (USEPA). The requirements for reporting and deliverables specified in the above documents are required for data to be used in engineering design. In addition, data deliverables consistent with the NYSDEC 1991 Analytical Service Protocols (ASP) will be requested from the project laboratory (ies) for applicable analysis (TCL and TAL parameters). Field analyses and measurements will adhere to Level I analytical support. Level I implies the use of portable instruments for field screening. The remainder of this QAPP describes the specific approaches that will be taken to achieve the required

DQOs. Sections C.7.0 and C.9.0 list methods and method specific quality control criteria which will be adhered to during sample collection and analysis. These criteria are discussed in detail in subsequent sections of this document.

Data collected during the predesign field investigation will be of sufficient quality to meet the DQOs. The QA/QC Program described herein has been developed to assess adherence to the DQOs. The USEPA CLP states that the purpose of the QA/QC program "is the definition of procedures for the evaluation and documentation of sampling and analytical methodologies and the reduction and reporting of data.

The objective is to provide a uniform basis for sample collection and handling, instrument and methods maintenance, performance evaluation, and analytical data gathering and reporting". This QAPP for sampling, analysis and data handling is consistent with the requirements set forth by SW-846 and USEPA.

Two types of analytical support will be utilized to achieved the DQOs necessary for this investigation: field analyses and laboratory analyses.

C.3.2 FIELD ANALYSES AND MEASUREMENTS

Field analyses will include on-Site analysis of pH, specific conductance, turbidity, and temperature of groundwater and organic vapor, combustibility and pressure of landfill gas. These field investigation activities do not require analytical sample collection, but nonetheless, involve measurements for which QA concerns are appropriate. Therefore, these activities will adhere to Level 1 analytical support.

These DQOs will be accomplished through the use of procedures described throughout this QAPP. Where specific procedures are not specified, appropriate references are provided. Proper sampling techniques and equipment as presented in the USEPA guidance document entitled, "A Compendium of Superfund Field Operations Methods", USEPA 600/2-80-018, have been specified. The appropriate sampling methods are presented in Section 4.0.

C.3.3 LABORATORY ANALYSES

Groundwater samples collected during the RD will be collected and analyzed for USEPA Target Compound List (TCL) volatile organic compounds (VOC) and semi-volatile organic compounds (SVOC) and Target Analyte List (TAL) inorganics using appropriate protocols as defined in SW-846.

In addition, three samples will be analyzed for total organic carbon (TOC), biochemical oxygen demand (BOD), chemical oxygen demand (COD), iron (total and soluble), manganese (total and soluble), total suspended solids (TSS), total dissolved solids (TDS), alkalinity, hardness, 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), polychlorinated biphenyls (PCB), calcium, sulfate pesticides, tetra to octa polychlorinated dioxins and furans (PCDD/PCDF) and gross alpha and beta radioactivity using appropriate protocols as defined in SW-846 and USEPA.

Table C.3.1 presents a summary of sampling and analytical program.

C.3.4 DEFINITIONS

The following is a brief description/definition of data quality parameters addressed in the QAPP.

Representativeness - refers to the degree to which a sample taken from a site accurately represents the matrix at the site. Representativeness is a qualitative parameter which concerns the proper design of the sampling program. This criterion will be satisfied by ensuring that the sampling points are properly selected and the number of samples collected is consistent with those presented in the RD/RA Work Plan. In addition, representativeness will be ensured by following the sampling procedures presented in Section 4.0.

Comparability - refers to the use of consistent procedures, reporting units, standardized methods of field and laboratory analyses and standardized data format with document control. Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Comparability is achieved through using standard techniques to collect representative samples and reporting analytical results in consistent units.

Completeness - refers to the process of obtaining all required data as outlined in the RD/RA Work Plan. Completeness is also defined as the percentage of measurements judged to be valid. The level of completeness will be required to be 85 percent for laboratory samples and 80 percent for field analyses.

Precision - describes the reproducibility of results. It is defined as the agreement between the numerical values of two or more measurements that have been made in an identical manner. Precision can be expressed in a variety of manners, including the absolute methods of deviation from the mean or medium values, standard deviation and variance, or by relative methods, such as relative deviation from the mean or median. Precision will be determined through the analysis of duplicate samples and through duplicate analysis of the same sample.

Accuracy - is a measure of closeness of an individual measurement or an average of a number of measurements to the true value, and is expressed in terms of absolute or relative error. Accuracy will be determined through analysis of spiked samples and through the analysis of standards with known concentrations.

C.4.0 FIELD PROCEDURES

All monitoring and sampling activities described in this document shall be conducted in accordance with the protocols detailed in the FOP (Appendix A) as well as the standards and criteria set forth in the RD/RA Work Plan and HSP (Appendix B).

Table C.4.1 presents a summary of the sample container, preservation and holding time period requirements.

C.5.0 SAMPLE CUSTODY

Chain of custody procedures will be instituted and followed throughout the study. These procedures include field custody, laboratory custody, and evidence files. Samples are physical evidence and will be handled according to strict chain of custody protocol. Documentation will be kept that traces the samples from the field to the laboratory and through the analyses. The National Enforcement Center of the USEPA has defined custody of evidence as follows:

i) in actual physical possession;
ii) in view after being in physical possession;
iii) in a locked laboratory; and
iv) in a secure, restricted area.

Quality Assurance measures for this project will begin with sample containers. Sample containers will be purchased from a USEPA certified manufacturer and will be precleaned (I-Chem Series 200 or equivalent). Chain-of-custody records will be kept starting in the field when sample collection has been completed.

The sampler will complete the custody form, package the samples including the custody form, and seal the package with evidence tape. Shipment may be made by commercial vendors, and their policy will be to document the transfer of the package within their organization. When the samples arrive at the laboratory, the sample custodian will sign the vendor's air bill or bill of lading. The sample custodian's duties and responsibilities upon sample receipt will be to:

i) document receipt of samples;

ii) inspect sample shipping containers for the presence or absence of custody seals, locks, and evidence tape, and for container integrity;

iii) record condition of the shipping and sample containers in the log books;

iv) sign the appropriate forms or documents;

v) verify and record the agreement or disagreement of information on sample documents and if there are discrepancies, record the problem and notify the QAO;

vi) label sample with laboratory sample number; and

vii) place samples in secure storage.

The hand-to-hand custody of samples in the laboratory will be maintained through preparation, extraction, and analysis. The analyst will be required to log samples into and from storage as the analysis proceeds. Samples will be returned to secure storage at the close of business. Log sheets will incorporate options for multiple entries, so that several people can handle the samples throughout the analytical scheme. Written records will be kept of each and every time the sample changes hands. The laboratory records may also be used as evidence in enforcement proceedings. Care must be exercised, therefore, to properly complete, date, and sign the items needed to generate data. Copies of the following items will be stored:

i) documentation of the preparation and analysis of samples, including copies of the analyst's notebooks;

ii) bench sheets, graphs, computer printouts, chromatograms, and mass spectra;

iii) copies of QA/QC data;

iv) instrument logs showing the date, time, and identity of the analyst; and

v) analytical tracking forms that record the date, time, and the identity of the analyst for each step of the sample preparation, extraction, and analysis.

The sample custodian will log in samples on a log-in form and note the appropriate information, including sample identification and the condition of the samples. Any inconsistencies in paperwork or comments on the condition of the samples will be duly noted on the form and filled with the case.

To further document the custody of each sample, the analyst will complete the Sample Preparation and Extraction Log and instrument log books. The chemist or technician will sign and date the appropriate forms when handling the samples. During the analyses, these forms will be maintained in a secure file. Following the completion of the analysis of a group of samples, appropriate forms and data sheets will be collected and stored in the files.

Upon completion of the analysis, the QAO or his assignee will begin assimilating the field and laboratory data reports. In this way, the evidence file for the project will be generated. The file will be chronologically arranged for ease of review. When the information has been gathered, the file will be inventoried, numbered, and stored for future reference.

C.6.0 CALIBRATION AND FREQUENCY

C.6.1 LABORATORY EQUIPMENT CALIBRATION

Calibration of laboratory analytical instrumentation is essential for the generation of reliable data which meets project data quality objectives. Analytical instrument calibration is monitored through the use of control limits which are established for individual analytical methods. Calibration procedures to be followed are specified, in detail, in the analytical methods. These proceeds specify the type of calibration, calibration materials to be used, range of calibration, and frequency of calibration.

The contract laboratory will be responsible for the proper calibration and maintenance of laboratory analytical equipment.

C.6.2 FIELD EQUIPMENT CALIBRATION

Field equipment used during this investigation, will be calibrated both prior to and following the day's surveys in accordance with the manufacturer's instructions. The equipment will also be operated in accordance with the manufacturer's instructions. Records of calibrations of field equipment will be recorded in a bound field notebook.

Generally, field equipment will be calibrated on a daily basis. The calibration range will be designed to bracket the concentrations of concern.

C.6.3 STANDARDS

Standards may be generally grouped into two classifications: primary and secondary. Primary standards include United States Pharmacopoeia (USP) drugs, National Institute of Standards and Technology (NIST) and ASTM materials, and certain designated USEPA reference materials. Other standards are to be considered secondary. No testing of primary standards is necessary. Primary standards should not be used if there is any physical indication of contamination or decomposition (e.g., partially discolored, etc.) or if they are expired. Secondary standards should be examined when first received, either by comparison to an existing primary standard or by comparing known physical properties to literature values. The less stable standards will be rechecked at appropriate levels, usually six months to one year.

C.6.4 RECORDS

A records book will be kept for each standard and will include:

i) name and date received;
ii) source;
iii) code or lot number;
iv) purity;

v) testing data including all raw work and calculations;

vi) special storage requirements;

vii) storage location; and

viii) expiration date.

These records will be checked periodically as part of the laboratory internal audit process.

C.6.5 EQUIPMENT

C.6.5.1 General

A. Each major piece of analytical laboratory instrumentation that will be used on this project will have been documented and will be on file with the analytical laboratory.

B. An equipment form will be prepared for each new purchase and old forms will be discarded when the instrument is replaced.

C.6.5.2 Testing

A. Each equipment form will detail both preventive maintenance activities and the required QA testing and monitoring.

B. In the event the instrument does not perform within the limits specified on the monitoring form, the Laboratory Manager will be notified and a decision will be made as to what corrective action necessary. The correction action procedure shall be necessary. The corrective action procedure shall be documented in the instrument log.

C. If repair is necessary, an "out-of-order" sign will be placed on the instrument until repairs are affected. Repairs made to the instrument will be documented in the instrument log book. Required QA/QC testing and monitoring will be completed prior to the resumption of sample analysis.

C.6.6 CALIBRATION RECORDS

A bound notebook will be kept with each instrument requiring calibration in which will be recorded activities associated with QA monitoring and repairs program. These records will be checked during periodic equipment review and internal and external QA/QC audits.

C.7.0 ANALYTICAL PROCEDURES

C.7.1 FIELD AND LABORATORY ANALYTICAL PROCEDURES

The analytical methods to be used for the predesign portion of the RD/RA are presented in Table C.7.1. Detection limits for analytical parameters are given in Tables C.7.2 and C.7.3. The accuracy and precision of the data generated by the laboratory will be determined through analysis of duplicates, spiked samples, synthetic reference standard samples, and field and laboratory blanks analyzed along with each set of samples. Interferences will be identified and documented.

When matrix interferences are noted during sample analysis, actions will be taken by the laboratory to achieve the specified detection limits. Samples will not be diluted by more than a factor of five to reduce matrix effects. (Samples may be diluted to a greater extent if analytes of concern generate responses in excess of the linear response of the instrument.) The laboratory will re-extract, resonicate, and/or use any of the cleanup methods presented in SW-846. In such cases, the Laboratory QA/QC Officer will assure that the laboratory demonstrates good analytical practices and that such practices are documented in order to achieve the specified detection limits.

In general, the methods accuracy and precision will be determined by spiking the sample matrix with the analyte. Percent recoveries of the spikes will be calculated and compared with laboratory determined control limits. A measure of precision will be obtained through the relative percent difference (RPD) between matrix spike (MS) and matrix spike duplicates (MSDs) for organic compounds and as the RPD between laboratory duplicates for metals. Sampling precision will be evaluated based on the RPD of duplicate field samples. RPDs will be compared to the laboratory determined control limits for MS/MSD and laboratory duplicate analyses.

The data generated will, whenever possible, be input to the laboratory database management system. Analyst's worksheets will be filed and stored for future reference. When approved and signed, data reports and pertinent information will be reported to the NYSDEC.

C.8.0 DATA REDUCTION, VALIDATION, AND REPORTING

C.8.1 GENERAL

A NYSDOH approved analytical laboratory will be conducting analysis on collected samples in accordance with SW-846 and USEPA protocols. Data reduction and laboratory validation will be incorporated into the in-house effort for all parameters and will follow SW-846 and USEPA guidelines.

C.8.2 DATA PRODUCTION, HANDLING, AND REPORTING

Data reporting and deliverable requirements will adhere to SW-846 and USEPA requirements.

The analytical data reports for all sample matrices will include the following information:

i) case narrative;
ii) date of sampling;
iii) case file;
iv) description of samples;
v) description of sample extraction and cleanup procedures;
vi) indication of analytical method;
vii) analytical results of all samples plus trip blank, field blank, and method blank (including TICs, if applicable);

viii) analytical results of QA/QC sample analyses;

ix) summarized calibration data;

x) detection limits for parameters analyzed;

xi) QA/QC data summaries (i.e. MS/MSD results and summaries); and

xii) copies of completed chain of custody forms;

C.8.3 DATA VALIDATION

The laboratory validation process begins with the group leaders who will review the raw and reduced data for possible calculation and transcription errors. Additionally, the group leaders will check unusually high or low parameter values. The laboratory QA/QC Officer will perform a final laboratory validation of the data which will include a review of QC sample analyses and data completeness. The laboratory report will then be reviewed and approved by the manager of analytical services prior to its release.

Prior to submittal of the data to the Project Manager for his review, data will be validated by the QA/QC Officer - Analytical Activities. Data validation is a systematic process of evaluating analytical data quality by comparing the data generation process (sample collection through sample analysis) to QC criteria established prior to the initiation of the field investigation. Data quality criteria are established based on the project data quality objectives which, in turn, are established based on the intended use of the data. A data validation report establishes data usability by determining the degree of adherence to QC criteria. As a result, sample data is determined to be usable as is, approximate, or unusable for the particular use established by the project data quality objectives. A data validation report will be generated.

The requirements to be checked for the validation of analytical data are as follows:

i) documentation completeness;
ii) holding times;
iii) GC/MS tuning;
iv) calibration;
v) blanks;
vi) surrogate recovery;
vii) MS/MSD;
viii) field duplicates;
ix) internal standards performance;
x) TCL compound identification;
xi) compound quantification and reported detection limits;
xii) TICs;
xiii) system performance; and
xiv) overall assessment of data for a case.

C.9.0 QUALITY CONTROL CHECKS

C.9.1 QC CHECKS

C.9.1.1 Laboratory

The numbers of QA/QC samples that must be taken for each sample matrix are listed in Table C.3.1. Upon completion of analysis, the results of QA/QC data will be reviewed to verify compliance with the criteria listed. When results are reported to the QAO, QA/QC data will be included in the package for review. MS and surrogates will be used to monitor the methodology and recoveries will be compared to the QA/QC criteria presented in Section C.7.0. MSD and duplicate samples will be incorporated as an indicator of the precision of the sample results. The RPD calculations will also be compared to the QA/QC criteria presented in Section C.7.0.

C.9.1.2 Field

Field instrument calibrations will be performed both prior to and following the day's surveys. Calibrations will be performed for equipment used in field activities according to manufacturer's recommendations. The calibration range will be designed to encompass the sample readings. The standards used in the field will be checked and replaced with fresh standards as they expire. The distilled water used in the field to clean the pH and other meter probes will be checked for conductance. Instrument conditions and calibration procedures will be checked by the on-Site sampling team leader. On each day of field sampling, approximately 5 percent of temperature, specific conductance, turbidity, pH, organic vapor, combustible gas and pressure measurements will be checked by duplicate measurements.

C.9.2 FIELD SAMPLING QUALITY CONTROL

Field sampling crews will always be under the direct supervision of a field sampling leader. Bound log books and appropriate data sheets will be used to document the collection of samples and data so that any individual sample or data set can be traced back to its point of origin, sampler and sampling equipment used. Sampling will be performed according to the methods provided in this document. Blind field duplicate samples will be collected in conjunction with the environmental samples. Field sampling precision will be evaluated through the RPD of the duplicate sample analyses results. Control limits for field duplicate precision have been established for groundwater (<50 RPD) samples. Decontamination of sampling equipment will be verified through the analysis of equipment blanks. Proper chain-of-custody protocols, as presented in this document, will be followed.

C.9.3 FIELD ANALYTICAL PROCEDURES QUALITY CONTROL

Field measurements of pH, temperature, turbidity, and specific conductance will be taken on groundwater samples and organic vapor, combustibility and pressure of landfill gas. The pH meter will be checked against two known standard pH buffers (7 and 10) before and after each day's use. Temperature measurements will be made with a digital Celsius thermometer. The thermometer will be checked periodically against a precision thermometer certified by the National Institute of Standards and Technology. Conductivity readings will be made with a portable specific conductance meter. The meter will be calibrated against a 0.010 N potassium chloride solution at least twice a day. Turbidity readings will be made with a nephelometer. The meter will be calibrated in a manner consistent with the manufacturer's guidelines and USEPA's standard methods. Organic vapor readings will be made with a photoionization detector and will be calibrated in accordance with the manufacturer's guidelines. Combustibility measurements will be made with an oxygen/combustible gas detector and will be calibrated in accordance with the manufacturer's guidelines. Landfill gas pressure will be measured using a Dwyer Magnahelic Pressure Gauge or performance equivalent. The pressure gauge will be calibrated in accordance with the manufacturer's guidelines.

C.10.0 PERFORMANCE AND SYSTEM AUDITS

C.10.1 LABORATORY

A performance audit consisting of analysis of appropriate blanks, spiked samples, and standard solutions may be performed. The laboratory QA/QC Officer will maintain a record of such audits. These audits will test not only the total system's response, but major measurement methods. The laboratory QA/QC Officer will report to the laboratory Project Manager the result of the assessment of the accuracy, precision, and completeness of the data, results of the performance and system audits, and any problems encountered in the analytical procedures. The QA/QC Officer - Analytical Activities, in conjunction with the Laboratory QA Coordinator, the analyst, analyst's supervisor, and Project Manager will formulate recommendations to correct any deficiencies in the analytical protocols or data. These corrective measures will be in accordance with on-going good laboratory practices and the overall QA/QC program.

System audits for the analytical laboratory may include the following items: evaluation of the laboratory's performance in analyzing P.E. samples (either USEPA or NYSDEC); review of the laboratory's SOPs; evaluation of analysts' experience; and, if deemed necessary, an on-Site audit of the laboratory facility.

C.10.2 FIELD

Audits of field techniques will be conducted by the Field QA/QC Officer. These audits will include review of the sample collection and instrument calibration logbooks and chain of custody documents. Field inspections will also be performed to review sample collection and handling techniques, on-Site supplies of sampling equipment and standards, and availability of relevant project documents.

C.11.0 PREVENTIVE MAINTENANCE

Preventive maintenance procedures will be carried out on field equipment in accordance with the procedures outlined by the manufacturer's equipment manual. Field equipment used during this project will have a specific maintenance instruction sheet accompanying it. Maintenance activities involving field equipment will be recorded in a field logbook.

A preventive maintenance schedule is followed and a maintenance log is kept for each laboratory instrument. Instrument downtime will be kept to a minimum by maintaining service contracts on essential instrumentation and maintaining a supply of critical spare parts. Maintenance, whether performed by laboratory or manufacturer personnel, will be documented on the appropriate instrument log. Log entries will include, the reason for maintenance, maintenance performed, date and initials of person in charge during maintenance.

C.12.0 DATA ASSESSMENT PROCEDURES

The Laboratory QA/QC Officer and the QA/QC Officer - Analytical Activities will be responsible for data assessment. Data quality assessment will be based on instrument tuning criteria, calibration and performance, surrogate recoveries, blanks and the analysis of QC samples. Procedures for data assessment will be consistent with those recommended by the "Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses" and "Laboratory Functional Guidelines for Evaluating Inorganics Analyses".

Precision and accuracy will be assessed utilizing control charts. Control charts are utilized to identify problems before corrective action procedures become necessary. For example, 6 to 7 points in succession below the mean may indicate deterioration of a reference standard or spiking solution. The reference or spiking solution can be remade and the next few points assessed to determine if the trend was in fact due to deterioration of the solution. The analytical laboratory will also utilize warning limits set at ±2 standard deviations of the mean to assist in determining procedural problems before "out of control" situations develop. Reducing "out of control" situations is important to produce valid analytical data in a timely fashion, since reanalysis time is minimized.

In general, the accuracy of the methods will be determined by spiking the sample matrix with the analyte. The spiking levels will be selected to bracket the concentration of interest. Percent recoveries of the spikes will be calculated and compared to the limits presented in

Section C.7.0. The precision of the methods will be determined by the analysis of MS and laboratory and field duplicate samples. The precision will be evaluated by calculating the RPD between the duplicates. RPD calculations will be compared to the limits presented in Section C.7.0.

The definitions and equations used for the assessment of data quality are the following:

A. <u>Accuracy and Precision</u>

Accuracy is a measure of the nearness of an analytical result, or a set of results, to the true value. It is usually expressed in terms of error, bias, or percent recovery (%R).

Normally the term "accuracy" is used synonymously with %R. It describes either the recovery of a synthetic standard of known value, or the recovery of a known amount of analyte (spike) added to a sample of known value. The %R or "accuracy" can be calculated by using:

i) standards - %R = (observed value/true value) x 100; and

ii) $$\text{spikes - \%R} = \frac{\text{(conc. spike + sample) - sample}}{\text{conc. spike}} \times 100$$

Precision

Refers to the agreement or reproducibility of a set of replicate results among themselves without assumption of any prior information as to the true result. Precision is usually expressed in terms of the %R or RPD.

B. Average

The average or arithmetic mean (X) of a set of n values (Xi) is calculated by summing the individual values and dividing by n:

$$X = (\sum Xi_{i = 1 \text{ to } n})/n$$

n = number of values

C. Range

The range (R_i) is the difference between the highest and lowest value in a group. For n sets of duplicate values (X_2, X_1) the range (R_i) of the duplicates and the average range (R) of the n sets are calculated by:

$$R_i = X_2 - X_1$$

and

$$R = \sum Rii = 1 \text{ to } n/^{n}$$

D. Standard Deviation and Variation

The standard deviation (S) of a sample of n results is the most widely used measure to describe the dispersion of a data set. It is calculated by using the equation.

$$S = \sqrt{\left(\sum \frac{(X_i - X)^2_i}{n}\right.} \quad -1 \text{ to } n$$

Where X is the average of the n results and Xi is the value of result i. Normally, X ±S will include 68 percent and X ±2S approximately 95 percent of the data in a normal distribution curve.

The variance is equal to S^2. The percent relative standard deviation (%RSD) or coefficient of variation (CV) is the standard deviation divided by the mean and multiplied by 100, i.e.:

$$CV = 100S/X$$

The Laboratory QA/QC Officer, with individual laboratory group leaders, will identify any data that should be rated as "unacceptable", based on the assessment of the QA/QC criteria.

It should be noted that the data generated may meet the analytical requirements of the methods but not fulfill the DQOs. In this case, resampling at the Site to achieve the DQOs may be necessary.

C.13.0 CORRECTIVE ACTION

Corrective action procedures will be implemented based on unacceptable audit results or upon detection of data unacceptability. The data generation process will be audited by assessing adherence to control limits specified in Section C.7.0. If required, corrective action procedures will be developed on a case-by-case basis. The enacted corrective actions will be documented in the appropriate laboratory notebook, instrument log, or case file.

Generally, the following actions may be taken. When calibration, instrument performance, and blank criteria are not met, the cause of the problem will be located and corrected. The analytical system will then be recalibrated. Sample analysis will not begin until calibration, instrument performance, and blank criteria are met. When MS, reference standard or duplicate analyses are out of control, sample analysis will cease and the problem will be investigated. Depending on the results of the overall quality control program for the sample set, the data may be accepted with qualification or rejected. If the laboratory rejects data, those samples will be reprepared and reanalyzed. If matrix interferences are suspected, samples will be subjected to one or more of the cleanup techniques specified in the analytical methods. If QC criteria are met upon reanalysis, only the new results are reported. If quality control criteria are still not met upon reanalysis, both sets of sample results will be reported. The laboratory will make every reasonable effort to correct quality control excursions and to document the presence of matrix interferences. In this way, unnecessary resampling of difficult matrices may be avoided. However, if matrix interferences are not documented resampling may be required. The specific corrective actions and the triggers for initiating laboratory corrective actions are specified in the methods presented in Section C.7.0 and will be followed during the laboratory analysis of the samples.

Corrective action required when the DQOs are not met will be triggered by assessing precision, accuracy, representativeness, completeness and comparability parameters. Precision and accuracy data are primarily generated during the laboratory analysis of matrix spikes and duplicate samples. However, blind performance evaluation samples and field duplicates which may be provided to the laboratory will be indicators of accuracy and precision.

Should the recovery of blind performance evaluation samples be outside of the acceptance criteria, the laboratory will be notified and the problem investigated. If the problem cannot be isolated, the analysis may be stopped at the discretion of the QA Officer. Analysis will not be resumed until the problem has been investigated and identified, corrective action implemented, and the results of the corrective action documented. Resampling at the Site may be required as determined by the findings of the corrective action investigation and is dependent on the amount of data effected by the problem.

Corrective action necessitated by imprecise results of field duplicate samples, as determined by the QA Officer, will require investigating both the field sampling and the analytical procedures. If the problem cannot be isolated, field activities may be ceased at the discretion of the QA Officer until it is identified, corrective action implemented, and the results of the corrective action documented. Resampling at the Site may be required based on the findings of the corrective action investigation.

Corrective actions due to lack of representativeness and comparability are not expected as these parameters are determined prior to field activities. However, they will be monitored by the QA Officer by reviewing field sampling techniques and the analytical data.

Completeness is required to be 85 percent for laboratory analyses and 80 percent for field analysis. Failure to produce data with these levels of completeness of field and laboratory procedures may necessitate resampling at the Site.

C.14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

The deliverables associated with the tasks identified in the RD/RA Work Plan will contain separate QA sections in which data quality information collected during the task is summarized. Those reports will be prepared by the QA/QC Officer - Analytical Activities and will include the validation report on the accuracy, precision, and completeness of the data and the results of the performance and system audits.

TABLE C.3.1

SUMMARY OF QA/QC SAMPLE REQUIREMENTS
PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, NEW YORK

RD Activity	*Sample Matrix*	*Analytical Parameters*	*Investigative Samples*	*Field Duplicates*	*Field/ Equipment (1) Blanks*	*Trip (2) Blanks*	*MS/MSD*	*Total*
Groundwater Sampling	Groundwater	TCL VOC, TCL SVOC	10	1	1	1	1	14
	Groundwater	TOC, BOD, COD, Iron (total and soluble), Manganese (total and soluble), TSS, TDS, pH, Alkalinity, Hardness, Turbidity, PCB, Calcium, Sulfate, Pesticides PCDD/PCDFs, Radiologicals	4	1	1	0	1	7
Treatability Study								
Lab-scale testing (3)	Water	TCL VOCs	24	3	0	(2)	2	26
		TDS Iron (total/soluble) Manganese (total/soluble)	4	1	0	0	1	6
		Alkalinity Hardness	12	2	0	0	1	15
		TSS	25	3	0	0	2	30
Pilot-scale testing (3)	Water	TCL VOCs	10	1	0	(2)	1	12

TABLE C.3.1

SUMMARY OF QA/QC SAMPLE REQUIREMENTS
PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, NEW YORK

RD Activity	*Sample Matrix*	*Analytical Parameters*	*Investigative Samples*	*Field Duplicates*	*Field/ Equipment (1) Blanks*	*Trip (2) Blanks*	*MS/MSD*	*Total*
Lab-scale testing (4)	Water	TCL VOCs	24	3	0	(2)	2	29
		TDS Iron (total/soluble) Manganese (total/soluble)	4	1	0	0	1	6
		Alkalinity Hardness	12	2	0	0	1	15
		TSS	25	3	0	0	2	30
		TCL SVOCs	66	7	0	0	4	77
		PCBs 2,3,7,8-TCDD	66	7	0	0	4	77
Pilot-scale testing (4)	Water	TCL VOCs TCL SVOCs	10	1	0	1	1	13
		PCBs 2,3,7,8-TCDD	10	1	0	0	1	12

Notes:

(1) Field/equipment blank samples will be submitted only when non-dedicated sampling equipment is used.
(2) Trip blanks will be submitted only with aqueous samples for VOC analysis only at a frequency of one per cooler.
(3) Sampling to be performed if SVOCs, PCBs and Dioxin are not detected in the samples collected from the prototype extraction wells and GW-2S.
(4) Sampling to be performed if SVOCs, PCBs and Dioxin are detected in the samples collected from the prototype extraction wells and GW-2S.

TABLE C.4.1

SAMPLE CONTAINER, PRESERVATION AND HOLDING TIME PERIODS
PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, NEW YORK

Analyses	*Sample Containers*	*Preservation*	*Maximum Holding Time from Sample Collection(1)*	*Volume of Sample*
Groundwater				
SVOC, PCB, Pesticides	Two 1-liter amber glass bottles per analysis	Iced, 4° C	7 days from extraction 40 days after extraction for analysis	Fill to neck of bottles
VOC	Four 40-mL teflon lined septum vials	HCl to pH <2, Iced, 4° C	14 days for analysis	Fill completely, no air bubbles
Metals, Hardness	One 1-liter plastic bottle	HNO3 to pH <2, Iced, 4° C	6 months (mercury - 28 days) for analysis	Fill to shoulder of bottle
Total Cyanide	One 500-mL plastic or glass bottle	NaOH to pH>12, Iced, 4° C	14 days for analysis	Fill to shoulder of bottle
TSS, TDS	One 1-liter plastic bottle	Iced, 4° C	7 days for analysis	Fill to neck of bottles
BOD	One 125-mL sterile plastic bottle	Iced, 4° C	48 hours for incubation	Fill to neck of bottles
COD, TOC	One 1-liter plastic bottle	H2SO4 to pH<2	28 days for analysis	Fill to neck of bottles
PCDD, PCDF	Two 1-liter amber glass bottles	Iced, 4° C	30 days for extraction 45 days for analysis	Fill to neck of bottles
Sulfate	One 500-mL plastic or glass bottle	Iced, 4° C	28 days for analysis	Fill to neck of bottles
Radiologicals	One 1-liter plastic bottle	Iced, 4° C	None	Fill to neck of bottles

(1) - These are technical holding times, i.e. are based on time elapsed from time of sample collection.

TABLE C.7.1

SUMMARY OF ANALYTICAL METHODS
PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, NEW YORK

Sample Matrix	*Analytical Parameter*	*Analytical Method (1)*	
Groundwater	TCL-VOCs	SW-846	8240
	TCL-SVOC	SW-846	8270
	TAL-Metals	SW-846	6010/7000 series
	Cyanide	SW-846	9010
	TOC	SW-846	9060
	BOD	USEPA	405.1
	COD	USEPA	410.1
	TSS	USEPA	160.1
	TDS	USEPA	160.2
	Alkalinity	USEPA	310.1
	Hardness	USEPA	130.1
	PCDD/PCDF	SW-846	8290
	TCL PCBs/Pesticides	SW-846	8080
	Sulfate	USEPA	375.4
	Gross Alpha, Beta Radiologicals	USEPA	900 series

Notes:

(1) SW-846 - "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", EPA SW-846, 3rd edition, November 1986.
USEPA - "Methods for Chemical Analysis of Water and Wastes", EPA 600/4-79-020, revised March 1983.
USEPA - "Prescribed Procedures for Measurement of Radioactivity in Drinking Water", EPA 600/4-80-032.

TABLE C.7.2

TARGETED QUANTITATION LIMITS
PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, NEW YORK

	Targeted Quantitation Limit(1)
	Water
	µg/L
Volatile Organic Compounds	
Chloromethane	10
Bromomethane	10
Vinyl chloride	10
Chloroethane	10
Methylene chloride	10
Acetone	10
Carbon disulfide	10
1,1-Dichloroethylene	10
1,1-Dichloroethane	10
1,2-Dichloroethylene (total)	10
Chloroform	10
1,2-Dichloroethane	10
2-Butanone	10
1,1,1-Trichloroethane	10
Carbon tetrachloride	10
Bromodichloromethane	10
1,2-Dichloropropane	10
cis-1,3-Dichloropropene	10
Trichloroethene	10
Dibromochloromethane	10
1,1,2-Trichloroethane	10
Benzene	10
trans-1,3-Dichloropropene	10
Bromoform	10
4-Methyl-2-pentanone	10
2-Hexanone	10
Tetrachloroethene	10
Toluene	10
1,1,2,2-Tetrachloroethane	10
Chlorobenzene	10
Ethyl benzene	10
Styrene	10
Total xylenes	10

TABLE C.7.2

TARGETED QUANTITATION LIMITS
PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, NEW YORK

	Targeted Quantitation Limit(1) *Water* *µg/L*
Semi-Volatile Organic Compounds	
Phenol	10
bis(2-Chloroethyl)ether	10
2-Chlorophenol	10
1,3-Dichlorobenzene	10
1,4-Dichlorobenzene	10
1,2-Dichlorobenzene	10
2-Methylphenol	10
2,2'-oxybis(1-Chloropropane)**	10
4-Methylphenol	10
N-nitroso-di-n-propylamine	10
Hexachloroethane	10
Nitrobenzene	10
Isophorone	10
2-Nitrophenol	10
2,4-Dimethylphenol	10
bis(2-Chloroethoxy) methane	10
2,4-Dichlorophenol	10
1,2,4-Trichlorobenzene	10
Naphthalene	10
4-Chloroaniline	10
Hexachlorobutadiene	10
4-Chloro-3-methylphenol	10
2-Methylnaphthalene	10
Hexachlorocyclopentadiene	10
2,4,6-Trichlorophenol	10
2,4,5-Trichlorophenol	25
2-Chloronaphthalene	10
2-Nitroaniline	25
Dimethyl phthalate	10
Acenaphthylene	10
2,6-Dinitrotoluene	10
3-Nitroaniline	25
Acenaphthene	10

TABLE C.7.2

TARGETED QUANTITATION LIMITS
PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, NEW YORK

	Targeted Quantitation Limit(1)
	Water
	µg/L
Semi-Volatile Organic Compounds	
2,4-Dinitrophenol	25
4-Nitrophenol	25
Dibenzofuran	10
2,4-Dinitrotoluene	10
Diethylphthalate	10
4-Chlorophenyl phenyl ether	10
Fluorene	10
4-Nitroaniline	25
4,6-Dinitro-2-methylphenol	25
N-nitrosodiphenylamine	10
4-Bromophenyl phenyl ether	10
Hexachlorobenzene	10
Pentachlorophenol	25
Phenanthrene	10
Anthracene	10
Carbazole	10
Di-n-butyl phthalate	10
Fluoranthene	10
Pyrene	10
Butyl benzyl phthalate	10
3,3'-Dichlorobenzidine	10
Benz(a)anthracene	10
Chrysene	10
bis(2-Ethylhexyl)phthalate	10
Di-n-octyl phthalate	10
Benzo(b)fluoranthene	10
Benzo(k)fluoranthene	10
Benzo(a)pyrene	10
Indeno(1,2,3-cd)pyrene	10
Dibenz(a,h)anthracene	10
Benzo(g,h,i)perylene	10

TABLE C.7.2

TARGETED QUANTITATION LIMITS
PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, NEW YORK

	Targeted Quantitation Limit(1)
	Water
	µg/L
PCB	
Aroclor 1016	1.0
Aroclor 1221	1.0
Aroclor 1232	1.0
Aroclor 1242	1.0
Aroclor 1248	1.0
Aroclor 1254	1.0
Aroclor 1260	1.0
Pesticides	
alpha-BHC	0.05
beta-BHC	0.05
delta-BHC	0.05
gamma-BHC (Lindane)	0.05
Heptachlor	0.05
Aldrin	0.05
Heptachlor epoxide	0.05
Endosulfan I	0.05
Dieldrin	0.1
4,4'-DDE	0.10
Endrin	0.10
Endosulfan II	0.10
4,4'-DDD	0.10
Endosulfan sulfate	0.10
4,4'-DDT	0.10
Methoxychlor	0.50
Endrin ketone	0.10
Endrin Aldehyde	0.10
alpha-Chlordane	0.05
gamma-Chlordane	0.05
Toxaphene	5.0
Radiologicals	
Gross Alpha Radioactivity	5 piC/L (2)
Gross Beta Radioactivity	5 piC/L (2)

TABLE C.7.2

TARGETED QUANTITATION LIMITS
PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, NEW YORK

	Targeted Quantitation Limit(1)
	Water
	µg/L
Inorganics	
Aluminum	200
Antimony	60
Arsenic	10
Barium	200
Beryllium	5
Cadmium	5
Calcium	5000
Chromium	10
Cobalt	50
Copper	25
Iron	100
Lead	3
Magnesium	5000
Manganese	15
Mercury	0.2
Nickel	40
Potassium	5000
Selenium	5
Silver	10
Sodium	5000
Thallium	10
Vanadium	50
Zinc	20
Cyanide	10

Notes:

(1) Targeted quantitation limits presented are for guidance only. Actual quantitation limits are highly matrix dependent and may not be achievable on all samples.
(2) PiC/L = picocuries per liter.

TABLE C.7.3

TARGETED QUANTITATION LIMITS
GENERAL CHEMISTRY AND DIOXIN PARAMETERS
PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, NEW YORK

Parameter	*Targeted Quantitation Limit(1)* *Water* ~~*mg/L*~~ *µg/L*
TOC	2.0
BOD	1.0
COD	2.0
TSS	5.0
TDS	5.0
pH	NA(2)
Alkalinity	1.0
Hardness	1.0
Sulfate	1.0
2,3,7,8-TCDD	0.00001 (3)
2,3,7,8-TCDF	0.00001
1,2,3,7,8-PeCDD	0.00005
1,2,3,7,8-PeCDF	0.00005
2,3,4,7,8-PeCDF	0.00005
1,2,3,4,7,8-HxCDD	0.00005
1,2,3,6,7,8-HxCDD	0.00005
1,2,3,7,8,9-HxCDD	0.00005
1,2,3,4,7,8-HxCDF	0.00005
1,2,3,6,7,8-HxCDF	0.00005
1,2,3,7,8,9-HxCDF	0.00005
2,3,4,6,7,8-HxCDF	0.00005
1,2,3,4,6,7,8-HpCDD	0.00005
1,2,3,4,6,7,8-HpCDF	0.00005
1,2,3,4,7,8,9-HpCDF	0.00005
Total TCDD	0.00001
Total TCDF	0.00001
Total PeCDD	0.00005
Total PeCDF	0.00005
Total HxCDD	0.00005
Total HxCDF	0.00005
Total HpCDD	0.00005
Total HpCDF	0.00005
OCDD	0.00010
OCDF	0.00010

Notes:

(1) Targeted quantitation limits presented are for guidance only. Actual quantitation limits are highly matrix dependent and may not be achievable on all samples.
(2) Not applicable.
(3) Actual sample detection limit based on signal to noise ratios will be determined for each sample.

D

APPENDIX D

HDPE MATERIALS COMPATIBILITY DATA

ASTM F-1248 utilizes rings cut from a pipe sample. The rings are notched on one side and compressed between parallel plates until the distance between the plates is three times the specified pipe minimum wall thickness. The compressed ring samples are subjected to an elevated temperature bath of a surface active agent and visibly inspected for crack formation or propagation.

The Ring ESCR test provides useful information regarding the different polyethylene pipe grade materials. Driscopipe 8600 shows no tendency for sample failures when tested in excess of 10,000 hours. This further reinforces the unique ability of Driscopipe 8600 to provide the highest degree of resistance to the external stresses inherent to a pipeline installation.

Driscopipe 1000, an extra high molecular weight HDPE pipe, will exhibit a ring ESCR of $F_{50} > 1000$ hours. Other lower molecular weight pipes may exhibit lower F_{50} values.

Chemical Corrosion Resistance

The outstanding resistance of Driscopipe to attack by most chemicals makes it suitable to transport these chemicals or to be installed in an environment where these chemicals are present. Factors which determine the suitability and service life of each particular application include the specific chemical and its concentration, pressure, temperature, period of contact and service conditions which may introduce stress concentrations in the pipe or fittings.

Driscopipe is, for all practical purposes, chemically inert within its temperature use range. This advantageous engineering characteristic is one of the primary reasons for the wide use of Driscopipe in industrial applications. It does not rot, rust, pit, corrode or lose wall thickness through chemical or electrical reaction with the surrounding soil, whether acid, alkaline, wet or dry. It neither supports the growth of, nor is affected by, algae, bacteria or fungi and is resistant to marine biological attack. It contains no ingredients which make it attractive to rodents, gophers, etc.

Information relative to the resistance of Driscopipe to a wide range of chemicals is shown in the following tables. This information is based on results of immersion tests (usually 3 months) at various temperatures. Changes in tensile strength and elongation are evaluated at a rapid strain rate to emphasize any strength decay in the material.

Most acids, bases and other chemicals can be transported by Driscopipe using the same design parameters as would apply to water, natural or manufactured gas and water solutions of inorganic salts. Strong oxidizing agents such as fuming sulfuric acid may adversely affect the pipe, depending upon concentration, temperature and period of contact. In many cases, such as gravity flow waste lines, these chemicals can be handled because of dilution and intermittent flow.

Some chemicals, such as all types of liquid hydrocarbons, will mechanically absorb into the wall of the pipe and cause a reduction in hoop stress but this does not degrade the material. This effect is temporary if exposure is intermittent. Where exposure is continuous, it is necessary to derate the pressure capability of the pipe for long term service. This includes such products as gasoline, ethyl alcohol, benzene, carbon tetrachloride, crude and refined oils, etc. Where 5-100% hydrocarbon liquids are continuously present in a pressure system, a service design factor of .25 should be used to calculate design pressures instead of the service design factor of .5 used with water.

$$P = \frac{2S}{SDR - 1} \times F \quad \text{or} \quad P = 2S\frac{t}{D - t} \times F$$

Where:
- D = Outside Diameter, Inches
- P = Design Pressure, psi
- S = Long Term Hydrostatic Strength, psi, at the design temperature
- t = Minimum Wall Thickness, Inches
- F = Service Design Factor
- SDR = Standard Dimension Ratio of D/t

CHEMICAL RESISTANCE OF DRISCOPIPE

S – Satisfactory
U – Unsatisfactory
M – Marginal
N – Not known

All concentrations are 100% unless noted otherwise.

On reagents marked marginal, chemical attack will be recognized by a loss of physical properties of the pipe which may require a change in design factors.

Reagent	70°F (21°C)	140°F (60°C)
Acetic Acid 1-10%	S	S
Acetic Acid 10-60%	S	M
Acetic Acid 80-100%	S	M
Acetone	M	U
Acrylic Emulsions	S	S
Aluminum Chloride-Dilute	S	S
Aluminum Chloride Conc.	S	S
Aluminum Fluoride Conc.	S	S
Aluminum Sulfate Conc.	S	S
Alums (All Types) Conc.	S	S
Ammonia 100% Dry Gas	S	S
Ammonium Carbonate	S	S
Ammonium Chloride Sat'd	S	S
Ammonium Fluoride 20%	S	S
Ammonium Hydroxide 0.88 S.G.	S	S
Ammonium Metaphosphate Sat'd	S	S
Ammonium Nitrate Sat'd	S	S
Ammonium Persulfate Sat'd	S	S
Ammonium Sulfate Sat'd	S	S
Ammonium Sulfide Sat'd	S	S
Ammonium Thiocyanate Sat'd	S	S
Amyl Acetate	M	U
Amyl Alcohol 100%	S	S
Amyl Chloride 100%	N	U
Aniline 100%	S	N
Antimony Chloride	S	S
Aqua Regia	U	U
Barium Carbonate Sat'd	S	S
Barium Chloride	S	S
Barium Hydroxide	S	S
Barium Sulfate Sat'd	S	S
Barium Sulfide Sat'd	S	S
Beer	S	S
Benzene	M	U
Benzene Sulfonic Acid	S	S
Bismuth Carbonate Sat'd	S	S
Bleach Lye 10%	S	S
Black Liquor	S	S
Borax Cold Sat'd	S	S
Boric Acid Dilute	S	S

Reagent	70°F (21°C)	140°F (60°C)
Boric Acid Conc.	S	S
Bromic Acid 10%	S	S
Bromine Liquid 100%	M	U
Butanediol 10%	S	S
Butanediol 60%	S	S
Butanediol 100%	S	S
Butyl Alcohol 100%	S	S
Calcium Bisulfide	S	S
Calcium Carbonate Sat'd	S	S
Calcium Chlorate Sat'd	S	S
Calcium Chloride Sat'd	S	S
Calcium Hydroxide	S	S
Calcium Hypochlorite BL'GH Sol.	S	S
Calcium Nitrate 50%	S	S
Calcium Sulfate	S	S
Camphor Oil	N	U
Carbon Dioxide 100% Dry	S	S
Carbon Dioxide 100% Wet	S	S
Carbon Dioxide Cold Sat'd	S	S
Carbon Disulfide	N	U
Carbon Monoxide	S	S
Carbon Tetrachloride	M	U
Carbonic Acid	S	S
Castor Oil Conc.	S	S
Chlorine Dry Gas 100%	S	M
Chlorine Moist Gas	M	U
Chlorine Liquid	M	U
Chlorobenzene	M	U
Chloroform	M	U
Chlorosulfonic Acid 100%	M	U
Chrome Alum Sat'd	S	S
Chromic Acid 20%	S	S
Chromic Acid Up to 50%	S	S
Chromic Acid and Sulfuric Acid	S	M
Cider	S	S
Citric Acid Sat'd	S	S
Coconut Oil Alcohols	S	S
Cola Concentrates	S	S
Copper Chloride Sat'd	S	S
Copper Cyanide Sat'd	S	S
Copper Fluoride 2%	S	S
Copper Nitrate Sat'd	S	S
Copper Sulfate Dilute	S	S
Copper Sulfate Sat'd	S	S
Cottonseed Oil	S	S
Crude Oil*	S	M
Cuprous Chloride Sat'd	S	S
Cychohexanol	S	S
Cyclohexanone	M	U
Detergents Synthetic	S	S
Developers, Photographic	S	S
Dextrin Sat'd	S	S
Dextrose Sat'd	S	S
Dibutylphthalate	S	M
Disodium Phosphate	S	S

Reagent	70°F (21°C)	140°F (60°C)
Diazo Salts	S	S
Diethylene Glycol	S	S
Diglycolic Acid	S	S
Dimethylamine	M	U
Emulsions, Photographic	S	S
Ethyl Acetate 100%	M	U
Ethyl Alcohol 100%	S	S
Ethyl Alcohol 35%	S	S
Ethyl Butyrate	M	U
Ethyl Chloride	M	U
Ethyl Ether	U	U
Ethylene Chloride	U	U
Ethylene Chlorohydrin	U	U
Ethylene Dichloride	M	U
Ethylene Glycol	S	S
Ferric Chloride Sat'd	S	S
Ferric Nitrate Sat'd	S	S
Ferrous Chloride Sat'd	S	S
Ferrous Sulfate	S	S
Fish Solubles	S	S
Fluoboric Acid	S	S
Fluorine	S	U
Fluosilicic Acid 32%	S	S
Fluosilicic Acid Conc.	S	S
Formaldehyde 40%	S	N
Formic Acid 0-20%	S	S
Formic Acid 20-50%	S	S
Formic Acid 100%	S	S
Fructose Sat'd	S	S
Fruit Pulp	S	S
Fuel Oil	S	U
Furfural 100%	M	U
Furfuryl Alcohol	M	U
Gallic Acid Sat'd	S	S
Gas Liquids*	S	M
Gasoline*	M	U
Gin	S	U
Glucose	S	S
Glycerine	S	S
Glycol	S	S
Glycolic Acid 30%	S	S
Grape Sugar Sat'd Aq.	S	S
Hexanol, Tert.	S	S
Hydrobromic Acid 50%	S	S
Hydrocyanic Acid Sat'd	S	S
Hydrochloric Acid 10%	S	S
Hydrochloric Acid 30%	S	S
Hydrochloric Acid 35%	S	S
Hydrochloric Acid Conc.	S	S
Hydrofluoric Acid 40%	S	S
Hydrofluoric Acid 60%	S	S
Hydrofluoric Acid 75%	S	S
Hydrogen 100%	S	S
Hydrogen Bromide 10%	S	S
Hydrogen Chloride Gas Dry	S	S

*HDPE Resin Service Design Factor for hydrocarbons per the formula on page 3 and 8 is F = 0.25 to compensate for hydrocarbon saturation effects on long term hydrostatic strength.

continued on page 10

continued from page 9

CHEMICAL RESISTANCE OF DRISCOPIPE

Reagent	70°F (21°C)	140°F (60°C)
Hydrogen Peroxide 30%	S	S
Hydrogen Peroxide 90%	S	M
Hydrogen Phosphide 100%	S	S
Hydroquinone	S	S
Hydrogen Sulfide	S	S
Hypochlorus Acid Conc.	S	S
Inks	S	S
Iodine (Alc. Sol.) Conc.	S	U
Lactic Acid 10%	S	S
Lactic Acid 90%	S	S
Latex	S	S
Lead Acetate Sat'd	S	S
Lube Oil*	S	M
Magnesium Carbonate Sat'd	S	S
Magnesium Chloride Sat'd	S	S
Magnesium Hydroxide Sat'd	S	S
Magnesium Nitrate Sat'd	S	S
Magnesium Sulfate Sat'd	S	S
Mercuric Chloride Sat'd	S	S
Mercuric Cyanide Sat'd	S	S
Mercurous Nitrate Sat'd	S	S
Mercury	S	S
Methyl Alcohol 100%	S	S
Methyl Bromide	M	U
Methyl Chloride	M	U
Methyl Ethyl Ketone 100%	M	U
Methylsulfuric Acid	S	S
Methylene Chloride 100%	M	U
Milk	S	S
Mineral Oils	S	U
Molasses Comm.	S	S
Nickel Chloride Sat'd	S	S
Nickel Nitrate Conc.	S	S
Nickel Sulfate Sat'd	S	S
Nicotine Dilute	S	S
Nicotinic Acid	S	S
Nitric Acid 0-30%	S	S
Nitric Acid 30-50%	S	M
Nitric Acid 70%	S	M
Nitric Acid 95-98%	U	U
Nitrobenzene 100%	U	U
Octyl Cresol	S	U
Oils and Fats*	S	M
Oleic Acid Conc.	S	U
Oleum Conc.	U	U
Orange Extract	S	S
Oxalic Acid Dilute	S	S
Oxalic Acid Sat'd	S	S
Ozone 100%	S	U
Perchloric Acid 10%	S	S
Petroleum Ether	U	U
Phenol 90%	U	U
Phosphoric Acid Up to 30%	S	S
Phosphoric Acid Over 30%	S	S
Phosphoric Acid 90%	S	S
Phosphorous (Yellow) 100%	S	N
Phosphorus Pentoxide 100%	S	N
Photographic Solutions	S	S
Pickling Baths		
Sulfuric Acid	S	S
Hydrochloric Acid	S	S
Sulfuric-Nitric	S	U
Plating Solutions		
Brass	S	S
Cadmium	S	S
Chromium	N	N
Copper	S	S
Gold	S	S
Indium	S	S
Lead	S	S
Nickel	S	S
Rhodium	S	S
Silver	S	S
Tin	S	S
Zinc	S	S
Potassium Bicarbonate Sat'd	S	S
Potassium Borate 1%	S	S
Potassium Bromate 10%	S	S
Potassium Bromide Sat'd	S	S
Potassium Carbonate	S	S
Potassium Chlorate Sat'd	S	S
Potassium Chloride Sat'd	S	S
Potassium Chromate 40%	S	S
Potassium Cyanide Sat'd	S	S
Potassium Dichromate 40%	S	S
Potassium Ferri/ Ferro Cyanide Sat'd	S	S
Potassium Fluoride	S	S
Potassium Hydroxide 20%	S	S
Potassium Hydroxide Conc.	S	S
Potassium Nitrate Sat'd	S	S
Potassium Perborate Sat'd	S	S
Potassium Perchlorate 10%	S	S
Potassium Sulfate Conc.	S	S
Potassium Sulfide Conc.	S	S
Potassium Sulfite Conc.	S	S
Potassium Persulfate Sat'd	S	S
Propargyl Alcohol	S	S
Propyl Alcohol	S	S
Propylene Dichloride 100%	U	U
Propylene Glycol	S	S
Rayon Coagulating Bath	S	S
Sea Water	S	S
Selenic Acid	S	S
Shortening	S	S
Silicic Acid	S	S
Silver Nitrate Sol.	S	S
Soap Solution Any Conc'n	S	S
Sodium Acetate Sat'd	S	S
Sodium Benzoate 35%	S	S
Sodium Bicarbonate Sat'd	S	S
Sodium Bisulfate Sat'd	S	S
Sodium Bisultite Sat'd	S	S
Sodium Borate	S	S
Sodium Bromide Dilute Sol.	S	S
Sodium Carbonate Con.	S	S
Sodium Carbonate	S	S
Sodium Chlorate Sat'd.	S	S
Sodium Chloride Sat'd	S	S
Sodium Cyanide	S	S
Sodium Dichromate Sat'd	S	S
Sodium Ferricyanide	S	S
Sodium Ferrocyanide Sat'd	S	S
Sodium Fluoride Sat'd	S	S
Sodium Hydroxide Conc.	S	S
Sodium Hypochlorite	S	S
Sodium Nitrate	S	S
Sodium Sulfate	S	S
Sodium Sulfide 25%	S	S
Sodium Sulfide Sat'd Sol.	S	S
Sodium Sulfite Sat'd	S	S
Stannous Chloride Sat'd	S	S
Stannic Chloride Sat'd	S	S
Starch Solution Sat'd	S	S
Stearic Acid 100%	S	S
Sulfuric Acid 0-50%	S	S
Sulfuric Acid 70%	S	M
Sulfuric Acid 80%	S	U
Sulfuric Acid 96%	M	U
Sulfuric Acid 98%	M	U
Sulfuric Acid, Fuming	U	U
Sulfurous Acid	S	S
Tallow*	S	M
Tannic Acid 10%	S	S
Tanning Extracts Comm.	S	S
Tartaric Acid Sat'd	N	N
Tetrahydrofurane	N	U
Titanium Tetrachloride Sat'd	N	U
Toluene	M	U
Transformer Oil	S	M
Trisodium Phosphate Sat'd	S	S
Trichloroethylene	U	U
Urea Up to 30%	S	S
Urine	S	S
Vinegar Comm.	S	S
Vanilla Extract	S	S
Wetting Agents	S	S
Whiskey	S	N
Wines	S	S
Xylene	M	U
Yeast	S	S
Zinc Chloride Sat'd	S	S
Zinc Sulfate Sat'd	S	S

For additional chemical resistance listings, consult the P.P.I. technical report #TR 19/10-84, Table I and the ISO technical report #ISO/Data 8-1979, Tables I, II, III.

CHEMICAL RESISTANCE

INTRODUCTION

Outstanding resistance to both internal and external chemical attack has made the SCLAIRPIPE system the material of choice for the transport of lower temperature (below 150°F) fluids in adverse chemical environments. High-density polyethylene is chemically inert to a wide range of industrial chemicals.

The chemical, its concentration in the fluid, its temperature, its contact time with the piping material and other service conditions, determines the suitability and expected service life of the SCLAIRPIPE system for the application. For most bases, acids, inorganic salts and other chemicals, you usually apply the same design parameters as considered for water service conditions. Chemical attack of SCLAIRPIPE may be divided into three categories: OXIDATION, STRESS-CRACKING and PLASTICIZATION.

OXIDIZERS are the only group of materials which are capable of chemically degrading the SCLAIRPIPE system. Some strong oxidizers have only a gradual effect on the pipe, therefore short-term effects are not measurable. If continuous exposure is expected, chemical effects should be defined. The following oxidizers are unsuitable for long-term contact with the SCLAIRPIPE system: Nitric acid (fuming), Sulphuric acid (fuming), Aqua Regia, wet chlorine gas and liquid bromine. However, weaker solutions of mineral acids, such as battery acid or reagent nitric acid, do not attack the pipe. Other common oxidizing agents,such as hydrochloric acid, hydrofluoric acid, hydrobromic acid and hydrogen peroxide have been shown to have no measurable effects on SCLAIRPIPE after 3 or 4 years' exposure.

STRESS CRACKING AGENTS are chemicals that accelerate the cracking of polyethylene when subjected to stress, but have no chemical effect on the material itself. Although some polyethylenes are extremely sensitive to brittle fracture, SCLAIRPIPE is highly resistant to this type of failure.

PLASTICIZERS are chemicals that can be absorbed to varying degrees by polyethylene, causing softening, some loss of yield strength and some gain in impact strength. These plasticizing materials cause no chemical degradation of polyethylene and they are not solvents for the material. SCLAIRPIPE is designed to give high resistance to this absorption and consequent weakening, but if it is to be exposed continuously to these environments, an added safety factor should be applied. Some of these materials are sufficiently volatile that when they are removed, the pipe will "dry out" and return to its original strength. Intermittent exposure to these materials, therefore, has little or no effect on SCLAIRPIPE.

GENERAL GUIDE TO RESISTANCE OF SCLAIRPIPE TO VARIOUS CHEMICALS

This chemical resistance chart is a comprehensive listing of chemicals, concentrations and pipe resistance at two temperatures. In all cases, SCLAIRPIPE at higher temperatures should be considered to have variable resistance. Contact your KWH Pipe representative for design assistance in these applications.

CODE:
- R = Resistant
- VR = Variable resistance, depending on conditions*
- NR = Not resistant
- O = Oxidizer
- P = Plasticizer
- SC = Potential stress-cracker

*The classification "variable resistance" is very broad. Depending on the nature of the chemical, its concentration, the service temperature and pressure and the time of exposure, SCLAIRPIPE can be either very resistant or very susceptible to attack. Therefore, where SCLAIRPIPE is said to have variable resistance to a chemical, it is strongly recommended that caution be exercised and that the specific application be discussed with a technical representative of KWH Pipe.

Chemical		73°F	120°F
Acetic acid, 20%	SC	R	R
Acetic acid, 80%	SC	VR	NR
Acetone	SC	NR	NR
Alcohol, ethyl		R	VR
Alcohol, isopropyl		R	R
Alcohol, methyl		R	R
Aluminum salts		R	R
Alums		R	R
Ammoniacal liquor		R	R
Amyl acetate		VR	NR
Aniline		R	R
Aqua Regia	O	NR	NR
Arsenic acid, 80%		R	R
Barium salts		R	R
Beer		R	R
Benzone (benzol)	P	NR	NR
Benzoic acid		R	R
Bleach plant wastes		R	R
Bleach, 12.5% active chlorine		R	NR
Bleach, 5.5% active chlorine		R	NR
Boric acid		R	R
Bromine, liquid	O	NR	NR
Bromic acid		NR	NR
Brine		R	R
Butadiene		R	VR
Butane		R	R
Butylene		R	R
Calcium salts		R	R
Calcium hydroxide		R	R
Calcium hypochlorite		R	R
Carbon disulfide	P	NR	NR
Carbon tetrachloride	P	N	NR
Chloric acid, 20%		R	NR
Chlorinated water		R	R
Chlorine (gas or liquid)	O	NR	NR
Chlorobenzene	P	NR	NR
Chloroform		NR	NR
Chromic acid, 50%		R	R
Copper salts		R	R
Corn oil		R	VR
Cresol	P	NR	NR
Creosote, coatings	P	NR	NR

		73°F	120°F
Cyclohexane	P	R	VR
Cyclohexanol	P	NR	NR
Detergent, synthetic	SC	R	R
Developers, photographic		R	R
Dextrin		R	R
Dichloroacetic acid		R	R
Dichlorobenzene	P	VR	NR
Dichloroethylene	P	NR	NR
Diesel fuels	P	R	VR
Diethylene glycol		R	R
Dimethylamine		VR	VR
Ethers		NR	NR
Ethylene glycol		R	R
Ethylene dichloride		NR	NR
Fatty acids		NR	NR
Ferric salts		R	R
Ferrous salts		R	R
Flourine, aqueous		VR	NR
Formaldehyde		R	R
Formic acid	O	R	NR
Fuel oil	P	VR	NR
Furfural		NR	NR
Gas, natural methane		R	R
Gasoline	P	NR	NR
Gelatin		R	R
Glycerine		R	R
Glycols		R	R
Glycolic acid		R	R
Heating oil	P	VR	VR
Hexane		R	VR
Hydrobromic acid, 20%		R	R
Hydrochloric acid, 30%		R	VR
Hydrofluoric acid, 10%		R	R
Hydrogen peroxide, 90%		R	NR
Hydrogen sulfide		R	R
Hypochlorous acid		R	R
Iodine, alc. sol.		NR	NR
Isooctane	P	VR	VR
Kerosene	P	NR	NR
Ketones		R	VR
Lactic acid, 25%		R	R
Lead acetate		R	R
Linseed oil		NR	NR
Lubricating oils	P	VR	NR
Magnesium salts		R	R
Manganese sulface		VR	VR
Mercury		R	R
Methyl bromide		NR	NR
Methyl chloride		NR	NR
Methyl cyclohexane	P	VR	VR
Methyl ethyl ketone		R	R
Mineral oils	P	VR	NR
Mixed acids (sulfuric & Nitric)		NR	NR
Mixed acids (sulfuric & phosphoric)		R	VR
Molasses		R	R
Monochlorobenzene		NR	NR
Naphtha	P	VR	NR
Nitric acid, 0 - 50%		R	VR
Nitric acid, 60%	O	VR	NR
Nitric acid, fuming	O	NR	NR
Nitrous acid		R	NR
Oil, animal & vegetable	P	NR	NR
Oleic acid		NR	NR
Oleum		NR	NR
Oxalic acid		R	R
Paraffin		VR	NR
Perchloric acid, 10 - 70%		R	R
Petroleum, crude asphaltic		NR	NR
Petroleum, crude paraffinic		NR	NR
Phenol		VR	NR
Phosgene, gas		VR	VR
Phosgene, liquid		NR	NR
Potassium salts		R	R
Potassium permanganate, 25%		VR	VR
Propylene glycol		R	R
Pulp-mill wastes (red & black liquor)		R	R
Sea water		R	R
Sewage, residential		R	R
Silicic acid		R	R
Silicone oil		R	VR
Silver salts		R	R
Soap solution (concentrated)		R	R
Sodium salts		R	R
Sodium chlorite		VR	NR
Sodium chlorate		R	VR
Sodium hydroxide (caustic soda)		R	R
Sodium hypochlorite		R	R
Stannous chloride		R	R
Starch solution		R	R
Stearic acid		R	R
Sulfite liquor		R	R
Sulfur dioxide		R	R
Sulfuric acid, 0 - 90%		R	NR
Sulfuric acid, 90 - 100%	O	NR	NR
Sulfurous acid		R	R
Tannic acid		R	R
Tartaric acid		R	R
Tetrabromoethane	P	NR	NR
Tetrachloroethane	P	NR	NR
Tetrahydrofuran	P	NR	NR
Toluene	P	NR	NR
Transformer oil	P	VR	VR
Trichloroethylene		NR	NR
Turpentine	P	VR	NR
Urea		R	R
Vinegar		R	R
Whiskey		R	R
Xylene		NR	NR
Zinc salts		R	R

TABLE 2.3-2

OBSERVED CONTAMINANT RANGES AND GUIDELINE VALUES
FOR SOILS AND SEDIMENTS

Parameter	Range of Detected Concentrations in Landfill Soils	Range of Detected Concentrations in Sediments	SCGs
Acetone	21 - 950	15 - 770	—
Chlorobenzene	18 - 2200	10 - 23	5.5
Methylene Chloride	5 - 690	9 - 150	—
Bis(2-ethyl hexyl) phthalate	51 - 100,000	—	4.35
Diethyl phthalate	150	—	7.0
Di-n-butylphthalate	—	250	8.0
Acenaphthylene	—	310	—
Anthracene	39 - 1900	370 - 2,500	7.0
Benzo(a) anthracene	55 - 24,000	150 - 6,000	—
Benzo(b) fluoranthene	70 - 32,000	—	0.33
Benzo(g,h,i) perylene	68 - 300	1,500 - 2,500	80.0
Benzo(a) pyrene	92 - 21,000	280 - 6,000	0.33
Chrysene	53 - 25,000	170 - 7,500	0.33
Dibenzofuran	120 - 1,900,000	2,400 - 13,000	2.0
Fluoranthene	120 - 67,000	160 - 13,000	19.0
Indeno(1,2,3-cd) pyrene	65 - 390	200	0.33
Phenanthrene	5 - 32,000	200 - 10,000	2.2
Pyrene	100 - 49,000	240 - 15,000	6.65
Aldrin	5 - 9	—	0.041
Beta - BHC	9.0	22 - 75	0.010
Gamma-chlordane	4.8 - 9	—	0.20
Dioxins/Furans		—	—
PCBs	3,700 - 8,700	4,000 - 7,700	10 a
Arsenic	3.1 - 575	3.0 - 29.9	7.5
Barium	34.9 - 12,500	95.5 - 2,220	300 or S.B.
Beryllium	0.17 - 2.3	0.23 - 0.63	0.14
Cadmium	1.3 - 39.4	2.2 - 18.5	1.0

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TABLE 2.3-2 (cont.)

OBSERVED CONTAMINANT RANGES AND GUIDELINE VALUES
FOR SOILS AND SEDIMENTS

Parameter	Range of Detected Concentrations in Landfill Soils	Range of Detected Concentrations in Sediments	SCGs
Chromium	7.8 - 18,100	9.4 - 43.1	10.0
Copper	—	14.8 - 270	25.0
Lead	12 - 36,200	27.8 - 985	32.5 or S.B.
Manganese	198 - 4,430	132 - 1,770	S.B.
Mercury	0.14 - 4.4	0.18 - 1.2	0.1
Nickel	0.0061 - 565	10.0 - 125	13.0
Silver	0.68 - 11.2	—	200.0
Zinc	64 - 35,300	69.1 - 2,770	20.0
Cyanide	0.74 - 33.4	1.5 - 8	—

NOTES: All units in mg/kg or ppm.
SCGs shown are based on draft soil cleanup criteria issued by Technology Section, Bureau of Program Management, Division of Hazardous Waste Remediation, NYSDEC.

[a] Value shown is subsurface soil guideline values. Value for surface soil criteria is 1 ppm.

TABLE 2.3-4

GROUND WATER AND LEACHATE SEEPS: COMPARISON OF OBSERVED CONCENTRATION RANGES WITH CLASS GA STANDARDS

Parameter	Range of Detected Concentrations in Shallow Ground Water	Range of Detected Concentrations in Bedrock Ground Water	Range of Detected Concentrations in Leachate Seeps	Class GA Standards
Benzene	2.7 - 290	23	3 - 8	ND(2)
Chlorobenzene	1,200 - 11,000	—	2 - 140	5
Chloroethane	900	3.7	1 - 31	—
1,2-Dichlorobenzene	4	—	4 - 57	
1,4-Dichlorobenzene	2 - 240	—	2 - 6	4.7
1,3-Dichlorobenzene	82	—	4 - 89	5
1,1-Dichloroethane	5.6 - 4900	4.1	2.3 - 4.9	5
1,1-Dichloroethylene	240	—		5
trans-1,2-Dichloroethylene	9.2	9.2	64 - 85	5
Ethylbenzene	—	—	6	5
1,1,1-Trichloroethane	26 - 15,000	—	—	—
Toluene	3 - 43	3	—	5
Xylenes	400	—	—	5
2-Chlorophenol	13	—	—	—
2,4-Dimethylphenol	630 - 940	—	30	—
2-Methylphenol	72	—	—	—
4-Methylphenol	75	—	—	—
Phenol	6 - 4,000	16	7 - 10	1 a
Dibenzofuran	15 - 20	—	20 - 63	—
Diethylhexylphthalate (DEHP)	3 - 66	3 - 42	9 - 60	50
Endosulfan II	0.69	—	0.032 - 0.054	—
PCBs	110	0.05	—	0.1
PAHs	—	—	2 - 39	—
Aldrin	—	—	0.007 - 0.008	ND(0.05)
Dieldrin	—	—	0.007 - 0.028	ND(0.05)
DDD	—	—	0.011	ND(0.05)
Endrin	—	—	0.028	ND(0.05)

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TABLE 2.3-4 (cont.)

GROUND WATER AND LEACHATE SEEPS: COMPARISON OF OBSERVED CONCENTRATION RANGES WITH CLASS GA STANDARDS

Parameter	Range of Detected Concentrations in Shallow Ground Water	Range of Detected Concentrations in Bedrock Ground Water	Range of Detected Concentrations in Leachate Seeps	Class GA Standards
Aluminum	224-74,000	56.1 - 1,630	39 - 303,000	—
Arsenic	2.1 - 22.3	2.4 - 4.7	2.2 - 16.7	25
Barium	52.2 - 1,530	24.9 - 240	80.3 - 10,000	1000
Cadmium	1.3 - 12	1.1 - 4.2	3.7 - 122	10
Chromium	2 - 196	2.4-728	3.5 - 426	50
Cobalt	2 - 46.9	7.1	3.4 - 157	—
Copper	2.7 - 3,060	3.7 - 28.4	13.9 - 784	200
Lead	2.3 - 369	2.3 - 6.8	6.7 - 1,640	25
Manganese	62.1 - 3450	5.9 - 428	123 - 16,100	300
Mercury	0.23 - 3.3	0.48	0.25 - 4.7	2
Nickel	11.8 - 141	10.7 - 198	20.4 - 521	—
Silver	2.1 - 23.7	2	3.4 - 16.6	50
Vanadium	1.4 - 124	1.4 - 35.3	3.3 - 471	—
Zinc	7.5 - 1490	1.4 - 44	66 - 8,270	300
Cyanide	30	—	18 - 31	100

NOTES: Effluent limits from 6NYCRR Parts 702 and 703.
All units in micrograms per liter (µg/L).

E

APPENDIX E

GROUNDWATER TREATABILITY STUDY WORK PLAN

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E.1.0 INTRODUCTION

The groundwater remedy for the Pfohl Brothers Landfill Site (Site) consists of groundwater extraction and treatment at a local POTW. In the event the POTW option is not available, an on-Site pretreatment system will be considered. The selection and design of the groundwater pretreatment process(es) will be based on existing groundwater quality data, the additional groundwater quality data to be generated from the prototype groundwater collection system testing, and the detailed findings from a groundwater treatability study. This document is a work plan for such a treatability study and includes a description of treatability objectives, equipment and testing procedures.

The conceptual groundwater pretreatment system under consideration is expected to contain the following unit operations:

- treatment for the inorganic constituents by using chemical precipitation;
- removal of any residual volatile organics via air stripping; and
- removal of residual semi-volatile organics in the groundwater by carbon adsorption.

The need for a chemical precipitation operation will depend, in part, on whether metal removal is required. The Site groundwater is expected to contain both dissolved and suspended solids which typically deposit or precipitate onto groundwater treatment components such as air strippers and carbon adsorbers. This deposition and precipitation will adversely affect the performance of these pretreatment system components. Consequently, the additional groundwater characterization data and the groundwater treatability studies described below have been scoped to determine both performance and operational design parameters for the groundwater pretreatment system.

The production rates of sludge and solids to be expected in the groundwater pretreatment system will be determined from the results of the treatability studies. The final design of the sludge dewatering system (i.e. type, size, auxiliary equipment) will be based on the results of these treatability studies. Dewatered materials may or may not be classified as hazardous wastes, and a final determination will be made on the basis of chemical analyses. Provisions for disposal of dewatered materials will be consistent with their chemical characterization and applicable regulatory requirements.

Quality assurance/quality control (QA/QC) procedures for the analytical component of the treatability studies will be in accordance with those specified in the Remedial Design (RD) and Quality Assurance Project Plan (QAPP). Health and safety protocols for sample collection activities will be in accordance with the RD Health and Safety Plan (HSP). The laboratory selected to perform the treatability study will submit, prior to execution, a copy of the laboratory HSP.

E.2.0 TREATABILITY STUDY SCOPE OF WORK

E.2.1 SCOPE OF WORK

The scope of work for the groundwater treatability studies will include bench scale tests which will be carried out at an off-Site research testing facility. The need for pilot-scale testing will be determined based on the results of the laboratory results.

Specific tests which may comprise the treatability scope of work include the following:

Laboratory-Scale Testing

Test 1: Laboratory-scale jar tests to evaluate solids precipitation resulting from pH adjustment;

Test 2: laboratory-scale test to evaluate solids precipitation resulting from aeration and VOC removal by low air to water ratio aeration processes;

Test 3: laboratory-scale jar tests to evaluate precipitation processes resulting from chemical addition;

Test 4: manganese green sand filtration tests to evaluate solids removal processes;

Test 5: multi-media filtration tests to evaluate solids removal processes;

Test 6: isotherm batch tests to evaluate activated carbon processes;

Test 7: UV/H_2O_2 lab test to evaluate chemical oxidation processes.

Pilot Tests:

Test 8: Pilot scale test to evaluate and develop air stripping design parameters.

E.2.2 SITE-SPECIFIC PARAMETER LIST

A Site-Specific Parameter List (SSPL) will be developed for the analytical program in support of the groundwater treatability studies. The SSPL will be developed following a review of the analytical data collected during the testing of the prototype groundwater collection system.

The SSPL will be used when evaluating treatment system performance during the treatability studies. Consequently, the SSPL will consist of the VOCs and heavy metals, if determined to be present above the groundwater cleanup standard. Additional compounds to be added to the SSPL for the purpose of the treatability studies may include compounds which adversely affect treatment performance for the targeted compounds or adversely affect operations.

E.2.3 DATA MANAGEMENT AND REPORTING

Treatability study data will be reviewed for precision, accuracy and completeness. If QA objectives are not met, appropriate corrective actions will be taken.

Data will be presented in tabular or graphical form where possible. The performance and validity of each site specific objective will be evaluated. Critical parameters for supplemental testing will be identified. Data collection efforts for pilot scale work will allow statistical analysis to be performed.

E.3.0 LABORATORY-SCALE TESTS

Laboratory-scale treatability evaluations will be conducted as the first step towards the evaluation of several treatment technologies. The objective of the laboratory-scale studies will be to determine which treatment technologies are appropriate to the treatment of the groundwater at the Pfohl Brothers Landfill Site.

A representative 40-gallon sample of the groundwater extracted during the prototype groundwater collection system pumping test will be collected in 2-gallon clean glass bottles. Ten gallons will be collected from each of the three prototype wells at the end of the 48-hour pumping tests. In addition, ten gallons will be collected from monitoring well MW-2S. These glass bottles will be properly capped, labeled with date of collection and sample location, and stored at 40 degrees Fahrenheit until the laboratory-scale tests are complete. Each time a test sample is withdrawn from the representative sample, the bottle shall be tightly recapped and returned to storage. This representative groundwater sample will be used to conduct all tests targeted in the laboratory-scale treatability studies to ensure consistency in the results.

E.3.1 PH ADJUSTMENT TEST

A pH adjustment test will be performed to determine the effect, if any, of increasing the initial pH of the extracted groundwater on the potential for solids precipitation. During the conductance of the pH adjustment tests, the following variables shall be controlled:

- temperature of the jar contents;
- chemical strength of the alkaline solution for pH adjustment;
- method of adding the alkaline solution;
- duration and intensity of mixing the alkaline solution into the groundwater test sample; and
- method of sample decantation for evaluating solids formation.

Equipment

1) six 1-liter glass beakers
2) a stock solution of sodium hydroxide (NaOH)
3) 10 mL glass pipette for NaOH addition
4) Phipps and Bird Jar Stirrer apparatus
5) pH meter
6) glass thermometer
7) six 750 mL glass Erlenmeyer flasks
8) six 1-liter glass graduated cylinders

Procedure

1) Fill six 1-liter clean glass beakers with a groundwater sample from the 30-gallon sample.

2) Place the six beakers on the jar stirrer apparatus.

3) Record temperature and determine turbidity in accordance with Standard Methods.

4) Lower the rotor blades into the beakers to a depth of 10 cm.

5) Prepare a 1 N NaOH solution in accordance with Standard Methods.

6) Turn the stirrer on at zero rotation. Adjust the rotation of the stirrer to 10 rpm, allowing slow mixing during NaOH addition.

7) Measure and record the pH of the control sample (Beaker #1) using a calibrated pH meter.

8) Adjust the pH in Beaker #2 slowly adding prepared NaOH solution. Add NaOH solution dropwise using a 5 mL pipette. Drops should be added to the beaker form approximately 1 cm above the water level in the beaker. Continue to add the NaOH solution dropwise until the final pH reading is approximately 0.5 units (plus or minus 0.1) higher than the pH reading of the control beaker. Record the final pH reading and the volume of the NaOH solution added to raise pH to selected value.

9) Repeat Step 8 above in Beaker #3. Add the NaOH solution until the final pH reading is 0.5 units higher than that recorded for Beaker #2. Ensure that mixing is continued throughout the NaOH addition. Record the final pH and volume of the NaOH added.

10) Repeat Step 8 above for Beakers #4, #5 and #6, each time raising the pH by approximately 0.5 units, respectively.

11) When the pH in all the beakers has been adjusted to the selected pH, turn the stirrer off and raise the mixing blades from the sample. Measure the final pH and temperature and determine the turbidity for the six beakers.

12) Inspect beakers visually for signs of precipitation. Record nature of precipitate (color, visual density, approximate depth of the precipitate layer).

13) Remove beakers from the jar stirrer apparatus slowly so as not to disturb the precipitate. Carefully decant the sample from each beaker into six 1-liter graduated cylinders. Record amount of liquid decanted to each graduated cylinder.

14) Filter the liquid from each graduated cylinder into a properly labeled 750 mL Erlenmeyer flask.

15) Analyze the liquid in each flask for the total suspended solids (TSS) and the semi-volatile portion of the SSPL.

16) Cover each beaker and flask with aluminum paper and store in a cool dark place for further testing, if required.

E.3.2 AERATION TESTS

Laboratory-scale aeration tests will be performed to determine the effectiveness of oxidation and low air to water ratio air stripping, and to determine the potential for the formation of precipitates during air stripping. The aerated water will be used also for the carbon isotherm tests. The procedures to be implemented for conducting the laboratory-scale aeration tests are as follows:

Equipment

1) three 1-liter aeration beakers
2) Phipps and Bird Jar Stirrer apparatus
3) pH meter
4) glass thermometer
5) six 750 mL glass Erlenmeyer flasks
6) six 1-liter glass graduated cylinders
7) air compressor
8) filtration kit

Procedure

1) Fill three nominal 1-liter clear plastic aeration test beakers with groundwater.

2) Aerate one beaker for one hour, aerate the second beaker for two hours, or longer if necessary, and maintain one beaker as a control.

3) Inspect beakers for signs of precipitates.

4) Conduct filtration tests on each beaker.

5) Analyze the filtrate for TSS and the semi-volatile portion of the SSPL.

The standard laboratory air compressor pump will be used to provide the volume of air necessary for the aeration test. The air flow to each beaker will be controlled.

E.3.3 CHEMICAL PRECIPITATION TESTS

The need to conduct laboratory-scale chemical precipitation (coagulation) jar tests will be determined based on visual observations of the turbidity of the extracted groundwater and whether a precipitate is generated during the performance of the laboratory-scale pH adjustment tests and aeration tests. The purpose of the laboratory-scale coagulation test will be to determine the requirements for chemical aids to promote coagulation, if required.

If laboratory-scale coagulation tests are assessed to be necessary, a jar test program will be conducted. The laboratory-scale coagulation tests will be performed using procedures similar to those presented in Standard Methods.

The chemical precipitation test will also be used to evaluate the efficiency of the coagulation/flocculation process in removing any suspended matter and reducing metals concentrations, mainly iron.

During the conductance of the laboratory-scale chemical precipitation testing, the following variables will be controlled:

- temperature of jar contents;
- coagulant solution strength;
- coagulant dosage quantity;
- pH;
- method of coagulant addition;
- sequence of addition of reactants; and
- duration and intensity of mixing.

Equipment

1) six 1-liter glass beakers
2) a stock solution of NaOH
3) a stock solution of sulfuric acid (H_2SO_4)
4) a stock solution of aluminum sulfate (alum)
5) 10 mL glass pipette for alum addition
6) Phipps and Bird Jar Stirrer apparatus
7) pH meter
8) glass thermometer
9) six 750 mL glass Erlenmeyer flasks
10) six 1-liter glass graduated cylinders

11) six 200 mL glass bottles with teflon coated screw top

Procedure

1) Fill six 1-liter clean glass beakers with a groundwater sample from the 30-gallon sample.

2) Place the six beakers on the jar stirrer apparatus.

3) Measure and record temperature, pH and determine turbidity in accordance with Standard Methods.

4) Lower the stirrer blades into the beakers to a depth of 10 cm.

5) Turn the stirrer on at zero rotation. Adjust rotation to 10 rpm, allowing slow mixing during acid addition.

6) Adjust the final pH in all beakers to be between 5.5 and 6.5 using stock solutions of 0.1 N sulfuric acid or 0.1 N NaOH. Slowly add acid/base dropwise using a 10 mL pipette. Add acid/base approximately 1 cm above the water level in the beaker. Adjust the final pH in all six beakers to within 0.1 pH unit. Measure and record the final pH of all the samples.

7) Adjust the rotation of the stirrer blades to 100 rpm for one minute of rapid mixing.

8) Adjust the rotation of the stirrer of the stirrer blades to 30 rpm for one minute slow mixing.

9) Turn the stirrer off and allow the raw water samples to sit for a period of five minutes.

10) Add 10 mL of alum solution to Beaker #2. Add the alum approximately 1 cm above the water level in the beaker.

11) Add 20 mL of alum solution to Beaker #3.

12) Add 30 mL of alum solution to Beaker #4

13) Add 40 mL of alum solution to Beaker #5.

14) Add 50 mL of alum solution to Beaker #6.

15) Turn the stirrer apparatus on and adjust the rotation to 100 rpm and mix for one minute.

16) Adjust stirrer rotation to 30 rpm and mix for 20 minutes. during mixing note the time of floc appearance, as well as the color, consistency, visual density and estimated size (mm) of the floc particles.

17) Turn the stirrer off and allow the floc to settle for 30 minutes. During settling, observations shall be noted on the floc settling characteristics.

18) Raise the rotor blades very carefully from the jars. Remove the jars form the jar stirrer apparatus slowly so as not to disturb the floc. Decant the clear liquid from each beaker into a properly labeled 1-liter graduated cylinder. during transferring the samples, make sure not to transfer any of the floc material.

19) Analyze the liquid in the beakers and graduated cylinders for alkalinity, hardness, turbidity, TSS and the semi-volatile portion of the SSPL.

20) Transfer the samples from the graduated cylinders to properly labeled 750 mL Erlenmeyer flasks. cover the flasks with aluminum foil paper and store in a cool dark place for further testing, if required.

21) Transfer the remainder of the samples in the beakers containing the floc material to properly labeled 200 mL glass bottles. Ensure that all floc material has been transferred.

22) Cover each bottle with aluminum foil paper and cap. Store in a cool dark place for further analysis, if required.

E.3.4 MANGANESE GREEN SAND FILTRATION

The need to conduct a green sand filtration test will be based on the presence (nonpresence) of elevated levels of iron and manganese. Any pretreatment of groundwater prior to this filtration test will be based on results of previous lab testing. Groundwater will be passed through a conditioned bed of green sand media at a hydraulic loading rate of 1.5 gallons per minute per square foot of filter bed (gpm/tt^2). The bench-scale green sand filter will consist of a 60-inch long by 3-inch diameter Lucite column, packed with 6 inches of pea gravel, 30 inches of manganese green sand and 12 inches of anthracite. Influent and effluent samples will be collected and analyzed for:

- iron total,
- iron soluble,
- manganese total,
- total dissolved solids,
- total suspended solids,
- dioxin, and
- PCBs

E.3.5 MULTI-MEDIA FILTRATION

The need to conduct a bench-scale multi-media filtration test will be based on the presence of suspended solid materials. A sample of the groundwater will be passed through a conditioned filter bed at an hydraulic loading rate of 5 gpm. The filter will consist of a 24-inch long by 3-inch diameter Lucite column, packed with 4 inches of pea gravel, 4 inches of garnet sand, 4 inches of liter sand and 12 inches of anthracite. Influent and effluent samples will be collected and analyzed for:

i) total dissolved solids; and

ii) total suspended solids

iii) Dioxin

iv) PCBs

E.3.6 ACTIVATED CARBON TESTING

Activated carbon isotherm batch tests will be conducted to determine organics removal efficiency provided by the carbon and to assess the potential consumption rate of the carbon. The test will be conducted on a sample as received from the Site and a sample aerated from the previous aeration test (3.2). During these tests, the following factors will be controlled:

- type of carbon
- carbon preparation steps
- contact time
- temperature
- pH

Equipment and Reagents:

1) activated carbon (virgin, granulated)
2) 100 mL clean volumetric flask
3) deionized water
4) 42 precleaned 40 mL glass vials with teflon-lined caps
5) laboratory shaker

Procedure

1) Grind the activated carbon into fine powder using a mortar and pestle.

2) Screen the fine powder through 200-400 mesh screens and use the carbon fraction between 200-400 mesh (0.0381 - 0.0736 mm) for the isotherm test.

3) Dry the carbon powder (200 - 400 mesh) overnight at 1 05°C, then keep it in a desiccator to cool down to room temperature.

4) Prepare a carbon suspension (10,000 ppm) by weighing one gram dried carbon into a 100 mL volumetric flask and adding deionized water until the 100 mL mark.

5) Prepare the isotherm batch solution using varying amounts of carbon in each vial (0.1, 0.5, 2.5, 5 and 10 mgo). Prepare 30 vials for each carbon concentration using the carbon suspension 10, 50, 250, 500, 1000 µL.

6) Prepare duplicate sets of vials for blank test without the addition of any carbon.

7) Finally add groundwater to each vial (30 mL) and seal the vials immediately. The amounts of carbon suspension and deionized water added to each vial is shown below:

Vial #	*Carbon Suspension (μL)*	*Deionized Water (μL)*
1-6	0	1
7-9	0.01	0.99
10-12	0.05	0.95
13-15	0.25	0.75
16-18	0.5	0.5
19-21	1.0	0

8) Rotate the bottle overnight on the shaker.

9) Separate the carbon by centrifugation, and analyze the supernatant for SSPL (subsamples should be taken through bottle cap holes to minimize losses via volatilization).

10) Calculate Fruendlich isotherm for the total and specific SSPL as shown below:

$$q = x/m - k_d c_e^{1/n}$$

where:

x	=	weight of analyte adsorbed (mg)
	=	$(C_i - C_e)$
v	=	volume of groundwater used (mL)
c_i	=	initial concentration of analyte (mg/L)
c_e	=	equilibrium concentration of analyte (mg/L)
m	=	weight of carbon (g)
k_d, n	=	empirical constant

The Freundlich equation parameters and 1/n are determined by applying regression to logarithmic form of the equation, where log q is taken as the dependent variable and log c_e as the independent variable. The slope of the plot gives the value of 1/n and its intercept with the log q axis yields the value of log kd. Estimate carbon consumption rate from the graph and determine the amount of carbon required to treat 1000 gallons of groundwater.

E.4.0 PILOT-SCALE TESTS

E.4.1 OVERVIEW

Pilot-scale testing will be restricted to an assessment of aeration/air stripping. Information to assess the suitability of the other processes (i.e. carbon treatment, filtration) to be implemented as part of the treatment program can reasonably be extrapolated from the laboratory/bench-scale tests.

E.4.2 AERATION/AIR STRIPPING TEST

If the results of the laboratory aeration test prove to be successful, the tank aeration test will be conducted at a pilot scale. The final size and configuration of the pilot unit will be based on the results of the laboratory test and the additional data on groundwater characterization. If the results of the laboratory aeration test proved to be unsatisfactory, packed tower or shallow tray air stripping will be considered as an alternative technique. The selected treatment process will be tested at a pilot scale (10 gpm). The test will be used to determine key parameters such as optimum air to water ratio, percent removal efficiency, and solids formation.

Groundwater will be pumped from a feed tank to the pilot aeration unit. During the operation of the pilot test, influent and effluent samples will be collected daily and analyzed for the SSPL.

At the end of the pilot test run, the pilot unit will be shut down and inspected for signs of deposition, precipitation and biological growth. The rates of deposition, precipitation and biological growth will be determined by visual inspection. As necessary, samples of deposits will be collected with follow-up analysis for compounds (i.e. calcium, iron, sulphate) which may appear.

APPENDIX F

SLURRY WALL MATERIALS COMPATIBILITY TESTING WORK PLAN

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F.1.0 INTRODUCTION

This report outlines the procedures and protocols to be implemented during the materials testing program as part of the predesign portion of the Remedial Design/Remedial Action (RD/RA) for the Slurry Wall design at the Pfohl Brothers Landfill Site (Site).

F.2.0 SELECTION OF CANDIDATE BACKFILL MATERIALS

Previous testing conducted within the same geographic area as the Site have indicated that bentonite is the most appropriate candidate for use in a slurry wall at the Site.

Bentonite is a generic name given to the clay mineral sodium-montmorillonite. This mineral has a "platelike" structure with high activity and thus, has excellent swelling characteristics when hydrated by water. Bentonite is a naturally occurring mineral mined in the States of Wyoming, South Dakota and Montana and is a readily available commercial product. Conventional bentonite such as Premium Gel from American Colloid will be used in the testing program. "Contaminant resistant polymerized bentonites" will not be used in this program as the existing literature suggests that they provide no advantage over the conventional bentonite and they are more expensive. In addition, it is noted that the polymer may degrade over long term applications.

The results and analysis of the overburden borehole and test pit/trench investigation will be used to determine if the native soils will provide a minimum of 25 percent fine materials (silts and clays passing the No. 200 standard sieve) and thus be appropriate for use in the backfill mixture with bentonite. The soil which will be utilized in the laboratory testing program for backfill materials will be comprised of native soil obtained from borehole samples located along the alignment of the perimeter barrier containment system. If these native soils are not appropriate (ie. fines content <25 percent) or of insufficient volume, alluvial soil from off-Site sources shall be evaluated and used.

F.3.0 OVERVIEW OF TESTING PROGRAM

The testing program to be used will be comprised of three phases. Phase I will be concerned with testing the bentonite in bentonite-slurry mixtures such as would be used to keep the trench open prior to backfilling. These tests will determine the potential reactivity of the bentonite slurry mixtures when hydrated with clean tap water and site groundwater. Bentonite slurries which show adverse reactions, such as flocculation, with these permeants will be removed from subsequent testing phases. Rationale for determining adverse reactions is discussed in Section F.4.

Phase II of the testing program will determine a design backfill mixture of soil/bentonite (SD) which provides the lowest hydraulic conductivity when permeated by clean tap water.

Finally, Phase III testing will determine the durability of the selected design mixtures when permeated by tap water and site groundwater over an extended length of time (90 to 180 days). The purpose of the Phase III testing is to determine the long term effects of the various permeants on the hydraulic conductivity of the selected design mixture(s).

Laboratory hydraulic conductivity testing protocols utilizing the consolidometer permeameter are presented in Attachment F-1.

Table F.1 presents a summary of the design compositional ranges for SB and backfill mixes. These design ranges are based upon experience and are consistent with a review of the available scientific literature.

F.4.0 PHASE I TESTING PROGRAM

The Phase I testing program is designed to provide an accelerated method of screening the test bentonite slurry mixtures. This phase will show initial gross incompatibilities and thus, these mixtures may then be removed from subsequent costly and time consuming analyses. The bentonite shall be mixed into three slurries with bentonite concentrations of 3.5, 5.0, and 6.5 percent be weight. Four types of bentonite shall be tested. The bentonites will be both untreated and treated from manufacturers N.L. Baroid and American Colloid. These samples represent the trenching slurries which would be used to maintain trench stability. Two sets of slurries shall be formulated with each of these mixes as follows:

1. hydrated with clean tap water,
2. hydrated with Site groundwater,

Slurry samples shall be prepared in accordance with API-13 and shall be tested for the following using API RP 13B methods:

1. vicosity,
2. apparent viscosity,
3. plastic viscosity,
4. yield point,
5. filtrate loss,
6. filter cake thickness, and
7. density.

Table F.2 provides a summary of the test samples for the bentonite trenching slurries.

All slurry samples will be visually inspected for flocculation and other adverse physical attributes. The criteria which will be used to identify slurry mixtures which exhibit adverse effects to permeating fluids will generally be of a qualitative nature. Those mixtures will be visually inspected in a graduated cylinder by experienced laboratory technicians. Adverse effects such as flocculation and lamination are easily verified by visual inspection. Photographic documentation of the test design mixes for the Phase I testing program will provide part of the visual evaluation of the sample mixtures. In addition, all mixtures identified in the Phase I program will have specific gravity measurements recorded upon completion of thorough mixing and hydration. Adverse effects will be gauged by comparing the results of baseline condition (samples mixed with water) to the results of samples mixed with the Site groundwater. Mixtures exhibiting adverse effects are expected to show dramatic decreases in the specific gravity of the mixture. Adverse reactions will be characterized visually and will be quantified as any mixture which has a specific gravity decrease of greater than five percent when compared to the baseline mixtures.

The Phase I testing program will also include "cracking" tests on the clays. The cracking tests will include the mixing (i.e. hydrating) of the clays in an open pan with the addition of water, and site groundwater. Samples will be hydrated enough to produce a 4 to 6 inch slump. The samples will be visually inspected for cracking and shrinkage. Photographic documentation of the tests will provide part of the visual evaluation. These tests will provide a qualitative measure of the effects of water, and groundwater on the filter cake which would form during the actual construction activity.

F.5.0 PHASE II TESTING PROGRAM

The Phase II testing program is concerned with designing a suitable backfill mixture providing the required hydraulic conductivity. The grain size distribution of the SB backfill soils shall be determined (ASTM D422) and fines passing the Standard U.S. Sieve #200 shall be added if required such that the soil has minimum of 25% passing the #200 U.S. Standard Sieve.

Phase II testing shall determine the two design backfill mixtures which provide the lowest hydraulic conductivity when permeated with tap water. Phase II shall involve selecting the best two types of bentonite from Phase I and creating three SB mixtures for each type of bentonite for a total of six samples. The three mixtures for each bentonite type shall use the best percentage of bentonite identified in Phase I. In two of the three mixtures for each type of bentonite, an additional 1 and 2 percent by dry weight of bentonite shall be added to the soil prior to slurry addition. Each sample shall be hydrated and permeated using tap water for approximately one week. In addition, baseline hydraulic conductivity testing (remolded) will be conducted on the backfill soils (without clay particle or remolded fines addition to the native soils) to determine the hydraulic conductivity of the native soils which shall be used to complete the construction of the perimeter barrier containment system.

The SB mixtures will be mixed with water to achieve a required slump of four to six inches (ASTM C143).

The fully hydrated, thoroughly mixed samples will then be subjected to hydraulic conductivity testing using consolidometer permeameters permeated by tap water (see Attachment F-1 & EPA-SW846-9100). The samples that produce the lowest hydraulic conductivities will then become potential test specimens for the Phase III testing program. A summary of the test specimens is provided on Table F.3.

F.6.0 PHASE III TESTING PROGRAM

The best two design mix(es) selected during the Phase II program shall be tested for long term durability to determine the effects on hydraulic conductivity of the mixes when permeated by tap water and Site groundwater over extended lengths of time (90 to 180 days).

Each sample shall be placed in a consolidometer permeameter as specified in Attachment F-1 (also see method EPA-SW848-9100). Samples shall be prepared using both tap water and Site groundwater for hydrating agents and prepared in duplicate for each of two permeating liquids. All sample hydraulic conductivities will be monitored over an extended length of time (90 to 180 days) and graphs of hydraulic conductivity versus time shall be prepared. In addition, pore volumes, which are a measure of dimensionless time, will be monitored in the laboratory by measuring column percolate. It is expected that the extended length of time proposed for this program will allow more pore volumes to percolate through the samples than what is currently being done in the industry. This will provide a better estimate as to the long term durability of a constructed slurry wall. The suitability of the backfill materials will be determined from this phase.

Table F.4 provides a summary of the number of samples which must be analyzed for each design mixture test material.

TABLE F.1

COMPARISON OF DESIGN MIXES

1.	Trenching Slurry (Bentonite-Water)	- water-bentonite - 3.5% to 6.5% bentonite - 1,050 kg/m^3 (density) - minimum 40 Marsh funnel seconds viscosity
2.	SB Backfill	- water-soil-bentonite - 3.5% to 6.5% bentonite - minimum 1,300 kg/m^3 (density) - minimum 25% fines (i.e. less than 0.074 mm) - slump: 4 to 6 inches

TABLE F.2

PHASE I: TRENCHING SLURRY TEST MIXES

Sample #	*Bentonite Type*	
BW-1	1	3.5% bentonite tap water
BW-2	1	5% bentonite tap water
BW-3	1	6.5% bentonite tap water
BW-4	1	3.5% bentonite Site groundwater
BW-5	1	5% bentonite Site groundwater
BW-6	1	6.5% bentonite Site groundwater
BW-7	2	3.5% bentonite tap water
BW-8	2	5% bentonite tap water
BW-9	2	6.5% bentonite tap water
BW-10	2	3.5% bentonite Site groundwater
BW-11	2	5% bentonite Site groundwater
BW-12	2	6.5% bentonite Site groundwater
BW-13	3	3.5% bentonite tap water
BW-14	3	5% bentonite tap water
BW-15	3	6.5% bentonite tap water

TABLE F.2

PHASE I: TRENCHING SLURRY TEST MIXES

Sample #	*Bentonite Type*	
BW-16	3	3.5% bentonite Site groundwater
BW-17	3	5% bentonite Site groundwater
BW-18	3	6.5% bentonite Site groundwater
BW-19	4	3.5% bentonite tap water
BW-20	4	5% bentonite tap water
BW-21	4	6.5% bentonite tap water
BW-22	4	3.5% bentonite Site groundwater
BW-23	4	5% bentonite Site groundwater
BW-24	4	6.5% bentonite Site groundwater

Notes:

1. BW denotes bentonite-water slurry mix.

Bentonite Type:
1 N.L. Baroid - untreated
2 N.L. Baroid - treated
3 American Colloid - untreated
4 American Colloid - treated

TABLE F.3

PHASE II: SB TEST MIXES

Sample #	
SB-1	Phase I best bentonite % 25% fines
SB-2	Best Phase I bentonite % + 1% dry bentonite 25% fines
SB-3	Best Phase I bentonite % + 2% dry bentonite 25% fines
SB-4	2nd Best Phase I bentonite % 25% fines
SB-5	2nd Best Phase I bentonite % + 1% dry bentonite 25% fines
SB-6	2nd Best Phase I bentonite % + 2% dry bentonite 25% fines
Control	0% bentonite 0% fines addition to native soil

Notes:

1.) The specified fines will consist of naturally occurring fines and supplemental fines (as required).

2.) The balance of the samples composition will be native soils and tap water such that the mixtures achieve a required slump between 4 and 6 inches.

3.) The percentages to be evaluated are based upon experience and review of the scientific literature. Should the testing of any phase of the program indicate that other mixture percentages need to be evaluated, they will be undertaken.

TABLE F.4

PHASE III: DURABILITY TESTING

Sample No.	
D-1	- 1st Phase II design mix - hydrated with tap water - permeated with tap water
D-2	- 1st Phase II design mix - hydrated with tap water - permeated with Site groundwater
D-3	- 2nd Phase II design mix - hydrated with tap water - permeated with tap water
D-4	- 2nd Phase II design mix - hydrated with tap water - permeated with Site groundwater

Notes:

1.) This is the required number of samples for the analysis of two design mixes carried from Phase II.

2.) One duplicate per design mix will be made.

3.) D denotes design mix.

ATTACHMENT F-1

PRELIMINARY TESTING PROTOCOLS

1. conduct a grain size analysis on backfill soils,

2. as applicable add the appropriate amount of fines (i.e. minus #200 sieve size) to bring the fines content up to the specified 25 percent minimum,

3. conduct a grain size analysis on the materials,

4. measure out the appropriate percentage of bentonite on a dry weight basis,

5. add hydrating fluid (i.e. tap water or site groundwater to the bentonite),

6. thoroughly mix and agitate the bentonite slurry,

7. allow the slurry to hydrate for 24 hours,

8. thoroughly mix and agitate the bentonite slurry,

9. add the bentonite slurry to the soil backfill material,

10. thoroughly mix and agitate the backfill sample,

11. conduct slump test,

12. add hydrating fluid as required to achieve the required slump (i.e. 4 to 6 inches),

13. thoroughly mix and agitate the backfill sample,

14. allow the sample to hydrate for 24 hours,

15. thoroughly mix and agitate the backfill sample,

16. place backfill sample in consolidometer permeameter with porous stones on top and bottom.

    The sample volume will be on the order of 350 cubic centimeters with the following dimensions:

    1. height 2 to 4 inches (5 to 10 cm)

    2. diameter 2 to 4 inches (5 to 10 cm)

This alternative "2-stage" test for the Phase III testing may be applicable. This type of procedure could be utilized dependent upon the laboratories apparatus availability.