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PREDESIGN ACTIVITY REPORT

VOLUME I - TEXT

Pfohl Brothers Landfill
Cheektowaga, New York

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CONESTOGA-ROVERS & ASSOCIATES

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2.0 ACCESS AGREEMENTS

On- and off-Site access agreements were obtained by the Steering Committee prior to conducting the predesign activities. Table 2.1 lists all parties from whom access agreements were secured for the predesign activities.

The MacPeek property (Section-Block-Lot: 82.03-4-11) was the only property acquired through the Real Estate Plan annexed to the IRM Completion Work Plan.

3.0 SITE SURVEY

3.1 BASE AND TOPOGRAPHIC MAPS

An accurate base map of the Site and surrounding area at a scale of 1 inch = 100 feet has been generated from aerial photographs of the Site. The aerial photographs were also used to generate a topographic map with a contour interval of one foot. The base/topographic map is presented on Plan 1.

The base/topographic map allows for:

i) delineation of surface water drainage pathways (a component of the surface water management plan);
ii) accurate estimates of quantities for Site grading and capping; and
iii) an accurate footprint of the existing landfill materials.

3.2 HORIZONTAL CONTROL

The base map is related to both the New York Transverse Mercator and the New York State Plane Grid System. This relationship has been identified on the base/topographic map.

Each of the existing monitoring wells used during predesign RD/RA activities and all wells, boreholes and test pits/trenches installed during the predesign RD/RA have been tied into the grid coordinate system with an accuracy of ±1 foot. All survey work was performed by a professional land surveyor licensed by the State of New York.

3.3 VERTICAL CONTROL

All existing monitoring wells used during predesign RD/RA activities and all wells, boreholes, and test pits/trenches installed during the predesign RD/RA activities were surveyed by a professional land surveyor licensed by the State of New York. The top of the casing of these wells were surveyed to an accuracy of ±0.01 feet and the ground elevations of the boreholes and test pits/trenches were surveyed to an accuracy of ±0.1 feet.

3.4 PERMANENT MARKERS

The locations and elevations of permanent markers used for the survey have been identified on the base/topographic map.

4.0 PREDESIGN SOIL INVESTIGATIONS

Two soil investigations were conducted as part of the predesign activities. The first investigation was performed primarily to delineate the areal extent of the Site waste and any areas of waste that could be excavated and consolidated on the landfill. The second investigation was performed primarily to provide information necessary to design and construct a perimeter barrier containment system. Details of each investigation are provided in the following subsections.

4.1 AREAL EXTENT OF LANDFILL MATERIALS AND AREAS TO BE EXCAVATED AND CONSOLIDATED

This predesign soil investigation was performed to:

i) compile all available information (including that developed during the IRM) regarding the areal extent and thickness of the fill;

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.

This investigation consisted of the following activities:

i) installation of test pits or trenches at 42 locations (1A to 28, 36A to 38A, 45D, and 48 to 56) at approximately 200-foot centers along the north, south, east and west property boundaries of Areas B and C except for the southwest portion of Area C which was delineated by the NYSDEC as part of their off-Site Investigation;

ii) installation of test pits or trenches at 14 locations (29 to 35 and 39 to 45) at approximately 400-foot centers along Aero Drive (in pairs, one north and one south of Aero Drive); and

iii) installation of 14 boreholes in the vicinity of the "L-shaped" ditch in which NYSDEC test pit DR-33 was installed.

Six drums were encountered during test pit installation (TP-4 three drums, TP-11, TP-18 and TP-32, one drum each). The drums were disposed as presented in Section 12.1.

The RD/RA Work Plan stated that 16 boreholes would be installed to investigate the "L-shaped" ditch area. Only 14 of the 16 boreholes were installed due to the fact that two of the boreholes were located immediately adjacent to perimeter boreholes BH-7 and BH-8. Therefore boreholes BH-7 and BH-8 were used to evaluate the northern portion of the "L-shaped" ditch area. This was performed with the concurrence of the NYSDEC's On-Site Representative.

Additional test pits/trenches were excavated in locations where fill materials were not encountered in the initial test pits/trenches. In areas where physical barriers prohibited defining the areal extent of fill materials (e.g., the perimeter fence), a test pit/trench was installed on both sides of the barrier.

The locations of these boreholes and test pits/trenches are shown on Plan 2.

In most locations, test pits/trenches were extended to the fill/native material contact or to a maximum depth of ten feet, or to the groundwater table, whichever was encountered first. In certain areas where the fill was unsaturated, native soil samples collected from the test trenches were used to determine if soils underlying the fill would be suitable for use in the Site cap or slurry wall and to determine the variation of fill thickness with respect to distance from the Site boundary and Aero Drive.

The test pits/trenches were excavated using a backhoe or trackhoe in accordance with the protocols presented in the RD/RA Work Plan. The test pits/trenches were installed between February 28, 1994 and March 26, 1994. Soil samples were collected and visually examined to determine stratigraphy and were logged using the Unified Soil Classification System (USCS). The stratigraphic logs are presented in Appendix A. The underlying native materials were screened with a photoionization detector (PID). The PID readings for each test pit/trench are presented on the stratigraphic logs. Samples of the underlying native materials from 16 selected test pits were submitted for grain size distribution and/or moisture content to evaluate the suitability of native soils for use in a slurry wall or in the cap. The physical testing results are presented in Appendix B and summarized in Table 4.1. Based upon the results of the test pit/trench program, the areal limit of waste was surveyed by a licensed surveyor.

Section 2.4.1 of the RD/RA Work Plan requires that a sample of the underlying native soil from each test pit/trench be submitted for grain size distribution and moisture content analyses. Section 2.4.2 requires that representative samples of the native soils from the perimeter boreholes be submitted for grain size distribution and moisture content analyses unless such a sample has been collected from a previously installed test pit/trench within 100 feet of the borehole. The procedure was reversed during the predesign field activities, with concurrence by the NYSDEC's On-Site Representative, such that the majority of the samples were collected from the boreholes and fewer samples were collected from the test pits/trenches.

Boreholes and test pits/trenches were installed along the entire Site perimeter except for the southwest corner of Area C (access permission for borehole installation was not granted by the Zelaskos).

Test pits were installed as outlined in Appendix A of the RD/RA Work Plan except that excavated soils were not always placed on polyethylene sheeting. Polyethylene sheeting was deemed not to be necessary when the excavated soils were the same as the immediately adjacent soils upon which the excavated soils were placed. This revision was made with the concurrence of the NYSDEC's On-Site Representative.

A total of 14 boreholes (designated ABH-1 to ABH-14) were installed in the immediate vicinity of the "L-Shaped" ditch in which former test pit DR-33 is located as shown on Plan 2. The boreholes were installed between March 18 and March 23, 1994. No drums were encountered in these boreholes.

Nine of the 14 boreholes located within the "L-Shaped" ditch area were installed to the top of bedrock. The remaining five boreholes located within the "L-Shaped" ditch area were drilled until a confining unit (i.e., silty clay and/or till) was encountered, in concurrence with the NYSDEC's On-Site Representative. The confining unit was penetrated a minimum of four feet in these five boreholes and was observed in all 14 boreholes. Boreholes were installed as described in Appendix A of the RD/RA Work Plan. Soil samples were collected from nine boreholes and analyzed for grain size distribution, moisture content, permeability and/or Atterberg limits. The results are presented in Appendix B and summarized in Table 4.1.

4.2 PERIMETER BARRIER CONTAINMENT SYSTEM

A predesign soil investigation was conducted to provide information necessary to design and construct a perimeter barrier containment system. The investigation was 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 physical hydraulic barrier (e.g., interceptor drain) supplemented with an overburden groundwater collection system within the confines of the hydraulic barrier, if required; or

iii) a combination of a physical 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, sheet piles, or high density polyethylene (HDPE) liner on the exterior side of the interceptor drain, or a 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 variable hydraulic conductivity of the fill materials (10^{-1} to 10^{-3} cm/s range), the relatively thin saturated overburden, and the reduction of recharge 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 physical hydraulic barrier consisting of a perimeter interceptor drain is the preferred option.

The soil investigation involved the installation of 52 boreholes extending to a minimum depth of two feet below the top of the confining unit with the exceptions described below, in concurrence with the NYSDEC's On-Site Representative. The boreholes were spaced at approximately 200-foot centers along the proposed alignment of the perimeter barrier system as shown on Plan 2. The information from the test pit/trenches along the perimeter of Areas B and C was also used in selecting the borehole locations. Final borehole locations were selected with the concurrence of the NYSDEC's on-Site Representative. These boreholes were located along the proposed alignment of the perimeter barrier system which is located outside of the landfill waste material limits as determined by the predesign test pits/trenches and the results of the NYSDEC borehole program along the southwest border of Area C. Additional boreholes were installed in the southwest area of Area C since the samples collected by the NYSDEC from the clay/till material were obtained from the drill cuttings and were not undisturbed samples. The boreholes were installed beginning on March 7, 1994 and were completed on April 15, 1994. No drums were encountered in these boreholes.

Drilling was performed using two all terrain drilling rigs. Continuous samples were collected using 3-inch diameter split spoon samplers in advance of the augering operation (8 1/4-inch outside diameter).

Soil samples were collected and examined to determine stratigraphy and were logged using the USCS. Stratigraphic logs are presented in Appendix C. Geologic record samples were collected and are stored at the Site. Borehole installation protocols and soil sampling protocols were performed as outlined in the RD/RA Work Plan with the following exceptions:

i) not all boreholes were drilled to a depth of two feet below the top of clay/till (confining) unit, with the concurrence of the NYSDEC's on-Site Representative, as specified in the RD/RA Work Plan. A total of eight boreholes along the perimeter of the Site were installed to bedrock/auger refusal. Nine of the 52 perimeter boreholes were installed to a depth of less than two feet into the top of the confining unit due to either contacting till or similarity of stratigraphic units with the adjacent borehole. The remaining perimeter boreholes extended to a minimum depth of two feet into the top of the confining unit;

ii) each borehole installed to bedrock/auger refusal was grouted to the surface with bentonite/cement grout using positive displacement techniques. The RD/RA Work Plan required that only the bottom ±3 feet of the borehole be grouted with bentonite/cement grout; and

iii) all other boreholes were backfilled with bentonite pellets to a depth equivalent to the top of the confining unit.

Borehole drill cuttings and excess soil from split spoon samples not used for geologic samples collected during the predesign soil investigations were handled as discussed in Section 12.0.

To evaluate the native soil's suitability for use in a slurry wall or in a cap, representative soil samples were collected from selected boreholes to determine the grain size distribution and/or moisture content of the native soils. Samples from each different geologic layer of substantial thickness within these boreholes were submitted. Attempts were made to collect undisturbed samples of the clay/till material from every second borehole encountering the clay/till layer. The samples were submitted for permeability and Atterberg limits testing, where sufficient sample volume could be obtained. This was not always possible due to the high density of some of the till units which prevented the penetration of the sample collection device. The testing results are presented in Appendix B and summarized in Table 4.1.

4.3 EVALUATION OF DATA

A discussion and evaluation of the data collected by the predesign soils investigations is presented in the following subsection. A summary of the geologic layers encountered is presented in Table 4.2.

4.3.1 Site Geology

The following presents the Site geology as interpreted from the data collected during the NYSDEC RI and the predesign field activities.

The stratigraphic sequence observed at the Site is:

i) landfill waste/fill material overlying
ii) native glaciofluvial deposits overlying
iii) bedrock

4.3.1.1 Areal Extent and Thickness of Landfill Waste/Fill Material

The areal extent and thickness of the landfill waste/fill material was determined by the compilation of all existing information. This included data presented in the RI, data collected during the drum removal program (IRM) and data obtained during the predesign activities. The areal extent of the landfill waste materials is presented on Plan 2. The thickness of the fill materials, represented by a contour map, is presented on Plan 3.

As shown on Plan 2, the areal extent of the landfill waste materials covers an area of approximately 130 acres and generally follows the perimeter of the Site along the north, east, west and majority of the south side of the Site. Landfill waste materials extend beyond the existing chain-link fence along the south side that is adjacent to Pfohl Road, in a small area along the west boundary of Area B, and in a small area along the north boundary of Area C. Fill materials not representative of a municipal landfill operation but typical of fill for construction (eg. C&D debris) were observed in a few areas of the Site outside the limit of landfill waste. These areas were adjacent to Transit Road, primarily in Area B.

The landfill waste materials have a maximum thickness of approximately 17 feet in two discrete areas, the western portion and the central portion, of Area B. In Area C, the maximum landfill waste thickness was approximately 18 feet in the eastern portion. Average landfill waste thicknesses in Areas B and C is on the order of 10 feet.

4.3.1.2 Native Materials

The native materials have been divided into two units for the following discussion. The first unit is the upper portion of the native materials which consists of interbedded and discontinuous layers of silt, silty sand, and silty clay. The second unit is the lower portion, consisting of till and overlying clay and silty clay and is called the confining unit.

Using the available data, contour maps showing the elevation of the top of native material, elevation of the top of confining unit, thickness of the confining unit and elevation of the top of bedrock are presented on Plans 4, 5, 6 and 7, respectively.

The thickness of the upper portion in Areas B and C varies considerably over the Site and ranges in thickness from 0 to 17 feet thick (at BH-1 in Area B and NYSDEC SB-15 in Area C) without a consistent pattern. The lack of a consistent pattern is most likely due to the historic landfill operations which included cut, fill and cover.

The thickness of the confining unit, as shown on Plan 6, varies in thickness from 1.6 feet (SB-16) to 11.4 feet (GW-13S) in Area B and from 1.5 feet (GW-9S) to 13.4 feet (SB-12) in Area C. It is noted that a confining unit was observed in each of the 14 additional boreholes installed to define the areal extent of the reported lack of a confining unit in NYSDEC test pit DR-33. It is believed that a confining unit does exist in the vicinity of DR-33 based on the following:

i) a confining unit was observed at all 14 additional boreholes; and

ii) the depth to the confining unit in these boreholes (11.5 to 17.8 feet below ground surface (BGS) except for ABH-1 which was 7.5 feet BGS) is greater than the reported depth of 8± feet BGS to "bedrock" in DR-33.

4.3.2 Delineation of Landfill Areas to be Excavated and Consolidated

The areal extent of landfill waste material shown on Plan 2 indicates the following:

i) there are three areas where the landfill waste materials extend beyond the perimeter of the Site as defined by the existing chain-link fence; and
ii) there are two areas adjacent to Transit Road in which landfill waste was not observed.

The three areas where landfill waste was observed to extend beyond the chain-link fence are:

i) a small isolated area in the vicinity of test pit 21 where the landfill waste extends approximately 4 feet onto the Niagara Mohawk Power Corporation (NIMOH) right-of-way;

ii) in the backyard of the residential properties along the northside of Pfohl Road according to the Off-Site Investigation performed by the NYSDEC; and

iii) adjacent to the south edge of Aero Drive along the north perimeter of Area C in the vicinity of test pits 40 and 41.

Based on the areal extent of landfill waste, it is anticipated that landfill waste (0.67± acres) will be excavated for on-Site consolidation from the north perimeter of Area B to the extent required to allow construction of the final cap without adversely impacting the adjacent wet area/floodplain. Also it is anticipated that a small volume of waste on the western perimeter of Area B in the vicinity of test pit 21 (0.03± acres), and on the northern perimeter of Area C in the vicinity of test pits 40 and 41 (0.8± acres) will be excavated to consolidate these off-site wastes onto the Site. These are the only three areas which are currently anticipated for waste consolidation.

There are two areas adjacent to Transit Road in which landfill waste was not observed. Future use of the areas adjacent to Transit Road will need to consider the impact of the wet area reported to be under the jurisdiction of the NYSDEC (ie. Wetland LA-5).

4.3.3 Data Gap Resolution

As described in Section 4.1, 14 boreholes were installed in the immediate vicinity of the "L-shaped" ditch near former test pit DR-33 to evaluate the reported non-existence of a clay/till layer in this area. Bedrock was reported to be 8 feet BGS in DR-33. All of the 14 boreholes encountered a clay/till layer overlying the bedrock. The top of the clay/till layer ranged in depth from 7.5 to 16.9 feet BGS and the top of bedrock ranged from 14.0 to 22.9 feet BGS. In particular, the top of the clay/till layer in ABH-9, the closest borehole to TP-33 was 10.0 feet BGS and the bedrock was encountered at 18.6 feet BGS. It is believed that a continuous clay/till layer exists in the vicinity of the "L-shaped" ditch based on the following:

i) the greater depth to the top of the clay/till in all boreholes compared to the reported depth to bedrock at 8 feet BGS in DR-33; and
ii) the observed presence of a clay/till layer in all 14 ABH boreholes;

It should also be noted that the clay/till unit was observed in all intrusive activities of sufficient depth during predesign and IRM Completion activities. Therefore, it is believed that the clay/till is continuous beneath the Site as shown on Plan 6 and that the data from DR-33 was erroneously recorded as bedrock.

The borehole/test pits completed during the predesign activities have sufficiently resolved data gaps on the perimeter of Areas B and C except for the depth of the confining layer in the southwest corner of Area C. Access to the Zelasko property could not be obtained to install the proposed test pits/boreholes and consequently activities in this area were moved to adjacent locations inside the Site perimeter.

4.3.4 Proposed Perimeter Barrier System Alignment

The boreholes and test pits installed along the perimeter of the Site, including the boreholes installed by the NYSDEC as part of their Off-Site Investigation, delineated the areal extent of the landfill waste and the depth to the clay/till unit. Presented on Plan 8 is the proposed alignment of the perimeter barrier system. The alignment was selected to be approximately 10 feet outside the landfill waste materials except in areas where the waste was directly adjacent to wet areas reported to be under the jurisdiction of the NYSDEC (ie. Wetland LA-5). In the wet area, the alignment for the perimeter barrier system was selected to be along the current limit of waste. This will require excavation and on-Site consolidation of landfill wastes from the areas adjacent to the wet area such that upon construction of the landfill cap, the edge of the landfill cap will be at approximately the same location as the currently existing landfill waste. Profiles of the clay/till unit along the proposed barrier system alignment are presented on Plans 9 through 16.

4.3.5 Use of Landfill Materials for Site Grading

Landfilled materials will not be used for Site grading purposes, except for the following:

i) excess materials generated during construction of the Remedial Action (eg. perimeter barrier system);
ii) materials excavated during Site consolidation; and
iii) excess materials generated during any other intrusive construction activity under the RA.

4.3.6 Demolition Material

Any demolished structures from properties adjacent to the Site will be used as grading material on-Site.

4.3.7 Use of Native Materials

Excess native materials excavated during construction of the Remedial Action (RA) will consist of soils capable of supporting vegetation and underlying silts, sands and clays. These soils will be obtained from both areas outside the limit of landfill waste (eg. the perimeter barrier system) and from areas within the limit of landfill wastes (eg. interior overburden groundwater extraction system, if any). Potential uses of the native materials from areas outside the limits of the landfill waste are:

i) use of the soil capable of supporting vegetation as part of the upper layer of the final cap; and

ii) use of the underlying sands, silts and clays as either intermediate or final cover, or in the construction of a slurry wall, if required. An evaluation of the native materials for potential use in a slurry wall is presented in Section 9.1.

Excavated non-visibly impacted soils from both inside and outside the limit of landfill waste which are determined not to be suitable for the above uses will be used for Site grading during the Grading Project.

The two existing soil stockpiles and one clay stockpile located in Area B north of the support area used during the IRM Completion, will be used during the capping operations. If necessary to evaluate the suitability of these soils for use in the landfill cap, the materials will be physically tested pursuant to the appropriate Part 360 requirements and analytically tested using the Toxicity Characteristic Leaching Procedure (TCLP), which is consistent with the analyses used for the cover material stockpiling program.

5.0 INSTALL AND PUMP TEST PROTOTYPE GROUNDWATER COLLECTION SYSTEM

Three options are available for the construction of the perimeter barrier system. These are:

i) a physical barrier (e.g., a slurry wall, sheet piles); or
ii) a physical hydraulic barrier (e.g., an interceptor drain); or
iii) a combination of the above.

Some portions of the physical hydraulic barrier may be supplemented with a physical barrier to sever the hydraulic pathway between the physical hydraulic barrier and a source of recharge (e.g., Aero Lake) exterior to the perimeter barrier to reduce the quantity of clean water collected and to reduce any potential dewatering impact on the adjacent wet areas (ie. Wetlands LA-5 and LA-9).

During the RD, if a slurry wall is selected as the perimeter barrier system, an evaluation will be performed to determine the type and extent of the overburden groundwater collection system within the confines of the perimeter barrier system to maintain inward and upward gradients. If a physical hydraulic barrier is selected as the perimeter barrier system, an evaluation will be performed to determine whether an overburden groundwater collection system is required within the confines of the perimeter barrier system to maintain an upward gradient from the bedrock. This interior system may consist either of drain tiles or extraction wells.

To provide data to evaluate which of the three options will be used, three 6-inch diameter overburden groundwater extraction wells and three 2-inch diameter overburden groundwater monitoring wells were installed as a prototype groundwater collection system. Pumping tests of the prototype groundwater collection system were performed to determine overburden characteristics and zones of capture. Details of extraction and monitoring wells installation and the pumping tests are described in the following subsections.

5.1 PROTOTYPE EXTRACTION WELL LOCATION AND INSTALLATION

Three prototype extraction wells were installed at the locations shown on Plan 2 and pump tested. 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-2S and GW-5S);
ii) spatial variability (e.g., they are located in different areas of the Site); and
iii) any hydraulic effects on bedrock groundwater can be identified, since bedrock wells exist at two of these locations (GW-2D and GW-5D).

It was determined, in concurrence with the NYSDEC, that the extraction well and monitoring well originally proposed to be installed in the area near GW-4S and GW-4D be relocated to an area adjacent to two of the trenches located in Area B installed during the IRM Completion. An oily substance was observed within these trenches and to prevent any potential migration of these materials off Site by performance of the pumping tests, the extraction and monitoring wells (EW-1 and MW-1) were relocated to this area. EW-1 was installed approximately 15 feet away from the trenches. EW-1 and MW-1 were installed to the top of the confining unit.

The prototype extraction wells (EW-2 and EW-3) were installed approximately 50 feet away from the corresponding existing monitoring well (GW-2S and GW-5S) respectively, and were installed as outlined in the installation protocols for extraction wells presented in Appendix A of the RD/RA Work Plan with the following exceptions:

i) Prototype extraction well EW-3 located north of GW-5S and GW-5D was installed to a total depth of 8 feet BGS instead of 25 feet BGS as specified in the FOP of the RD/RA Work Plan. A confining unit, comprised of over 6 feet of continuous clay and silt, was encountered at a supplementary borehole located approximately 5 feet north of MW-3.

Therefore, the well was set above the confining unit. Also the overburden interval monitored by GW-5S consists of sand and silt from 20.0 to 25.7 feet bgs. According to the stratigraphic log for boring 5D, the depth of 25.7 feet bgs corresponds to the top of bedrock. Thus, it is likely that well GW-5S is hydraulically connected to the bedrock groundwater. Due to this hydraulic connection, the Committee recommends abandonment of well GW-5S to prevent further migration of overburden groundwater to the bedrock via the pathway provided by the well.

The stratigraphic log for 5D shows that there are clay/silt layers from 8.3 to 10 and 10.5 to 18 feet bgs separated by a 6-inch layer of fill. To prevent direct hydraulic connection with the bedrock groundwater and to obtain the worst case (ie., highest concentrations) overburden groundwater conditions for evaluation of potential discharge options, EW-3 and MW-3 were installed to a depth of 8 feet bgs, which includes the landfill waste layer; and

ii) Prototype extraction well EW-2 was installed to a total depth of 9.9 feet BGS due to the presence of a confining unit (3 1/2 feet of continuous clay) observed to a depth of 12 feet BGS at this location. The FOP included as Appendix A of the RD/RA Work Plan had specified this extraction well be installed to a depth of 16 feet.

Stratigraphic and instrumentation logs for the prototype extraction wells are presented in Appendix D. As shown on the logs, the prototype extraction wells were installed in loose fill materials and loose fine to medium-grained sands.

5.2 MONITORING WELL LOCATION AND INSTALLATION

Three overburden monitoring wells were installed at the locations shown on Plan 2. Each monitoring well was installed approximately 10 to 15 feet from its respective prototype extraction well. The monitoring wells were used in conjunction with existing monitoring wells, where present, to collect hydraulic data to assess the performance of the pumping tests.

Each monitoring well was installed to the same depth and screened at the same interval (to the extent possible) as the corresponding prototype extraction well.

The monitoring wells were constructed using 2-inch diameter stainless steel pipe and a stainless steel well screen as outlined in Appendix A of the RD/RA Work Plan.

Cuttings produced during extraction and monitoring well installations were spread in the immediate vicinity of the well, as described in Section 12.0.

Stratigraphic and instrumentation logs for the monitoring wells are presented in Appendix E.

5.3 WELL DEVELOPMENT

On April 18, 1994, each of the three monitoring wells were developed. An equivalent of five well volumes of groundwater was purged from each of the three installed monitoring wells using disposable teflon bailers and nylon rope. Following development, the bailers and rope were disposed off Site as described in Section 12.1. The wells were surged during development to remove any accumulated fines from the sandpack. Development waters were stored in 55-gallon drums which were staged adjacent to the well pairs. The contents of the drums were pumped into storage trailers following completion of the 48-hour constant rate pumping test and were treated/disposed off Site as described in Section 12.2.

The step-drawdown tests described below were used as well development for the prototype extraction wells.

5.4 PUMPING TESTS

5.4.1 Overview

The objective of the pumping tests was to assist in determining the type of perimeter barrier (i.e., physical or physical hydraulic) and to provide sufficient hydraulic and water quality data for the detailed design of the overall groundwater extraction system and groundwater discharge options. Specifically, the tests provided 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 or to a surface water body.

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

5.4.2 Step-Drawdown Tests

Step-drawdown tests were conducted in advance of the 48-hour constant rate pumping test in each of the three installed prototype extraction wells. The results of the step-drawdown tests were used to determine the pumping rate for the constant rate tests. A summary of the step-drawdown test results for each extraction well is shown on the hydrographs presented on Figures F.1 through F.4 in Appendix F.

The step-drawdown tests were performed on April 21, 22, and 25, 1994 in accordance with the protocols outlined in the RD/RA Work Plan, with the following exception:

i) Due to the low availability of water for both EW-1 and EW-2, two-step drawdown tests were performed. Following these two steps, a constant pumping rate was established and maintained for 38 minutes in EW-1 and for 56 minutes in EW-2. Two different pumping rates were initially tested in EW-3. It was decided in the field to enlarge the hose capacity as the discharge hose appeared to restrict the pumping rate obtainable during these tests. Five additional step tests were performed following installation of a larger hose and pump.

Pumping of prototype extraction wells EW-1 and EW-2 during both the step-drawdown and constant rate pump tests was performed using electric submersible pumps manufactured by Grundfos. Pumping of prototype extraction well EW-3 for the step-drawdown tests was performed using two gas powered trash pumps (different pumping capacities). An electric submersible pump manufactured by Grundfos was utilized during the constant rate pumping test.

Heavy duty 1-inch inside diameter (ID) rubber tubing was used to transfer water from prototype extraction wells EW-1 and EW-2 to the staged storage tankers. Black 2-inch ID poly tubing was used to pump water from prototype extraction well EW-3 to the storage tankers staged on Pfohl Road.

The step-drawdown test at prototype extraction well EW-1 was performed on April 21, 1994. Due to the low rate of pumping achievable, a two-step-drawdown test was performed, the initial step at 2± gpm and the second at 3± gpm. During the second step, the pumping rate stabilized at approximately 2.6 gpm. Water levels in EW-1 were monitored using a pressure transducer. The plotted water levels and pump rate information are presented on Figure F.1 in Appendix F. Based on the results of the step-drawdown test, a pumping rate of 2.5± gpm was proposed for the 48-hour test at EW-1.

The step-drawdown test at prototype extraction well EW-2 was performed on April 21, 1994. Due to the low rate of pumping achievable, a two-step-drawdown test was performed; the initial step at 2± gpm and the second at 4± gpm. During the second step, the pumping rate stabilized at approximately 2.1 gpm. Water levels in EW-2 were monitored using a pressure transducer. The plotted water levels and pump rate information are presented on Figure F.2 in Appendix F. Based on the results of the step-drawdown test, a pumping rate of 2.0± US gpm was proposed for the 48-hour test at EW-2.

Step-drawdown tests at prototype extraction well EW-3 were performed on April 22 and April 25, 1994. The maximum pumping rate achieved during the April 22 test was 6± gpm due to the restriction imposed by the diameter of the discharge hose. A larger diameter discharge hose was obtained for the April 25, 1994 test and a five-step-drawdown test was performed at flow rates of 8±, 12±, 16±, 19±, and 22.5± gpm. Water levels in EW-3 were monitored using a pressure transducer. The plotted water levels and pump rate information are presented on Figures F.3 and F.4 in Appendix F. Based on the results of the step-drawdown test, a pumping rate of 20± gpm was proposed for the 48-hour test at EW-3.

The proposed 48-hour pumping rates were approved by the NYSDEC on May 4, 1994.

Groundwater extracted during each of the step-tests was stored in 6,000-gallon stainless steel trailer tanks (tankers) staged in the following areas:

i) on the access road approximately 260 feet north of EW-2;
ii) at the rolloff staging area approximately 150 feet south of EW-1; and
iii) on Pfohl Road (during testing) approximately 150 feet south of EW-3.

The trailer on Pfohl Road was relocated to Area B, immediately following completion of the step-tests at extraction well EW-3. A containment system consisting of 6-inch by 6-inch by 8-foot timbers lined with 8-mil polysheeting was placed beneath the trailer on Pfohl Road throughout the course of testing operations in EW-3. Section 12.0 presents further discussion involving the storage and disposal of extracted groundwater.

5.4.3 Constant Rate 48-Hour Pumping Tests

A constant rate pumping test was conducted on each prototype extraction well for 48± hours at approximately the approved pumping rates. Water levels were measured in the prototype extraction well and in the nearby monitoring wells during these tests. The observation wells monitored during the constant rate pumping test are shown on Plan 2.

Prior to the constant rate tests, water levels were monitored for a minimum 48-hour period of time to establish static water levels. Select static water level data for wells EW-1, EW-2 and EW-3 are presented in Table 5.1. Static water levels were observed not to fluctuate significantly prior to the pumping tests.

Constant rate pumping tests were performed simultaneously, with NYSDEC concurrence, on extraction well EW-1 and EW-2 beginning May 4, 1994 and ending May 6, 1994. The constant rate pumping test performed at extraction well EW-3 was begun on May 31, 1994 and was completed on June 2, 1994.

An initial pumping rate of 2.5 gpm was used for the 48-hour pumping test at prototype extraction well EW-1. As the water level within EW-1 drew down, the pumping rate decreased. The average pumping rate over the entire test was 2.3 gpm. Water levels in both EW-1 and monitoring well MW-1 were monitored before, during and after the constant rate test.

An initial pumping rate of 2.0 gpm was used for the 48-hour pumping test at prototype extraction well EW-2. During the initial 25 hours of the test, the water level in EW-2 did not draw down to the level expected based on the results of the step-drawdown test. Thus, the pumping rate was increased to 2.2 gpm after 25 hours. The average pumping rate over the entire test was 2.1 gpm. Water levels in EW-2 and monitoring wells GW-2S, GW-2D, and MW-2 were monitored before, during and after the constant rate test.

An initial pumping rate of 20 gpm was used for the 48-hour pumping test at prototype extraction well EW-3. As the water level within the pumping well drew down the pumping rate decreased. The final pumping rate was 16.5 gpm and the average pumping rate over the entire test was 18.2 gpm. Water levels in EW-3 and monitoring wells MW-3, GW-5S and GW-5D, were monitored before, during and after the constant rate test.

Groundwater extracted during these tests was stored in 6,000-gallon stainless steel tankers staged in the following areas:

i) one tanker was staged on the access road approximately 260 feet north of EW-2;

ii) one tanker was staged within the rolloff staging area approximately 150 feet south of EW-1. A 500-gallon poly storage tank was also staged at this location. Both tanks were placed in a containment system consisting of 6-inch by 6-inch timbers lined with 8-mil polysheeting; and

iii) two tankers were temporarily staged on Pfohl Road (during testing) approximately 150 feet south of EW-3. These tankers were moved to Area B, immediately upon completion of the 48-hour test. Containment systems consisting of 6-inch by 6-inch by 8-foot timbers lined with 8-mil polysheeting were placed beneath these tankers during the course of testing.

All extracted groundwaters were handled in accordance with the protocols outlined in the RD/RA Work Plan and as discussed in Section 12.0 of this report.

Water level measurements in the prototype extraction wells and the observation wells were obtained by means of pressure transducers and dataloggers. The water levels in the observation wells and in the pumping wells were confirmed hourly for the duration of each of the constant rate pump tests using manual water level indicators. Both transducer and manual water level data are shown on the hydrographs for the pumping tests presented on Figures F.5 through F.14 in Appendix F. The water level indicators were cleaned between measurements in different observation wells. The pumping test flow rate was continuously recorded using a flow meter with a flow totalizer.

Following termination of pumping, water levels in the prototype extraction well and monitoring wells were monitored until a minimum of 80 percent recovery was achieved.

5.5 INTERPRETATION OF PUMPING TEST RESULTS

5.5.1 EW-1 Test

Prototype extraction well EW-1 was pumped at an average rate of approximately 2.3 gpm for 48± hours. Hydrographs for EW-1 and MW-1 during the pumping test are presented on Figures F.5 and F.6, respectively in Appendix F. No significant drawdown response was measured in the observation well (MW-1) for the test. Therefore, the measured response in the pumping well was used to estimate the transmissivity of the surrounding media. A storage coefficient for the overburden materials cannot be accurately estimated when the only responding well is the pumping well. Therefore, the storage coefficient was not estimated for the EW-1 test.

In estimating transmissivity based on the pumping well response, it is generally more accurate to use the measurements obtained during the recovery period (after pumping at a constant rate for a sustained period) than it is to use the measurements obtained during the drawdown period. The drawdown response in the pumping well is influenced by casing storage, turbulence and well entry head loss to a greater extent than the recovery response.

The Theis Recovery Method was used to estimate transmissivity from the pumping well recovery data. Transmissivity is estimated as the slope of the semilog plot of residual drawdown(s) versus the ratio of time since pumping began (t) to time since pumping stopped (t'). The s versus t/t' plot for EW-1 is shown on Figure F.15 in Appendix F. The first five minutes of recovery data was neglected due to the elastic storage which occurs in unconfined conditions. The estimated transmissivity based on this plot was 0.029 $ft.^2$/min. (41.7 $ft.^2$/day). Using the saturated thickness of the aquifer immediately adjacent to EW-1 (6.3 feet), the hydraulic conductivity was calculated to be 2.3×10^{-3} cm/sec.

5.5.2 EW-2 Test

Extraction well EW-2 was pumped at an average rate of approximately 2.1 gpm for 48± hours. Hydrographs for EW-2 and the three observation wells used for the test (MW-2, GW-2S, and GW-2D) are presented on Figures F.7 through F.10, respectively, in Appendix F. No significant drawdown response was measured in any of the observation wells. Therefore, as with the EW-1 test, the test well recovery data was used to estimate transmissivity and the storage coefficient was not estimated.

The Theis recovery plot for EW-2, neglecting the first five minutes of recovery data due to elastic storage in unconfined aquifers, is shown on Figure F.16 in Appendix F. The transmissivity estimated based on this plot was 0.36 $ft.^2$/min. (520 $ft.^2$/day). Using the saturated thickness of the aquifer immediately adjacent to EW-2 (5.1 ft), the hydraulic conductivity was calculated to be 3.6×10^{-2} cm/sec.

5.5.3 EW-3 Test

Extraction well EW-3 was pumped at an average rate of approximately 16.8 gpm for 48± hours. Hydrographs for EW-3 and the three observation wells for the test (MW-3, GW-5S and GW-5D) are presented on Figures F.11 through F.14, respectively, in Appendix F. Of the observation wells, MW-3 showed significant drawdown response during the test. As anticipated, due to the clay/silt layers between the intervals monitored by GW-5S/5D and pumped by EW-3, no response was observed in wells GW-5S/5D. The response in observation well MW-3 allowed the application of several methods for transmissivity estimation, and also provided data from which the storage coefficient could be estimated. However, as evidenced on the hydrograph for MW-3, the early pumping data was influenced by an intense three-hour precipitation event which began approximately one hour prior to the start of pumping. Therefore, the recovery data was used to estimate transmissivity and storage coefficient.

The Theis recovery plot for EW-3, neglecting the first five minutes of recovery data due to elastic storage in unconfined aquifers, is shown on Figure F.17 in Appendix F. The transmissivity based on this plot was 3.0 $ft.^2$/min. (4,290 $ft.^2$/day). Using the saturated thickness of the aquifer immediately adjacent to EW-3 (2.6 feet), the hydraulic conductivity was calculated to be 3.2×10^{-1} cm/sec.

Transmissivity was also estimated based on the MW-3 recovery data using the Theis recovery plot (see Figure F.18 in Appendix F). The value obtained using this method was 2.9 ft^2/min. (4,127 ft^2/day). Using the saturated thickness of the aquifer immediately adjacent to MW-3 (4.3 ft), the hydraulic conductivity was calculated to be 3.4×10^{-1} cm/sec.

Recovery data from MW-3 was also used to estimate transmissivity using a semilog plot of the calculated recovery (projected drawdown if pumping continued minus the measured residual drawdown) versus time since pumping stopped (t'). This graph (Figure F.19 in Appendix F) was used to estimate the transmissivity and storage coefficient using the following equations:

$$T = \frac{.183\,Q}{\Delta S}$$

$$S = \frac{2.25Tt_o}{r^2}$$

Where:

T	=	Transmissivity (L^2/t)
Q	=	Pumping rate (L^3/t)
ΔS	=	Recovery over a log cycle (L)
S	=	Storage Coefficient (unitless)
t_o'	=	Value of t' obtained by extending the straight line portion of the data to the x axis
r	=	Distance from pumping well to observation well where drawdown was measured.

The values of transmissivity and storage coefficient obtained using this method were 2.73 $ft.^2/min.$ (3,930 ft^2/day) and 0.20, respectively. Using the above saturated thickness, the hydraulic conductivity was calculated to be 3.2×10^{-1} cm/sec.

The transmissivity values estimated for the EW-3 pumping test using the three different methods are in close agreement (less than 10 percent difference).

5.5.4 Discussion

Table 5.2 presents a summary of the results of the 48-hour pumping tests. The transmissivity results indicate very heterogeneous conditions in the upper soil and fill unit. Each well was pumped at close to its maximum sustainable yield during the 48-hour test. The specific capacities, defined as the ratio of the pumping rates to the corresponding drawdowns, were calculated for each well based on the conditions observed near the end of the 48-hour pumping step. These values, listed below, also vary widely and increase with increasing transmissivity.

Well	*Transmissivity (ft.²/day)*	*Final Specific Capacity (gpm/ft.)*	*Hydraulic Conductivity (cm/sec)*
EW-1	41.7	0.3	2.3×10^{-3}
EW-2	520	0.8	3.6×10^{-2}
EW-3	4288	3.1	3.4×10^{-1}

The general lack of response of observation wells to pumping is probably a result of not reaching steady-state conditions. Unconfined waterbearing zones respond very slowly to pumping. Long-term pumping from these wells over a period of months would likely result in more extensive cones of influence, decreased sustainable pumping rates, or both, as the unit becomes partially dewatered over time.

5.6 GROUNDWATER SAMPLING

Representative samples of the groundwater extracted during the 48-hour pumping tests were 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 or to a surface water body.

Groundwater samples were collected from each prototype extraction well 10 minutes, 24 hours and 48 hours after initiation of the constant rate pump test. These samples were analyzed for Target Compound List (TCL) volatiles and semi-volatiles and Target Analyte List (TAL) metals. The 48-hour samples were also analyzed for the additional parameters listed in Table 5.3. The additional parameters were sampled to assist in the evaluation of the design of various treatment systems and discharge permits. Additionally, 14 gallons of groundwater were collected from each extraction well at the completion of the constant rate pumping test for potential use in groundwater treatability studies.

Samples were collected using the protocols presented in Appendices B and C of the RD/RA Work Plan with the following exception:

i) due to an oversight, groundwater samples collected during the 48-hour pumping tests were not measured in the field for specific conductivity, temperature, turbidity, or pH. The 48-hour samples were measured for turbidity and pH at the laboratory.

The analytical results are summarized in Appendix G. A summary of the detected compounds is presented in Table 5.4. A Quality Assurance/Quality Control (QA/QC) assessment is presented in Appendix H. The QA/QC assessment concluded that the data were acceptable with qualifications. The qualifications are shown in Table 5.4 and do not affect the use of the data for predesign assessments.

The analytical results on Table 5.4 show sporadic low level concentrations of ten volatile organic compounds (VOCs). The detected VOC with the highest concentration (39 µg/L) was 1,1-dichloroethane in the 48-hour sample from EW-2. All other detected VOCs were less than or equal to 12 µg/L with the majority less than 5 µg/L.

Twelve SVOCs were sporadically detected at low level concentrations. The detected SVOCs with the highest concentrations were phenol (100 µg/L) and n-nitrosodiphenylamine (37 µg/L) in the duplicate 48-hour sample and the 24-hour sample, respectively, from EW-1. All other detected SVOCs were less than 30 µg/L with the majority less than 10 µg/L.

Only two pesticides, alpha-BHC and heptachlor, were detected. These two pesticides were detected in only well EW-1 at low level concentrations on the order of 0.06 µg/L.

Low level concentrations of the dioxin isomers hexa, hepta and octa were detected in all three prototype extraction wells at low level concentrations ranging from 3 to 42 pg/L with the exception of OCDD in the 48-hour sample from EW-2 (200 pg/L). The dioxin isomers detected are the least toxic dioxins. Low level concentrations of PCDF's, ranging from 1.4 to 51 pg/L were detected in all three prototype extraction wells.

The metal concentrations detected in EW-1 are typical of groundwater impacted by municipal refuse. The metal concentrations detected in EW-2 and EW-3 are similar to the concentrations presented in the RI report for well GW-2S and GW-5S, respectively.

In all these wells, low level concentrations of Ra-226 (0.05 to 0.32 pCi/L), total radium (0.03 to 0.34 pCi/L), gross alpha (0.34 to 1.1 pCi/L) and gross beta (3.4 to 18 pCi/L) were detected.

6.0 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 involved producing an accurate delineation and marking in the field of the boundaries of the wet areas potentially affected by the remedial actions. The delineation was performed jointly by the NYSDEC and Environmental Design and Research (EDR) of Syracuse, New York, in accordance with the NYSDEC Freshwater Wetlands Mapping Technical Methods Statement (1986) and in compliance with Article 24. Discussions will be held with the United States Army Corps of Engineers (Corps) and the Division of Fish and Wildlife to determine which of the wet areas are under the jurisdiction of the Corps and/or the NYSDEC. If jurisdictional wetlands are potentially adversely impacted by the RA, the appropriate actions required (i.e., wetlands elimination, modification or replacement) will be developed. Since discussions will be held with the Corps, the Corps 1987 protocols for wetland delineation were used for guidance.

The wetlands delineation/field marking was performed by EDR on April 28-29, 1994. The NYSDEC performed a Site walk through on April 29, 1994 to confirm EDR's delineation.

The wetlands delineation was surveyed by a professional surveyor licensed by the State of New York upon completion. The field markings were surveyed on May 20 and 24, 1994 and June 6 and 15, 1994. The wetlands delineation map is presented on Figure 5 in Appendix I.

A summary of EDR's delineation procedures is presented in Appendix I. A detailed wetlands assessment using the information obtained through the wetland delineation will be presented in the 30 percent design report. The assessment will consist 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 floodplain assessment will also be presented in the 30 percent design report and 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.

7.0 LANDFILL GAS STUDY

As part of the predesign activities at the Site, a landfill gas study was performed. The purpose of the landfill gas study was to provide data that will assist in the evaluation of landfill gas generation potential and landfill gas quality at the Site and to determine if measures are required to control the landfill gas. Details of the landfill gas study are provided below.

7.1 BACKGROUND

There are two pathways of emissions for landfill gas; migration through the subsurface and emissions into the atmosphere. Migration of landfill gas through the subsurface may create an unacceptable environment in nearby subsurface structures (i.e., basement, manhole, etc.). However, due to the lack of a low permeable cover at the Site, the principal migration pathway during non-frozen conditions (i.e. summer) would be emissions of landfill gas to the atmosphere with little lateral subsurface migration. During the winter months, the potential for lateral subsurface migration exists. The rate of production and quality of landfill gas that is produced at the Site must be determined in order to assess the potential impacts of landfill gas emissions.

Typical landfill gas from municipal solid waste landfills contains approximately 50 percent methane by volume and 50 percent carbon dioxide by volume. The primary factors that affect the rate of landfill gas production include, but are not limited to the following:

- degree of saturation (moisture content) of the refuse;
- age of refuse;
- mass of refuse;
- organic content of the refuse;
- refuse density;
- pH of the moisture;
- microbial population present;
- temperature within the refuse;

- quality and quantity of nutrients; and
- cover soils.

7.2 SITE HISTORY

The Site operated from approximately 1932 to 1971. The Site received both municipal and industrial waste from surrounding areas. A large portion of the municipal and industrial wastes were placed at the Site by the Town of Cheektowaga. The industrial wastes included 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. These wastes were generally placed in shallow excavations. The thickness of landfill waste ranges from 0 to 17 feet and averages approximately 10 feet as shown on Plan 3. The groundwater table is generally 6 to 9 feet below the ground surface.

During IRM Completion investigative activities, primarily non-putrescible waste was observed. These materials included glass, plastic, wood, brick, construction and demolition debris, and industrial waste. There was essentially no observed evidence of putrescible material within the refuse at the Site.

The current potential receptors of landfill gas adjacent to the Site include the industrial areas to the southwest of the Site (Rein Road and Pfohl Road) and at the corner of Transit Road and Pfohl Road. Air emissions of landfill gas during RA construction may also be a concern. It is anticipated that the property owners on the northside of Pfohl Road adjacent to the Site will eventually responded favorably to the Real Estate Plan and will have moved prior to initiation of RA activities. Thus, they were not considered as potential receptors.

7.3 GAS PROBE INSTALLATION

The study consisted of installing six landfill gas probes in the locations shown on Plan 2. The gas probes were installed on March 24 and 25, 1994. The six locations represent the thickest areas of unsaturated fill at the Site which are anticipated to coincide with the areas of highest landfill gas production.

Each probe was constructed of one-inch diameter polyvinyl chloride (PVC) pipe which extended to the bottom of the fill or top of the groundwater table (between 8 and 10 feet below ground surface). The bottom 5 feet of each gas probe was screened. The probes were installed as outlined in Appendix A of the RD/RA Work Plan. Stratigraphic and instrumentation logs for the gas probes are presented in Appendix J.

7.4 GAS PROBE MONITORING

Following installation of the probes, each probe was monitored for gas pressure, organic vapor, combustible gas, and oxygen. Monitoring was performed on a weekly basis commencing on April 1, 1994. The final weekly monitoring event was performed on June 24, 1994. The RD/RA Work Plan stated that this sampling would be performed for a maximum period of two months; however, the sampling was extended an additional five weeks. Atmospheric pressure, temperature, and precipitation records for the monitoring period were obtained from the Buffalo Airport meteorological station for the period of gas probe monitoring. The records are presented in Appendix K.

Procedures for monitoring the landfill gas probes were performed as outlined in Appendix A of the RD/RA Work Plan with the following exceptions:

i) monitoring of the gas probes was performed for 13 consecutive weeks which exceeded the two months as stated in the RD/RA Work Plan;

ii) organic vapors were initially measured using only a Photoionization Detector (PID). Due to elevated Lower Explosive Limit (LEL) readings and reduced oxygen readings with no corresponding increase in PID values, a Century organic vapor analyzer (OVA) was utilized to detect a greater number of organic compounds (including methane which PIDs cannot detect). A combustible gas indicator was also utilized; and

iii) groundwater levels were only measured during the initial four weeks of monitoring due to the fact that water levels remained stable allowing the unsaturated zone to be adequately defined.

The following instruments were utilized during landfill gas monitoring:

Instrument	*Use/Detects*
Dwyer Magnehelic Pressure Gauge	Probe pressure
Industrial Scientific LEL/O_2 meter	Combustible gas less than LEL (0 to 5 percent by volume) and oxygen
Photovac MicroTIP	Compounds with an ionization potential less than 10.6 eV
Century OVA	Compounds with an ionization potential less than 15.4 eV
MSA Gascope	Combustible gas on LEL (0 to 5 percent by volume) and volume (0 to 100 percent) scales

Pressure is an indication of the rate of landfill gas generation. Typically, the greater the rate of generation of gas, the higher the pressure in the landfill. However, the pressure in the landfill is also influenced by other factors such as recent changes in barometric pressure, the permeability of the refuse and the permeability and integrity of any cover soils. Typical landfill gas pressures in municipal solid waste landfills are in the order of 1 to 5 inches of water column but have been recorded in excess of 40 inches of water column.

Combustible gas indicators measure the percent combustible gas in air by volume. Typically, the combustible gas from landfills is assumed to be primarily methane. Two scales are used, percent volume and percent lower explosive limit (LEL). Methane is explosive in the range of 5 to 15 percent by volume in air, hence the LEL is 5 percent by volume in air. Therefore, a reading of 50 percent LEL is equal to 2.5 percent by volume.

Oxygen level is a indicator of landfill gas generation. As landfill gas is generated, conditions within landfills typically become anaerobic and the percentage of oxygen decreases from an ambient level of approximately 21 percent.

The PID measures total or undifferentiated volatile organic compounds. The instrument does not differentiate between discrete chemicals. A PID with a 10.6 eV lamp (which does not detect methane) was used to monitor the gas probes at the Site. The PID readings are typically used to monitor air quality for health and safety during Site field activities. The PID levels detected in the gas probes can be used in conjunction with an estimate of the landfill gas generation to estimate the emissions into the atmosphere.

The OVA meter uses a flame to ionize the organic vapors and can detect VOCs, methane, and other organic compounds. The range of the OVA meter is 0 to 1,000 ppm as methane and therefore the meter is only capable of measuring up to 0.1 percent by volume.

7.5 EVALUATION OF DATA

The Site history, results of investigative studies, and results of the landfill gas study are all used to assess the potential for landfill gas generation and the potential impact that landfill gas generated in the Site may have on the surrounding areas.

7.5.1 Landfill Gas Generation

Based on the Site history and results of investigative studies, the landfill gas generation at the Site should be relatively low. This is due to:

i) the age of the Site. The refuse in the Site is between 23 to 62 years old;
ii) little putrescible waste was observed during the IRM Completion activities; and
ii) the fill at the Site is in thin layers with little or no low permeable cover.

The results from monitoring the landfill gas probes are shown in Table 7.1. The pressure, combustible gas, and oxygen readings are used to provide an indication of the landfill gas generation at the Site.

The results of monitoring pressure at the probes show that the pressure in the Site ranges from 0 to 0.12 inches of water column with the majority of readings in the range of 0 to 0.03 inches of water column. Since generation of landfill gas typically creates pressure on the order of 1 to 5 inches of water column, these pressures indicate that the landfill gas generation is very low. The average daily barometric pressure recorded at the Buffalo International Airport was plotted with the measured probe pressures. The graph is included in Appendix K. No correlation or influence of barometric pressure on the probe pressure is evident.

The combustible gas levels measured at the probes varied from 0 to 8 percent by volume. Typically, the concentration of combustible gas in a municipal landfill is in the range of 40 to 60 percent by volume. Only GP-5 had any significant readings of combustible gas of up to 8 percent by volume. A reading of 0.9 percent by volume (18 percent LEL) was also detected at GP-5 which indicates that the gas generation around this probe is variable. The lower oxygen readings at GP-5 (1.2 to 18 percent by volume) also indicate that some gas is being generated in the vicinity of GP-5.

All readings at the remaining gas probes (GP-1, GP-2, GP-3, GP-4 and GP-6) are below 3.2 percent by volume and generally less than 0.5 percent by volume (10 percent LEL). The oxygen readings at these probes are all close to ambient. These results indicate that there is virtually no gas being generated in the vicinity of these probes. The reading of 8.3 percent oxygen at GP-2 on May 13, 1994 is considered to be an anomalous reading since it is considerably lower than all other readings at that probe, the May 13 readings for the other parameters at GP-2 are consistent with prior and subsequent readings, and the readings at the other probes during that event are consistent with other data for those probes.

During the last two monitoring events (June 9 and 24, 1994), a combustible gas meter was used. The readings from this meter are higher than the readings from the LEL/0_2 meter. Since the probe was monitored first with the combustible gas meter and then by the LEL/0_2 meter, the combustible gas meter readings represent the initial or "built-up" gas concentration in the probe whereas the LEL/0_2 meter readings are more representative of long-term generation rates. This indicates that some, although small, amount of gas is being generated around these probes.

The readings obtained with the OVA meter correspond to the readings from the combustible gas meters. Converting the readings to percent by volume shows that the levels in the probes (except GP-5) are generally lower than 0.1 percent. The reading at GP-5 was consistently 1000+ppm indicating that combustible gas was present at a level greater than 0.1 percent by volume.

7.5.2 Landfill Gas Quality

The landfill gas quality, with respect to potential health and safety concerns, was evaluated using the PID readings which measure total or undifferentiated volatile organic compounds in each of the gas probes. The results are included in Table 7.1.

There were no detections at GP-4, GP-5, and GP-6; one detection of 1.0 ppm at GP-2; and one detection of 10 ppm which was not sustained at GP-3. GP-1 had a reading during each monitoring round of between 1.2 and 37 ppm. These results indicate that there is little or no concern with respect to health and safety for the landfill gas quality at the Site. This is further emphasized by the fact that the monitoring results are of in-ground conditions and not conditions in the breathing zone which will be diluted by orders of magnitude by ambient air.

Also, the fact that there is virtually no gas generation at the Site means that emissions to the atmosphere will be very minimal.

7.5.3 Summary

Based on the Site history, results of the investigative studies, and results of the landfill gas study, it is concluded that the landfill gas generation at the Site is very low to minimal. Landfill gas generation is the driving force for emissions into the atmosphere. Since the gas generation is very low and there were minimal detections on the PID, it can be concluded that emissions of landfill gas at this Site are negligible.

During the Grading Project, the Site will be covered with up to several feet of fill materials consisting of construction and demolition (C&D) debris and other approved materials which will have little or no putrescible waste and will then be capped.

Available information indicates that the hydraulic conductivities of C&D material and similar fill materials can be on the order of 1×10^{-2} cm/sec or greater. Since the hydraulic conductivity of this material is expected to be in the order of 1×10^{-2} cm/sec, a separate gas venting layer is not required to be installed during cap construction.

The proposed perimeter barrier system will essentially prevent lateral subsurface gas migration either by providing a physical barrier (e.g. slurry wall) or by also using the physical hydraulic barrier with passive gas vents, if required, for landfill gas venting. Thus off-site impacts due to gas migration will not occur. An engineering evaluation to determine the type of cap (eg. permeable or low permeable) to be constructed will be performed as part of the 30% design. If a low permeable cap is selected, gas buildup beneath the cover may occur. To prevent the possible building of landfill gas pressure, it is anticipated that the installation of passive gas vents without a gas venting layer will be sufficient to alleviate the potential pressure build-up. The number of vents required will be evaluated as part of the 30% design. If a permeable cap is selected, the hydraulic conductivities of the cap materials will be sufficient to allow venting to the atmosphere through the cap without the need of either the gas venting layer or gas vents.

8.0 GROUNDWATER TREATABILITY STUDY

Three discharge options are possible for the collected overburden groundwater:

i) direct discharge by forcemain to the 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 the potential discharge options shows that direct discharge to the POTW without pretreatment is the preferred alternative.

Groundwater samples were collected during the three 48-hour pumping tests performed at the Site as described in Section 5.0. The analytical results are presented in Appendix G and a summary of detected parameters is presented in Table 5.4. As shown in Table 5.4, the chemical constituents in the extracted groundwater are generally of low concentrations.

The groundwater analytical results are compared to Buffalo Sewer Authority (BSA) discharge criteria in Table 8.1.

As shown in Table 8.1, the concentration of chemicals present in the groundwater extracted from the Site meet the BSA discharge criteria and are for the most part, several orders of magnitude lower than the BSA discharge criteria. This indicates that pretreatment is not required to discharge Site overburden groundwater to the POTW.

The Steering Committee has presented this data to the Town of Cheektowaga and the BSA and are currently negotiating to obtain permission to discharge overburden groundwater to the POTW. The current negotiations with the Town of Cheektowaga and the BSA indicate that pretreatment is not required. Thus, the groundwater treatability studies presented in the RD/RA Work Plan are not required to be performed.

9.0 MATERIALS COMPATIBILITY STUDIES

The RD/RA Work Plan stated that 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 Work Plan also presented compatibility testing results from the literature for high density polyethylene (HDPE), the material selected for construction of the drain tile and forcemain. The compatibility testing results from the literature show that HDPE is the appropriate drain tile/forcemain material and it is believed that no compatibility study for draintile/forcemain material is required.

9.1 SLURRY WALL COMPATABILITY TESTING

The RD/RA Work Plan for the Site has indicated that a slurry wall materials compatibility study shall be performed if slurry wall techniques are selected as the method of construction for the perimeter barrier system. At present, it is expected that the primary component of the perimeter barrier system would be hydraulic in nature, consisting of a collection system circumscribing the Site. However, preliminary results of the computer modeling has shown that a physical barrier such as a slurry wall may be necessary around at least a portion of the Site perimeter to reduce the amount of clean off Site groundwater drawn into the perimeter physical hydraulic barrier and to limit any potential impact on adjacent wet areas reported to be under the jurisdiction of the NYSDEC (i.e. LA-5 and LA-9) caused by dewatering of the overburden.

Although the RD/RA Work Plan presents a proposed slurry wall materials compatibility testing work plan, it is believed that sufficient compatibility testing has been performed at other Sites such that testing is not required. The following paragraphs discuss and summarize similar programs at three other sites.

The proposed slurry wall materials compatibility study was based on a similar study conducted in 1990 and 1991 for the S-Area Landfill Site in Niagara Falls, New York. The S-Area program was also the base for slurry materials testing programs for the Schenectady International, Inc. Plant Site in Rotterdam Junction, New York, conducted in 1992, and for the G&H Landfill Site in Macomb County, Michigan, conducted in 1994 (Phase III currently on-going). These three testing programs were all set up using the same three-phase approach, resulting in long-term hydraulic conductivity testing over a 90 to 180-day period. A summary of the testing results for these three programs is presented in Table 9.1.

For the Phase I screening of bentonite products, all three of the referenced projects tested various types of bentonite at several percentages in combination with tap water and site groundwater. The primary purpose of Phase I was to determine any adverse reactivity of the bentonite products with the site groundwaters and to determine the design slurry mix required to hold the trench open during excavation. In all cases, the recommended bentonite product was a premium grade untreated bentonite at a concentration in tap water at 5.0 to 5.5 percent. For both the S-Area and G&H Landfill programs, bentonite slurry hydrated with site groundwater was taken into the subsequent Phases II and III but the eventual Phase II and III results did not justify the expense and effort required to obtain the significant quantities of site groundwater necessary to use this as the hydrating fluid.

The primary purpose of Phase II testing was to determine the design mixtures when permeated with tap water. For the Phase II short-term hydraulic conductivity testing, all three programs found that the 5.0 or 5.5 percent bentonite slurry alone was not adequate for the preparation of the soil-bentonite backfill mixture. In all cases, dry bentonite addition to the soil backfill prior to slurry mixing was required to reduce the hydraulic conductivity of the soil-bentonite backfill to less then 1×10^{-7} cm/sec. From Table 9.1 it can be seen that the G&H Landfill and Schenectady programs required 2.0 and 2.5 percent dry bentonite, respectively. Although the final recommended mixture for the S-Area program included 4.0 percent dry bentonite, the addition of 2.0 percent dry bentonite was also adequate. The hydraulic conductivity results from the S-Area Phase II utilizing dry bentonite addition of 2.0, 3.0 and 4.0 percent were 1.85×10^{-8}, 1.13×10^{-8} and 8.96×10^{-9} cm/sec, respectively. However, the S-Area program required the use of the tested mixture with the lowest achievable hydraulic conductivity and therefore only the 4.0 percent dry bentonite addition sample was tested in Phase III for the S-Area program.

For the Phase III long-term compatibility testing, no adverse affects on the hydraulic conductivity of the soil-bentonite backfill were observed when permeated with site groundwater. In fact, for the S-Area program, the hydraulic conductivity values became progressively lower over the 180 day test period and the reported hydraulic conductivity is the time-weighted geometric mean over the entire test period. At the end of the 180 days, the hydraulic conductivity for the last 64 days of the test was as low as 9.47×10^{-9} cm/sec. As noted on Table 9.1, the Phase III program for the G&H Landfill Site is currently ongoing and therefore the Phase II results are shown. In all three cases, the resultant hydraulic conductivities are almost an order of magnitude below 1×10^{-7} cm/sec.

Based on the above discussions of three very similar slurry materials compatibility testing programs, it is believed that there is sufficient data available to design the slurry and soil-bentonite mixtures for the Site without the compatibility testing using site-specific groundwater and soils. To support this belief, Table 9.2 presents a comparison of the groundwater analytical results at the three other sites to the Pfohl Brothers groundwater quality. At all sites, the groundwater used for testing was collected from a well in close proximity to the slurry wall with the highest concentration. At the Site, well MW-16S has the highest organics concentration along the perimeter of the landfill. In general, the Site groundwater has much lower concentrations than the three other sites, especially S-Area and Schenectady where the primary groundwater constituents are in the mg/L range.

An important component of the slurry wall design mix is the percentage of fines (i.e. silts and clays) in the soil to be used for construction of the slurry wall. The programs at the other three sites identified that a fines content ranging from 25 to 30 percent was required to achieve the desired hydraulic conductivity.

At Pfohl Brothers, the average fines content of the native materials underlying the fill at the 47 boreholes around the site perimeter ranged from 0.0 to 72.7 percent, with only eight boreholes containing less than 25 percent fines (see Table 4.1). The calculation of fines content (presented in Appendix L) was based on assigning all samples without specific grain-size analysis results, the minimum percent fines content reported for a similar soil type (i.e., SM - sandy silt) from all the borehole samples tested. This may be conservative, but the average fines content around the site perimeter was still greater than 25 percent, which has been shown sufficient to achieve a maximum hydraulic conductivity of 1×10^{-7} cm/sec. Soil mixing would be required in specific areas to adequately mix the low fines content soils with soils of higher fines content to ensure an adequate backfill.

9.2 SUMMARY

Based on the results of other slurry materials compatibility testing programs and the nature of the groundwater and soil at the Site, it does not appear necessary to perform a slurry wall material compatibility testing program for the Site. It is recommended that the design slurry mixture for the Site contain 5.5 percent bentonite and that 2.0 percent dry bentonite be added to the soil backfill prior to slurry mixing. Based on the reported results for the other three programs, this should result in a soil-bentonite wall with an appropriate low hydraulic conductivity. If a slurry wall is selected for use at the Site, the installation program will include in-place permeability testing of collected shelby tube samples to confirm that the required hydraulic conductivity was achieved.

10.0 BENEFICIAL END USE STUDY

An end use study to evaluate end uses of the Site after completion of the RA activities is currently underway. Negotiations between the Steering Committee and the Town of Cheektowaga are ongoing. Potential end uses could include:

i) composting facility;
ii) open space;
iii) a public park;
iv) public recreational facilities (i.e., baseball diamonds, golf course, golf driving range, nature trails, skiing, toboggan runs);
v) commercial development along roadways/buffer strips; and
vi) nature/wildlife preserve.

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.

11.0 FILL MATERIALS ASSESSMENT

The Steering Committee expects to generate from internal sources approximately 400 tons per day of C&D wastes based upon a consultants review of Waste Management, New York (WMNY) current operations in western New York. The following presents WMNY projections at this time.

Quantities and Sources		
Source	*Waste*	*Tons Per Day (TPD)*
WMNY	Buffalo C&D	200
WMNY	Rochester C&D	65
WMNY	Ontario C&D	100
Third Party	Depew T.S. (C&D)	50
Total Waste Quantity		415

In addition to C&D wastes, the NYSDEC has indicated that the following materials could also be acceptable due to their predetermined beneficial use status:

i) incinerator ash from coal combustion; and
ii) sewage sludge as a component of composting.

12.0 HANDLING OF MATERIALS GENERATED DURING PREDESIGN ACTIVITIES

12.1 SOLIDS

Borehole drill cuttings and excess soil from split-spoon samples not retained for geologic samples generated during the predesign soil investigations were 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 boreholes were either backfilled with material consistent with the surrounding surface or grouted to the ground surface. Excess materials which could not be replaced within the borehole were spread on Site in the immediate vicinity of the borehole.

Excavated soils from the test pits/trenches were placed back into the excavation in the reverse order from which they were removed. Six drums were encountered during predesign activities (TP-4 three drums, TP-11, TP-18 and TP-32, one drum each) and were handled pursuant to the procedures presented in Section A.6.3 of the RD/RA Work Plan. The drums and drum contents were disposed off-Site during the IRM Completion.

Personal protective equipment (PPE), disposable bailers and nylon rope generated during the predesign activities were containerized in 55-gallon drums and temporarily staged on the existing IRM staging pads and were disposed of off Site during the IRM Completion.

12.2 GROUNDWATER

Approximately 6,500; 6,000 and 51,500 gallons of groundwater were extracted during the step-drawdown and constant rate pumping tests performed at EW-1, EW-2 and EW-3, respectively.

Groundwater extracted from the tests performed at extraction well EW-1 was stored in one 6,000-gallon tanker and one 500-gallon polytank located on Site in Area B. Due to road weight restrictions approximately 1,000 gallons was transferred from the tanker to an additional tanker prior to shipment from the Site. The water in the poly tank was transferred to a tanker for off-Site treatment. Groundwater extracted from extraction well EW-2 was contained in one 6,000-gallon tanker located on Site in Area B.

Groundwater extracted from extraction well EW-3 was temporarily stored in one of two 6,000-gallon tankers temporarily staged on Pfohl Road. Containment pads constructed of treated 6-inch by 6-inch by 8-foot lumber, lined with 8-mil polysheeting, were placed underneath each of the staged tankers in the event of any spills, in concurrence with the NYSDEC's on-Site Representative.

When one tanker became full (approximately 5,000 gallons), water would be directed to the second staged tanker by use of a "Y" fitting with flow control valves. While the second tanker was filling, the full tanker was emptied by a vacuum tanker and the water was transported to Area B for on-Site storage. Water within Area B was stored in the frac tanks (12,000 gallons capacity each) or in tankers. Upon completion of the constant rate pumping test at extraction well EW-3, the full tankers staged on Pfohl Road were moved to Area B for temporary storage prior to treatment/disposal.

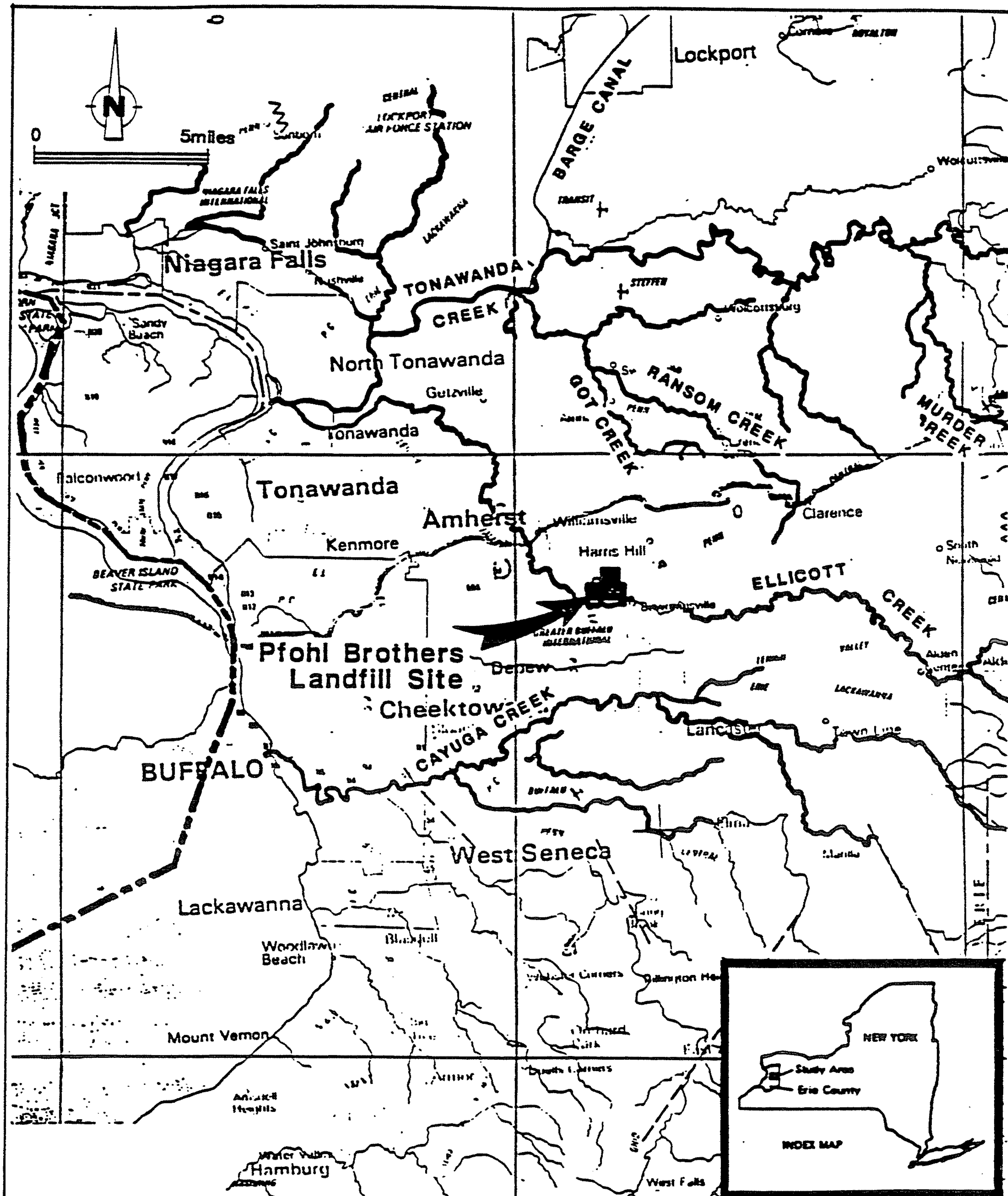
Each full frac tank, tanker, or polytank used for pumping tests at EW-1 and EW-3 was sampled for polychlorinated biphenyls (PCBs) and dichlorobenzene (DCB) prior to being shipped from the Site for treatment/disposal. In addition a grab sample from a tanker full of EW-3 test waters was submitted for VOC, SVOC, pesticides, PCB, herbicide, metals and select general chemistry analysis. The analytical results for these samples are presented in Appendix M. Samples other than the 0, 24 and 48-hour samples (see Section 5.4) were not collected from EW-2 during the pumping tests.

All extracted groundwater was treated/disposed of at Chemical Waste Management's (CWMs) Model City, New York facility. Bills of lading and manifests for these loads are presented in Appendix N.

12.3 EQUIPMENT CLEANING

All equipment utilized during the preliminary activities was cleaned in accordance with the protocols discussed in Appendix A of the RD/RA Work Plan.

FIGURES



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

figure 1.1

SITE LOCATION

CRA *Pfohl Brothers Landfill, Cheektowaga, New York*

1979 (14) SEPT.16/94(W) REV.0

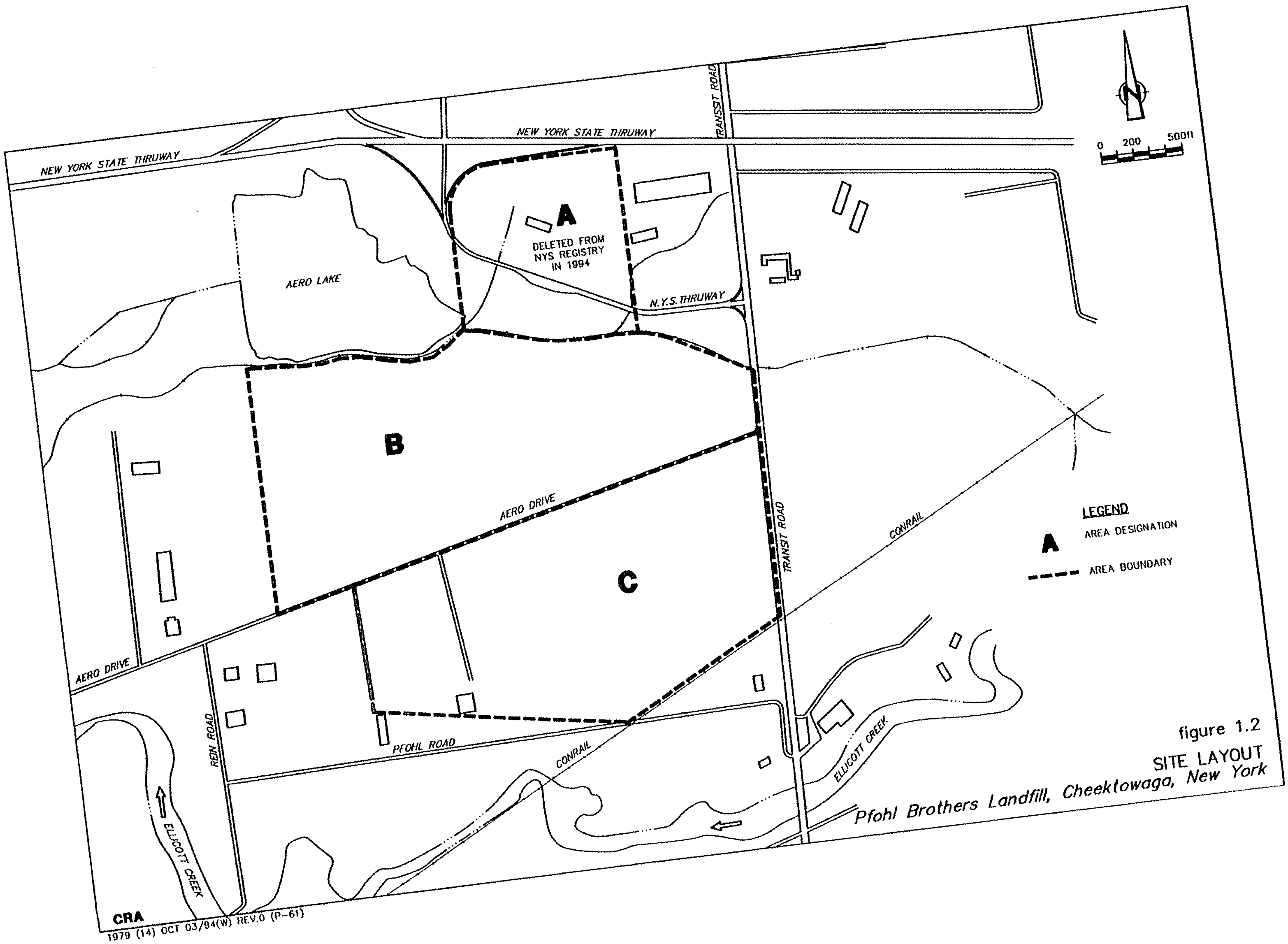


figure 1.2

SITE LAYOUT

Pfohl Brothers Landfill, Cheektowaga, New York

TABLES

TABLE 2.1

LIST OF REPORTED OWNERS
FROM WHOM ACCESS WAS OBTAINED FOR PREDESIGN ACTIVITIES
PFOHL BROTHERS LANDFILL

Tax Records Designation	*Lot Number*	*Description*
82.03-4	5	Transit Road Pfohl, Dolores M. & Paul & Bernice c/o Joseph Di Matteo Fiddler & Company One Towne Center W Amherst, N.Y. 14228
	6	Aero Drive Pfohl Enterprises c/o Joseph Di Matteo Fiddler & Company One Towne Center W Amherst, N.Y. 14228
	7	Transit Road Pfohl Enterprises c/o Joseph Di Matteo Fiddler & Company One Towne Center W Amherst, N.Y. 14228
	8	Transit Road Pfohl Enterprises c/o Joseph Di Matteo Fiddler & Company One Towne Center W Amherst, N.Y. 14228
	9.11	Aero Drive Hirsch, Jerome F. 215 California Drive Williamsville, N.Y. 14221

TABLE 2.1

LIST OF REPORTED OWNERS
FROM WHOM ACCESS WAS OBTAINED FOR PREDESIGN ACTIVITIES
PFOHL BROTHERS LANDFILL

Tax Records Designation	*Lot Number*	*Description*
82.03-4	9.12	Aero Drive Stuart Jenkins 42 Willowbrook Williamsville, N.Y. 14221
	9.2	1101 Aero Road Hirsch, Jerome F. 215 California Drive Williamsville, N.Y. 14221
	10	Pfohl Road McBride, Elizabeth L. Hilltop Drive Goshen, N.Y. 10924
	11	232 Pfohl Road Mac Peek, Robina Cheektowaga, N.Y. 14225
	12 & 13	E. NY State Elec. & Gas c/o Hugh Warfle 150 Erie Street Lancaster, N.Y. 14086
	14	Con Rail Corp. Property Tax Dept. c/o Frank Sobota 1002 Market Street P.O. Box 41403 Philadelphia, PA 19101
81.04-1	25	Niagara Mohawk Power Corp. Carl Reisig Land and Right of Way 535 Washington Street Buffalo, N.Y. 14203

TABLE 2.1

LIST OF REPORTED OWNERS
FROM WHOM ACCESS WAS OBTAINED FOR PREDESIGN ACTIVITIES
PFOHL BROTHERS LANDFILL

Tax Records Designation	*Lot Number*	*Description*
81.04-1	26	Aero Drive Pfohl William A. & I. 83 Pfohl Road Cheektowaga, N.Y. 14225
	27	Aero Drive Pfohl Enterprises c/o Joseph Di Matteo Fiddler & Company One Towne Center W Amherst, N.Y. 14228
	28.1	Aero Drive Pfohl Enterprises c/o Joseph Di Matteo Fiddler & Company One Towne Center W Amherst, N.Y. 14228
81.04-2	9.1	Aero Drive Pfohl Enterprises c/o Joseph Di Matteo Fiddler & Company One Towne Center W Amherst, N.Y. 14228
	9.211	Pfohl Road Pfohl, Robert W. Phillips, Marlene A. 559 Harris Hill Road Lancaster, N.Y. 14086
	9.22*	136-144 Pfohl Road Zelasko, Fred P. & Etal 121 Foisset Avenue Cheektowaga, N.Y. 14225

TABLE 2.1

LIST OF REPORTED OWNERS
FROM WHOM ACCESS WAS OBTAINED FOR PREDESIGN ACTIVITIES
PFOHL BROTHERS LANDFILL

Tax Records Designation	*Lot Number*	*Description*
81.04-2	9.212*	130 Pfohl Road Zelasko, Fred P. & Etal 121 Foisset Avenue Cheektowaga, N.Y. 14225
	10.1	Pfohl Road Pfohl Enterprises c/o Joseph Di Matteo Fiddler & Company One Towne Center W Amherst, N.Y. 14228
	11	Pfohl Road Pfohl Enterprises c/o Joseph Di Matteo Fiddler & Company One Towne Center W Amherst, N.Y. 14228
Pfohl Road		Town of Cheektowaga Mr. Chris Kowal Hiway Superintendent 3145 Union Road Cheektowaga, N.Y. 14206
Transit Road		Mr. David J. Barabasz New York State DOT Indian Road & Broadway Depew, New York 14043
Aero Drive		Mr. Melvin Case Permit Engineer Highway Division Erie County Public Works Department 95 Franklin Street Buffalo, New York 14202

Notes:

* Access permission was requested but was not granted by property owners.

TABLE 4.1

TEST PIT/BOREHOLE PHYSICAL TESTING RESULTS
PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, NEW YORK

Borehole/Test Pit Number	*USCS*		*Depth (ft)*	*Percent Gravel*	*Percent Sand*	*Percent Silt*	*Percent Clay*	*Moisture Content*	*Permeability (cm/sec)*	*Liquid Limit*	*Plastic Limit*	*Plasticity Index*
TP-1A	ML	*	Sample 1	0.3	12.4	48.3	39.0					
TP-4	SM	*	1 - 3	2.0	46.2	34.2	17.3					
TP-8	ML	*	Sample 3	0.0	22.0	45.6	32.4					
TP-10	SM/CL	**	3 - 4					10.3				
TP-11	CL	**	2 - 3					15.2				
TP-15	SM	*	1 - 4	0.1	74.1	15.1	10.7					
TP-27	SM	*	0 - 1	1.0	49.6	30.0	19.4					
TP-28	SP/SW	**	4.5					17.4				
TP-36A	ML	*	4 - 4.5	0.0	1.6	60.3	38.1					
TP-42	SM	**	3 - 4					17.3				
TP-44	MH	**	2 - 3					31.9				
TP-46D	SC	*	4.5	1.7	72.1	12.0	14.2					
TP-47	MH	**	3.5 - 5					21.6				
TP-47A	MH	**	3 - 3.5					19.2				
TP-48	ML	*	2 - 3	0.0	19.2	53.9	26.9	18.2				
TP-49	ML	*	3.5 - 4.5	0.3	22.4	52.3	25.0	15.7				
ABH-1-5ss	CL	**	8 - 10							26	15	11
ABH-1-6st	CL	**	10 - 12						1.30E-08			
ABH-2-5ss	SM	*	8.8 - 10	3.2	66.0	17.9	12.9	23.6				
ABH-3-8ss	ML	*	14.4 - 16	0.0	24.0	70.3	5.7	18.7				
ABH-3-10st	CL	**	18 - 20						8.94E-08			
ABH-4-6ss	MH/CH	**	10 - 12							31	16	15
ABH-5-8ss	ML	*	14 - 16	0.0	27.2	67.6	5.2	19.1				
ABH-5-9ss	CH	**	16.7 - 18							29	15	14
ABH-5-10st	CH	**	18 - 20						6.94E-08			
ABH-7-9ss	ML	*	16 - 17.8	0.1	5.9	83.6	10.4	17.2				
ABH-8-8ss	ML	*	14.8 - 16	0.0	12.3	78.0	9.7	16.2				
ABH-9-8ss	ML	*	14 - 15.3	0.0	14.4	77.7	7.9	17.2				
ABH-9-9st	CL	**	16 - 17.3						4.60E-08			
ABH-13-5ss	ML	*	8.3 - 9.8	0.2	16.7	65.3	17.8	16.0				
BH-1-2ss	ML	*	2 - 4	0.9	32.0	53.2	13.9	15.2				
BH-1-4ss	SM	*	6 - 8	1.2	64.2	20.0	14.6	17.6				
BH-1-5ss	SM	*	8 - 10	0.3	75.2	12.1	12.4	15.7				
BH-1-9ss	CL	**	16 - 18							17	11	6
BH-1-10st	SM	**	18 - 19.6						1.90E-04			

Notes:
* USCS CLASSIFICATION FROM SJB GRAIN SIZE AND PERMEABILITY ANALYSIS
** USCS CLASSIFICATION FROM CRA SITE S STRATIGRAPHIC LOGS
SS-SPLIT-SPOON
ST-SHELBY TUBE
CRA 1979 (14)

TABLE 4.1

TEST PIT/BOREHOLE PHYSICAL TESTING RESULTS
PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, NEW YORK

Borehole/Test Pit Number	*USCS*	*Depth (ft)*	*Percent Gravel*	*Percent Sand*	*Percent Silt*	*Percent Clay*	*Moisture Content*	*Permeability (cm/sec)*	*Liquid Limit*	*Plastic Limit*	*Plasticity Index*
BH-2-4ss	ML **	7 - 8					16.8				
BH-2-5ss	SM *	8 - 9	0.9	62.7	21.2	15.2					
BH-3-4ss	SM *	6.5 - 8	1.1	62.2	23.6	13.1	15.4				
BH-3-5ss	SM *	8 - 9.5	0.2	43.0	39.0	17.8	16.1				
BH-3-6ss	SM **	11.5 - 12							30	15	15
BH-3-7st	SM **	12 - 14						1.36E-06			
BH-4-1ss	ML *	0.5 - 2	0.2	30.6	48.5	20.7	15.2				
BH-4-3ss	ML *	4.5 - 6	0.2	29.4	45.9	24.5	14.0				
BH-5A-1ss	ML *	0.8 - 2	0.0	32.7	50.7	16.6	14.3				
BH-5A-3ss	SC *	4.7 - 5.8	1.8	65.3	13.9	19.0	13.6	5.10E-08			
BH-5A-4ss	ML **	7.7 - 8							27	15	12
BH-6-3ss	SM *	4.8 - 6	0.6	50.8	33.3	15.3	17.6				
BH-6-5ss	ML *	9.5 - 10	0.0	21.4	75.0	3.6	19.1				
BH-7-2ss	SM *	3.3 - 4	0.6	44.8	37.0	17.6	19.9				
BH-7-3ss	ML *	4.8 - 5.5	0.0	23.4	52.5	24.1	36.4				
BH-7-4ss	ML *	6.5 - 7.8	0.8	43.6	43.8	11.8	19.0				
BH-7-5ss	ML *	8.5 - 10	0.0	18.2	65.2	16.6	16.0				
BH-7-7ss	CL **	12.4 - 13.6							26	14	12
BH-8-1ss	ML *	0.5 - 2	0.2	6.1	58.3	35.4	13.9				
BH-8-3ss	ML *	4.5 - 5	0.0	36.5	51.7	11.8	16.0				
BH-8-4ss	SM *	7.5 - 8	0.0	54.3	36.4	9.3	18.4				
BH-8-5ss	CL **	8.5 - 10							24	15	9
BH-8-6st	CL **	10 - 11.1						1.22E-07			
BH-9-4ss	CL **	6 - 8							25	12	13
BH-9-5st	CL **	8 - 9.8						1.15E-08			
BH-10-4ss	SM *	7 - 8	1.2	79.8	10.6	8.4	20.3				
BH-11-1ss	ML *	0.5 - 2	0.4	31.0	42.5	26.1	16.3				
BH-11-5ss	CL **	8 - 9							20	15	5
BH-11-6st	ML **	10 - 12						1.87E-06			
BH-12-1ss	SM *	0.5 - 2	0.3	43.2	35.3	21.2	17.2				
BH-12-3ss	ML *	5 - 5.5	0.0	15.3	51.1	33.6	34.5				
BH-12-4ss	ML *	6.5 - 7.4	0.0	19.5	65.0	15.5	19.6				
BH-13-3ss	SM *	4.5 - 6	0.0	50.9	32.4	16.7	24.2				
BH-13-4ss	ML *	6.6 - 8	2.4	40.8	45.3	11.5	18.1				
BH-14-1ss	ML *	0.5 - 1.5	0.5	7.0	50.9	41.6	13.3				

Notes:
* USCS CLASSIFICATION FROM SJB GRAIN SIZE AND PERMEABILITY ANALYSIS
** USCS CLASSIFICATION FROM CRA SITE S
STRATIGRAPHIC LOGS
SS-SPLIT-SPOON
ST-SHELBY TUBE
CRA 1979 (14)

TABLE 5.2

SUMMARY OF 48-HOUR CONSTANT RATE PUMPING TEST RESULTS
PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, NEW YORK

Test Well	*Transmissivity*		*Hydraulic Conductivity*	*Storage Coefficient*	
	Method	*Value*		*Method*	*Value*
EW-1	Theis Recovery (using test well)	42 $ft.^2$/day	2.3 x 10^{-3} cm/sec	NA(1)	NA(1)
EW-2	Theis Recovery (using test well)	520 $ft.^2$/day	3.6 x 10^{-2} cm/sec	NA(1)	NA(1)
EW-3	Theis Recovery (using test well)	4,290 $ft.^2$/day	3.2 x 10^{-1} cm/sec	NA(1)	NA(1)
EW-3	Theis Recovery (using MW-3)	4,130 $ft.^2$/day	3.2. x 10^{-1} cm/sec	NA(1)	NA(1)
EW-3	Semilog with Calculated Recovery (using MW-3)	3,930 $ft.^2$/day	3.4 x 10^{-1} cm/sec	Semilog w/ Calculated Recovery (using MW-3)	0.20

Note:

(1) Not estimated due to lack of response in any observation well.

TABLE 5.3

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 (SO_4^{-2})
- Pesticides
- Tetra to Octa PCDD/PCDFs
- Gross Alpha and Beta Radioactivity
- Total Phosphate
- Total Phenols
- Trichlorofluoromethane
- Benzidene
- Bis (2-chlorisopropyl) ether
- 1,2-Diphenyl-hydrazine
- Acrolein
- Acrylonitrile
- Bis (Chloromethyl) ether
- 2-Chloroethylvinyl ether
- Dichlorodifluoromethane
- Ammonia (as N)
- Bromide
- Fluoride
- Nitrate (as N)
- Nitrite (as N)
- Total Organic Nitrogen (as N)
- Oil and Grease
- Total Phosphorus (as P)
- Sulfide (as S)
- Sulfite (as SO_3)
- Total Radium
- Total Radium 226
- Total Boron
- Total Tin
- Total Titanium
- Total Molybdenum
- Total Cyanide

TABLE 5.4

SUMMARY OF DETECTED PARAMETERS
48-HOUR PUMPING TESTS
PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, NEW YORK
MAY /JUNE 1994

	Units	EW-1 0 hr	EW-1 24 hr	EW-1 48 hr	EW-4 Field Dup of EW-1 48 hr
VOLATILES					
Acetone	µg/L	ND 10	ND 10	ND 10	5J
1,1-Dichloroethane	µg/L	ND 5	ND 5	ND 5	ND 5
1,2-Dichloroethene	µg/L	ND 5	ND 5	ND 5	ND 5
1,1,1-Trichloroethane	µg/L	ND 5	ND 5	ND 5	ND 5
Trichloroethene	µg/L	ND 5	ND 5	ND 5	ND 5
Benzene	µg/L	2J	2J	2J	2J
Toluene	µg/L	12	2J	ND 5	1J
Chlorobenzene	µg/L	ND 5	ND 5	ND 5	ND 5
Ethylbenzene	µg/L	ND 5	1J	1J	1J
Total Xylenes	µg/L	5	7	7	7
SEMI-VOLATILES					
Phenol	µg/L	9J	96	94	100
1,4-Dichlorobenzene	µg/L	1J	1J	1J	1J
2-Methylphenol	µg/L	ND 10	8J	8J	9J
4-Methylphenol	µg/L	ND 10	2J	2J	2J
Naphthalene	µg/L	ND 10	23	25	27
2-Methylnaphthalene	µg/L	ND 10	9J	9J	10
Acenaphthene	µg/L	ND 10	1J	ND 10	ND 10
Fluorene	µg/L	ND 10	ND 10	ND 10	1J
N-Nitrosodiphenylamine	µg/L	ND 10	37	33	36
Carbazole	µg/L	ND 10	3J	ND 10	ND 10
Di-n-butylphthalate	µg/L	ND 10	ND 10	ND 10	2J
bis(2-Ethylhexyl)phthalate	µg/L	ND 10	ND 10	ND 10	1J
PESTICIDES/PCBS					
alpha-BHC	µg/L	NA	NA	0.06	0.05
Heptachlor	µg/L	NA	NA	ND 0.03	0.05

TABLE 5.4

SUMMARY OF DETECTED PARAMETERS
48-HOUR PUMPING TESTS
PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, NEW YORK
MAY /JUNE 1994

		EW-2			EW-3		
	Units	*0 hr*	*24 hr*	*48 hr*	*0 hr*	*24 hr*	*48 hr*
VOLATILES							
Acetone	µg/L	ND 10	ND 10	ND 10	ND 10	ND 10	ND 10
1,1-Dichloroethane	µg/L	4J	32	39	ND 5	ND 5	ND 5
1,2-Dichloroethene	µg/L	1J	8	7	ND 5	ND 5	ND 5
1,1,1-Trichloroethane	µg/L	ND 5	ND 5	1J	ND 5	ND 5	ND 5
Trichloroethene	µg/L	ND 5	3J	3J	ND 5	ND 5	ND 5
Benzene	µg/L	ND 5	ND 5	ND 5	ND 5	ND 5	ND 5
Toluene	µg/L	ND 5	ND 5	ND 5	ND 5	ND 5	ND 5
Chlorobenzene	µg/L	ND 5	2J	2J	ND 5	ND 5	ND 5
Ethylbenzene	µg/L	ND 5	ND 5	ND 5	ND 5	ND 5	ND 5
Total Xylenes	µg/L	ND 5	ND 5	ND 5	ND 5	ND 5	ND 5
SEMI-VOLATILES							
Phenol	µg/L	90	ND 10	ND 10	ND 10	ND 10	ND 10
1,4-Dichlorobenzene	µg/L	1J	1J	1J	ND 10	ND 10	ND 10
2-Methylphenol	µg/L	8J	ND 10	ND 10	ND 10	ND 10	ND 10
4-Methylphenol	µg/L	2J	ND 10	ND 10	ND 10	ND 10	ND 10
Naphthalene	µg/L	16	ND 10	ND 10	ND 10	ND 10	ND 10
2-Methylnaphthalene	µg/L	16	ND 10	ND 10	ND 10	ND 10	ND 10
Acenaphthene	µg/L	1J	ND 10	ND 10	ND 10	ND 10	ND 10
Fluorene	µg/L	2J	ND 10	ND 10	ND 10	ND 10	ND 10
N-Nitrosodiphenylamine	µg/L	28	ND 10	ND 10	ND 10	ND 10	ND 10
Carbazole	µg/L	2J	ND 10	ND 10	ND 10	ND 10	ND 10
Di-n-butylphthalate	µg/L	1J	ND 10	ND 10	ND 10	ND 10	ND 10
bis(2-Ethylhexyl)phthalate	µg/L	3J	16	2J	4J	5J	ND 10
PESTICIDES/PCBS							
alpha-BHC	µg/L	NA	NA	ND 0.03	NA	NA	ND 0.03
Heptachlor	µg/L	NA	NA	ND 0.03	NA	NA	ND 0.03

TABLE 5.4

SUMMARY OF DETECTED PARAMETERS
48-HOUR PUMPING TESTS
PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, NEW YORK
MAY /JUNE 1994

	Units	*EW-1*			*EW-4 Field Dup of EW-1*
		0 hr	*24 hr*	*48 hr*	*48 hr*
DIOXINS					
Total HxCDD	pg/L	NA	NA	ND 4.1	3.6J
1,2,3,4,6,7,8-HpCDD	pg/L	NA	NA	3.4J	3.6J
Total HpCDD	pg/L	NA	NA	3.4J	7.8J
OCDD	pg/L	NA	NA	28J	ND 32
Total TCDF	pg/L	NA	NA	14J	3.3J
Total PeCDF	pg/L	NA	NA	3.8J	3.3J
1,2,3,4,7,8-HxCDF	pg/L	NA	NA	1.6J	1.6J
1,2,3,6,7,8-HxCDF	pg/L	NA	NA	1.5J	1.4J
2,3,4,6,7,8-HxCDF	pg/L	NA	NA	1.6J	ND 2.3
Total HxCDF	pg/L	NA	NA	8.0J	ND 7.0
1,2,3,4,6,7,8-HpCDF	pg/L	NA	NA	2.8J	2.4J
Total-HpCDF	pg/L	NA	NA	2.8J	2.4J
OCDF	pg/L	NA	NA	1.9J	2.6J
METALS					
Soluble Iron	µg/L	NA	NA	ND 80	ND 80
Soluble Manganese	µg/L	NA	NA	580	570
Total Aluminum	µg/L	540	25	ND 11	16
Total Antimony	µg/L	ND 14	ND 14	ND 14	ND 14
Total Arsenic	µg/L	3.0	1.2	3.0	2.9
Total Barium	µg/L	550	550	540	550
Total Cadmium	µg/L	ND 3.0	ND 3.0	ND 3.0	ND 3.0
Total Calcium	µg/L	190000	200000	200000	200000
Total Chromium	µg/L	2.3	ND 2.0	ND 2.0	ND 2.0
Total Cobalt	µg/L	4.6	3.5	3.4	3.8
Total Copper	µg/L	24	8.8	6.8	7.5
Total Iron	µg/L	40000	42000	42000	42000
Total Lead	µg/L	52	9.8	4.7	5.1
Total Magnesium	µg/L	37000	37000	36000	37000
Total Manganese	µg/L	590	590	610	610
Total Nickel	µg/L	6.3	ND 6.0	ND 6.0	ND 6.0
Total Potassium	µg/L	18000	18000	18000	19000
Total Sodium	µg/L	24000	24000	23000	24000
Total Vanadium	µg/L	3.7	ND 2.0	ND 2.0	ND 2.0
Total Zinc	µg/L	110	36	33	34
Total Boron	µg/L	NA	NA	650	670
Total Molybdenum	µg/L	NA	NA	ND 3.0	ND 3.0
Total Titanium	µg/L	NA	NA	1.4	1.3

TABLE 5.4

SUMMARY OF DETECTED PARAMETERS
48-HOUR PUMPING TESTS
PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, NEW YORK
MAY /JUNE 1994

		EW-2			EW-3		
	Units	*0 hr*	*24 hr*	*48 hr*	*0 hr*	*24 hr*	*48 hr*
DIOXINS							
Total HxCDD	pg/L	NA	NA	3.0J	NA	NA	ND 4.9
1,2,3,4,6,7,8-HpCDD	pg/L	NA	NA	21J	NA	NA	3.2J
Total HpCDD	pg/L	NA	NA	42J	NA	NA	3.2J
OCDD	pg/L	NA	NA	200	NA	NA	12J
Total TCDF	pg/L	NA	NA	51	NA	NA	ND 15
Total PeCDF	pg/L	NA	NA	32J	NA	NA	ND 7.4
1,2,3,4,7,8-HxCDF	pg/L	NA	NA	5.3J	NA	NA	ND 2.3
1,2,3,6,7,8-HxCDF	pg/L	NA	NA	2.7J	NA	NA	ND 2.0
2,3,4,6,7,8-HxCDF	pg/L	NA	NA	2.1J	NA	NA	1.5J
Total HxCDF	pg/L	NA	NA	27J	NA	NA	1.5J
1,2,3,4,6,7,8-HpCDF	pg/L	NA	NA	13J	NA	NA	1.6J
Total-HpCDF	pg/L	NA	NA	18J	NA	NA	1.6J
OCDF	pg/L	NA	NA	33J	NA	NA	2.4J
METALS							
Soluble Iron	µg/L	NA	NA	ND 80	NA	NA	410
Soluble Manganese	µg/L	NA	NA	1300	NA	NA	120
Total Aluminum	µg/L	13	17	59	36	19	21
Total Antimony	µg/L	ND 14	14	ND 14	ND 14	ND 14	14
Total Arsenic	µg/L	2.2	1.9	2.8	1.8	1.3	1.7
Total Barium	µg/L	81	78	88	110	100	97
Total Cadmium	µg/L	7.9	7.7	6.2	ND 3.0	3.5	ND 3.0
Total Calcium	µg/L	250000	250000	250000	300000	290000	280000
Total Chromium	µg/L	ND 2.0	ND 2.0	2.9	2.2	ND 2.0	ND 2.0
Total Cobalt	µg/L	31	28	27	ND 2.0	ND 2.0	ND 2.0
Total Copper	µg/L	120	100	93	84	43	40
Total Iron	µg/L	30000	32000	32000	640	180	190
Total Lead	µg/L	210	200	180	35	4.6	6.0
Total Magnesium	µg/L	39000	40000	41000	39000	38000	35000
Total Manganese	µg/L	1200	1300	1300	140	120	110
Total Nickel	µg/L	75	65	65	28	9.6	11
Total Potassium	µg/L	13000	13000	13000	16000	16000	15000
Total Sodium	µg/L	26000	28000	29000	30000	28000	25000
Total Vanadium	µg/L	2.4	2.7	2.6	ND 2.0	ND 2.0	2.8
Total Zinc	µg/L	790	710	620	200	190	210
Total Boron	µg/L	NA	NA	670	NA	NA	640
Total Molybdenum	µg/L	NA	NA	6.4	NA	NA	ND 3.0
Total Titanium	µg/L	NA	NA	3.6	NA	NA	1.0

TABLE 5.4

SUMMARY OF DETECTED PARAMETERS
48-HOUR PUMPING TESTS
PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, NEW YORK
MAY /JUNE 1994

	Units	EW-1			EW-4 Field Dup of EW-1
		0 hr	*24 hr*	*48 hr*	*48 hr*
GENERAL INORGANICS					
Alkalinity	mg/L	NA	NA	710	770
Ammonia	mg/L	NA	NA	16	16
BOD	mg/L	NA	NA	12	12
COD	mg/L	NA	NA	70	67
Fluoride	mg/L	NA	NA	0.1	0.1
Hardness	mg/L	NA	NA	660	650
Nitrate	mg/L	NA	NA	0.04	ND 0.02
Oil and Grease	mg/L	NA	NA	5	13
Phenols	mg/L	NA	NA	0.28	0.28
Phosphorous (total)	mg/L	NA	NA	0.09	0.09
Sulfate	mg/L	NA	NA	13	12
Sulfide	mg/L	NA	NA	2	3
TDS	mg/L	NA	NA	800	790
TSS	mg/L	NA	NA	100	98
TOC	mg/L	NA	NA	36	36
TON	mg/L	NA	NA	4.4	3.7
Turbidity	NTU	NA	NA	420	450
pH	S.U.	NA	NA	7.4	7.0
Chloride	mg/L	NA	NA		
RADIOLOGICAL RESULTS (pCi/L)					
Ra-226		NA	NA	0.17	0.32
Total Ra		NA	NA	0.20	0.34
Gross alpha		NA	NA	0.34	0.54
Gross beta		NA	NA	15	18

Notes:
* Compound analyzed as a tentatively identified compound (TIC). Detection limit not available.
ND Non-detect at the associated value.
J The associated value is estimated.
S.U. Standard Units
NTU Nephelometric Turbidity Units
BOD Biological Oxygen Demand
COD Chemical Oxygen Demand
TDS Total Dissolved Solids
TSS Total Suspended Solids
TOC Total Organic Carbon
TON Total Organic Nitrogen
PCBs Polychlorinated Biphenyls
pCi Picocures
NA Not analyzed.

TABLE 5.4

SUMMARY OF DETECTED PARAMETERS
48-HOUR PUMPING TESTS
PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, NEW YORK
MAY /JUNE 1994

		EW-2			*EW-3*		
	Units	***0 hr***	***24 hr***	***48 hr***	***0 hr***	***24 hr***	***48 hr***
GENERAL INORGANICS							
Alkalinity	mg/L	NA	NA	560	NA	NA	620
Ammonia	mg/L	NA	NA	5.6	NA	NA	ND 0.1
BOD	mg/L	NA	NA	7	NA	NA	ND 2
COD	mg/L	NA	NA	82	NA	NA	57
Fluoride	mg/L	NA	NA	0.5	NA	NA	0.1
Hardness	mg/L	NA	NA	820	NA	NA	850
Nitrate	mg/L	NA	NA	ND 0.02	NA	NA	0.12
Oil and Grease	mg/L	NA	NA	ND 5	NA	NA	35
Phenols	mg/L	NA	NA	0.014	NA	NA	0.010
Phosphorous (total)	mg/L	NA	NA	0.03	NA	NA	ND 0.01
Sulfate	mg/L	NA	NA	350	NA	NA	300
Sulfide	mg/L	NA	NA	2	NA	NA	ND 1
TDS	mg/L	NA	NA	1100	NA	NA	1200
TSS	mg/L	NA	NA	80	NA	NA	ND 4
TOC	mg/L	NA	NA	39	NA	NA	24
TON	mg/L	NA	NA	2.2	NA	NA	1.4
Turbidity	NTU	NA	NA	220	NA	NA	ND 1
pH	S.U.	NA	NA	7.4	NA	NA	7.4
Chloride	mg/L						32
RADIOLOGICAL RESULTS (pCi/L)							
Ra-226		NA	NA	0.13	NA	NA	0.05
Total Ra		NA	NA	0.14	NA	NA	0.03
Gross alpha		NA	NA	0.43	NA	NA	1.1
Gross beta		NA	NA	16	NA	NA	3.4

Notes:

*	Compound analyzed as a tentatively identified compound (TIC). Detection limit not available.
ND	Non-detect at the associated value.
J	The associated value is estimated.
S.U.	Standard Units
NTU	Nephelometric Turbidity Units
BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
TOC	Total Organic Carbon
TON	Total Organic Nitrogen
PCBs	Polychlorinated Biphenyls
pCi	Picocures
NA	Not analyzed.

TABLE 7.1

LANDFILL GAS PROBE MONITORING SUMMARY
PFOHL BROTHERS LANDFILL

Location	04/01/94	04/08/94	04/15/94	04/22/94	04/29/94	05/05/94	05/13/94	05/20/94	05/27/94	06/03/94	06/09/94	06/24/94
						Combustible Gas (% LEL)						
GP-1	0	0	0	5	1	0	0	2	2	3	3 (3.2)*	2 (3.0)*
GP-2	2	0	0	2	2	0	4	2	1	3	3 (2.0)*	2 (2.5)*
GP-3	0	0	0	0	1	1	2	2	1	3	2 (0)*	3 (0)*
GP-4	0	0	0	0	1	0	2	2	1	3	2 (0.2)*	2 (0.1)*
GP-5	50/18	49	84	60	21	50	65/27	120	95	31	98 (8.0)*	90 (7.5)*
GP-6	0	0	0	0	1	1	2	2	2	3	2 (0)*	2 (0)*
						PID (ppm)						
GP-1	1.5	20.7/5.0	PID malfunction	0	1.2	24/10	37/14	30/20	15/12	20	17	19
GP-2	0	0	PID malfunction	0	0	0	0	0	0	1.0	0	0
GP-3	0	0	PID malfunction	0	0	0	0	10/0	0	0	0	0
GP-4	0	0	PID malfunction	0	0	0	0	0	0	0	0	0
GP-5	0	0	PID malfunction	0	0	0	0	0	0	0	0	0
GP-6	0	0	PID malfunction	0	0	0	0	0	0	0	0	0
						Pressure (inches of water column)						
GP-1	0	0.05	Too windy	0.02	0.03	0	0	0.01	0.02	0.01	0.01	0.02
GP-2	0	0.02	Too windy	0.02	0.02	0.02	0.03	0.01	0.01	0.08	0.01	0.01
GP-3	0	0.07	Too windy	0.02	0.02	0.01	0.02	0.01	0.01	0.02	0.08	0.07
GP-4	0.01	0	Too windy	0	0	0	0	0.12	0.12	0.15	0.01	0.01
GP-5	0	0.07	Too windy	0.05	0.06	0.07	0.09	0.07	0.05	0.03	0.03	0.01
GP-6	0.03	0.07	Too windy	0.02	0.02	0.05	0.03	0.02	0.02	0.06	0.01	0.01

Notes:

All readings shown on table are sustained readings. If two values are given, the first value is an initial reading and the second is the sustained reading (i.e. 20/5).
NM - not monitored
NA - not available
BTOC - below top of casing
* measured with both LEL and LEL/ volume meters. Reading in brackets is % volume. The probe was monitored for % volume first and hence this reading represents the initial reading whereas the reading with the LEL meter represents a sustained reading.
** measured below inner casing

TABLE 7.1

LANDFILL GAS PROBE MONITORING SUMMARY
PFOHL BROTHERS LANDFILL

Location	*04/01/94*	*04/08/94*	*04/15/94*	*04/22/94*	*04/29/94*	*05/05/94*	*05/13/94*	*05/20/94*	*05/27/94*	*06/03/94*	*06/09/94*	*06/24/94*
						Oxygen (%)						
GP-1	21.5	21.0	21.5	21.5	21.0	21.0	21.0	21.0	21.2	21.0	21.3	21.3
GP-2	21.2	21.0	21.4	21.0	18.7	17.1	8.3	20.9	21.2	21.0	21.3	21.2
GP-3	21.5	21.0	21.5	21.5	20.7	21.1	21.1	20.5	21.0	21.0	21.1	21.2
GP-4	21.5	21.0	21.5	21.5	21.0	21.1	21.1	21.0	21.2	21.0	21.0	21.2
GP-5	15/18	14.9	17.0	13.0	10.9	15.0	1.9	5.4	8.0	4.4	1.2	5.4
GP-6	21.5	21.0	21.5	21.5	20.8	18.5	20.8	20.9	20.7	21.1	21.0	21.2
						OVA (ppm)						
GP-1	NA	NA	NA	120/15	75/5	175/5	128/20	140/30	50/10	1000+	1000+/300	1000+/250
GP-2	NA	NA	NA	1000+	900	700	790	820	500/220	280	1000+/240	1000+/210
GP-3	NA	NA	NA	98/35	50/20	45/5	30/2	1/0	0	7/<1.0	0	0
GP-4	NA	NA	NA	0	0	0	0	0	0	70/<1.0	21/2	10/1
GP-5	NA	NA	NA	1000+	1000+	1000+	1000+	1000+	1000+	1000+	1000+	1000+
GP-6	NA	NA	NA	0	0	0	0	0	0	0	0	0
						*Depth to Groundwater (ft. BTOC) **						
GP-1	7.7	7.32	7.71	7.80	NM	NM	NM	NM	NM	NM	NM	NM
GP-2	9.2	9.7	9.23	9.3	NM	NM	NM	NM	NM	NM	NM	NM
GP-3	8.58	8.59	8.58	8.7	NM	NM	NM	NM	NM	NM	NM	NM
GP-4	5.32	5.19	5.1	4.89	NM	NM	NM	NM	NM	NM	NM	NM
GP-5	Dry	Dry	Dry	Dry	NM	NM	NM	NM	NM	NM	NM	NM
GP-6	8.98	8.85	8.7	8.95	NM	NM	NM	NM	NM	NM	NM	NM

Notes:

All readings shown on table are sustained readings. If two values are given, the first value is an initial reading and the second is the sustained reading (i.e. 20/5).
NM - not monitored
NA - not available
BTOC - below top of casing
* measured with both LEL and LEL/ volume meters. Reading in brackets is % volume. The probe was monitored for % volume first and hence this reading represents the initial reading whereas the reading with the LEL meter represents a sustained reading.
** measured below inner casing

TABLE 8.1

COMPARISON OF 48-HOUR CONSTANT RATE PUMPING TEST
RESULTS TO BUFFALO SEWER AUTHORITY DISCHARGE CRITERIA

Parameter	*BSA Criteria (mg/L)*	*EW-1 48 Hour (mg/L)*	*Meets Criteria*	*EW-2 48 Hour (mg/L)*	*Meets Criteria*	*EW-3 48 Hour (mg/L)*	*Meets Criteria*
BOD	**No Limit**	12	Y	7	Y	ND 2	Y
TSS	**80,000**	100	Y	90	Y	ND 4	Y
Total Phosphorous	**No Limit**	0.09	Y	0.03	Y	ND 0.01	Y
Extractable Hydrocarbons	**100**	5	Y	ND 5	Y	35	Y
Purgeable Hydrocarbons	**5.3**	ND 0.25	Y	0.050	Y	ND 0.25	Y
Purgeable Aromatics	**5.3**	0.010	Y	0.002	Y	ND 0.030	Y
Semivolatiles	**5.3**	0.172	Y	0.003	Y	ND 1.0	Y
Pesticides	**0.1**	0.00006	Y	ND 0.003	Y	ND 0.003	Y
pH	**5.0 to 12.0**	7.4	Y	7.4	Y	7.4	Y
Arsenic	**1.8**	0.003	Y	0.0028	Y	0.0017	Y
Barium	**100**	0.54	Y	0.088	Y	0.097	Y
Cadmium	**1**	ND 0.003	Y	0.0062	Y	ND 0.003	Y
Chromium	**5**	ND 0.002	Y	0.0029	Y	ND 0.002	Y
Copper	**59.5**	0.0068	Y	0.093	Y	0.040	Y
Lead	**5**	0.0047	Y	0.18	Y	0.006	Y
Mercury	**0.2**	ND 0.0002	Y	ND 0.0002	Y	ND 0.0002	Y
Nickel	**21**	ND 0.006	Y	0.065	Y	0.011	Y
Selenium	**0.7**	ND 0.002	Y	ND 0.002	Y	ND 0.002	Y
Silver	**2.2**	ND 0.002	Y	ND 0.002	Y	ND 0.002	Y
Cyanide	**18.6**	ND 0.01	Y	ND 0.01	Y	ND 0.01	Y

Notes:

BOD Biological Oxygen Demand
TSS Total Suspended Solids

TABLE 9.1

SUMMARY OF SLURRY WALL
DESIGN MIXES FROM VARIOUS SITES

Location	*% Bentonite in Slurry*	*% Dry Bentonite*	*% Fines Content*	*Tap Water Hydration*	*Groundwater Permeant*	*Hydraulic Conductivity (cm/sec)*	*(1)*	*Type*
S-Area Landfill Site	5.5	4.0	50	X	X	1.17E-08		N.L. Baroid National Premium
Schenectady International, Inc.	5.0	2.5	25	X	X	1.40E-08		premium grade bentonite
G & H Landfill Site	5.5	2.0	28	X	X	3.40E-08	(2)	Bentonite Corp. Bara-Kade 90

Notes:

(1) Hydraulic Conductivities are time-weighted averages of Phase III testing.
(2) Result of Phase II only, Phase III testing still to be completed.

TABLE 9.2

SUMMARY OF GROUNDWATER ANALYSES
FROM VARIOUS SITES

Compounds (μg/L)	S-Area OW 244/245 11/21/91	Schenectady OW7A-84 8/4/92	G & H Landfill GW-003 12/9/93	Pfohl Bros. Landfill MW-16S 12/ /89
Acetone	NA	NA	14	NA
Benzene	NA	280	ND10	290
Bis (2-ethylhexyl) phthalate	NA	NA	NA	ND20
2-Butanone	NA	NA	15	NA
Chlorobenzene	1,809	ND15	ND10	1,200J
Chlorobenzoic Acids, Total	6,200	NA	NA	NA
2-Chlorophenol	NA	NA	NA	13J
4-Chloro-3-methylphenol	NA	NA	96	ND20
Chloroform	NA	NA	12	ND1
Cresols, Total	NA	NA	ND10	NA
Dichlorobenzenes, Total	NA	NA	NA	42J
1,1-Dichloroethane	NA	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	ND1.8
Di-n-butyl phthalate	NA	NA	10	ND20
Ethylbenzene	NA	19,000	ND10	ND3
Hexachlorobutadiene	17	NA	ND10	ND20
Hexachlorocyclohexane, Total	37	NA	NA	NA
Methylene Chloride	NA	NA	60	ND1.4
Phenols, Total	NA	450	ND10	ND20
Tetrachlorobenzenes, Total	1,147	NA	NA	NA
Toluene	NA	1,900	ND10	ND3
Trichlorobenzenes, Total	1,744	NA	ND10	ND20
1,1,1-Trichloroethane	NA	NA	NA	ND1.3
Total Organic Carbon (TOC)	37,000	NA	NA	NA
Total Organic Halides (TOX)	16,000	NA	NA	NA
Xylenes, Total	NA	39,700	NA	400J

Notes:

ND - Not detected
NA - Not analyzed
J - Estimate only. Below detection limit.