Hakes C&D Disposal, Inc.

HAKES CONSTRUCTION AND DEMOLITION DEBRIS LANDFILL

ENVIRONMENTAL MONITORING PLAN (EMP)

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1.0 INTRODUCTION

McMahon & Mann Consulting Engineers, P.C. (MMCE) prepared this report for Hakes C&D Disposal, Inc. (Hakes). This document presents the Environmental Monitoring Plan (EMP) for the Hakes C&D Facility in the Town of Campbell, New York (see Figure 1). The monitoring program covers both the permitted facility (Cells 1, 1A, 2, 3 and 4) and the proposed landfill expansion (see Figure 2).

Upon approval by the New York State Department of Environmental Conservation (NYSDEC), this document will replace the current environmental monitoring plan for the facility (Reference 1) and serve as the manual for the monitoring program at the Hakes C&D Facility.

1.1 Purpose and Report Organization

The goal of this monitoring program is to assess the potential impacts of the Hakes C&D Facility on surface water, ground water and the immediate environment surrounding the facility. The assessment of potential impacts will be done by monitoring conditions in the vicinity of the site and by monitoring the site environmental controls. Control of odors and gas are discussed in the Operation and Maintenance Manual.

Periodic revisions to this plan will occur with changing regulations, permit conditions or company policies. Any revisions to this plan will be submitted to the NYSDEC for review and approval before their implementation.

This report is organized in a format consistent with that described in 6 NYCRR Part 360 Section 2.11(c). Section 2.0 provides a summary of existing site conditions and describes the existing water quality program and Section 3.0 presents the proposed water quality program.

2.0 EXISTING SITE CONDITIONS

2.1 Setting

The site is located within the Appalachian Plateau physiographic province of New York State in the Town of Campbell, New York. The geology of this area is typified by hills and valleys comprised of glacial tills over sandstone, siltstone and shale. The sediment filled valleys of Meads Creek (approximately 1 mile west of the site) and the Cohocton River (approximately 2.6 miles south of the site) are the closest unconsolidated sources of groundwater.

The topography of the site and the surrounding area is shown on Figures 2 and 3. The site is located on the east side of a ridge that rises between Frog Hollow Road and Erwin Hollow Creek. The ground surface at the site slopes to the southeast toward Tributary 4 to Erwin Hollow Creek, at natural grades of 10 percent to 15 percent. Elevations range from approximately 1750 feet at the northwest corner of the site, to approximately 1450 feet at the southern boundary where Erwin Hollow Creek exits the site.

Surface water on the site drains to Tributary 4 to Erwin Hollow Creek (PA3-58-1-4). This intermittent stream (stream of seasonal flow) flows to the south, where it joins Erwin Hollow Creek (PA3-58-1), approximately 400 feet south of the landfill cell area. Erwin Hollow Creek then flows west for about 300 feet, where it exits the Hakes site, and then flows generally south for approximately 3 miles to where it discharges into the Cohocton River.

Tributary 4 to Erwin Hollow Creek and Erwin Hollow Creek upstream of its confluence with Tributary 4 have a water quality classification of C. The best usage of Class C waters is for fishing and fish propagation and the water quality should also be suitable for primary and secondary contact recreation even though other factors (such as water depth or access) may limit its use for this purpose. Erwin Hollow Creek downstream of its confluence with Tributary 4 has a water quality classification of C (T) indicating that it may support a trout population.

2.2 Groundwater Use

As required by 6 NYCRR Part 360-2.11 (a)(5), a survey of existing residential water supply wells was conducted within a one-mile radius of the site as part of the Hydrogeologic Report, Part III of this permit application (Reference 2).

A residential well summary table is included in Appendix B of Reference 2, listing the wells identified in the survey that are used for water supply within a one-mile radius of the facility. Figure 5 in Reference 2 shows the locations of the water supply wells identified by the survey.

2.3 Subsurface Conditions

Subsurface conditions at the site were investigated between the late 1980's and 2003 as described in Reference 2. Reference 2 concludes that the critical stratigraphic section for the site consists of the glacial till below the facility and the underlying upper bedrock zone.

2.3.1 Overburden

In general, the overburden includes topsoil underlain by till to bedrock. The overburden till varies from less than 10 feet thick in the northwest and southwest part of the site up to approximately 75 feet thick in the northeast corner of the expansion area.

As indicated by reviewing the laboratory testing summary tables in Appendix H of Reference 2, the glacial till soils are a dense mixture of sand, gravel, silt and clay. The till contains 18 to 73 percent silt and clay by weight and has a plasticity index that varies between 2 and 13 percent. The test results in Reference 2 indicate that the soils in the expansion area are similar to those tested during previous studies. Estimates of lateral hydraulic conductivity in monitoring wells screened in the overburden till based on variable head tests in the monitoring wells vary from 6.2×10^{-4} to 5.3×10^{-7} cm/sec with a geometric mean of 4.5×10^{-5} cm/sec (see Table F in Appendix F of Reference 2). The higher permeability values correspond to monitoring wells that are screened in or close to the top of bedrock.

2.3.2 Bedrock

Regionally, bedrock consists of sandstone, siltstone and shale of the West Falls Group, Nunda and West Falls Formations. As discussed in Reference 2, bedrock observed in the core samples of the test borings drilled at the site were described as gray sandstone, gray and brown shale and gray, brown and blue siltstone.

2.4 Groundwater Conditions

2.4.1 Water Table

A groundwater contour plan based on April 2004 data is presented in Reference 2 on Sheet 4. Figure 4, adapted from this plan, depicts the typical groundwater table contours. The groundwater table flow patterns on this map are similar to those on the water table map presented in Reference 1 based on data collected in August 1999.

It is noted that the elevation of the groundwater table is close to the top of rock in the western and northern parts of the site where the overburden material is thin. Therefore, monitoring wells screened in the till in these areas often do not contain water. For example, MW-K, located in the western part of the site, is screened from a depth of 5.3 feet down to 7.3 feet below the ground surface. As indicated on Table G in Appendix G of Reference 2, MW-K was observed to be dry during each measurement during the study period (August 2003 to November 2004). Bedrock was observed in borehole B11-03, located approximately 9 feet south of MW-K, at an elevation approximately 1 foot below the elevation of the bottom of the sand pack in MW-K.

Additionally, MW-I, located in the north part of the site, is screened from a depth of 4.5 feet down to 5.5 feet below the ground surface and was observed to be dry in March and June 2004 of the study period mentioned above. Bedrock was observed in borehole MW-I (boring), located approximately 10 feet north of MW-I, at an elevation approximately 1.7 feet below the elevation of the bottom of the sand pack in MW-I.

The locations of monitoring wells MW-K and MW-I are shown on Figure 3.

2.4.2 Groundwater Flow

Groundwater flows from the higher elevations surrounding the site toward the lower elevations generally following the ground surface and bedrock topography. Groundwater within the till is recharged by infiltration and from rainfall on the slopes and on the higher elevations surrounding the site. Figure 4 indicates that the flow direction is toward the topographically lower area in the southeast, discharging to Tributary 4 to Erwin Hollow Creek.

2.5 Existing Cells and Environmental Controls

The present landfill operation, 23.2-acres of landfill cells and ancillary facilities, occupy approximately 62 acres of land. The general site configuration is shown on Figure 3. Cells 1A, 1, 2, 3 and 4 are being filled.

Figure 3 has been updated to reflect conditions as of November 2010.

The environmental controls currently in place for the existing facility will continue to be implemented for the expansion and include:

- Waste Stream Control;
- Liner System;
- Groundwater and Leachate Collection Systems;
- Surface Water Collection System; and
- Final Cover System.

2.5.1 Waste Stream Control

Hakes will continue to implement a waste stream control system to preclude the disposal of unauthorized waste at the Hakes C&D Facility. The waste stream control system at the Hakes C&D Facility consists of:

- Securing the perimeter of the facility through fencing and natural barriers;
- A single site access point;
- A scale system to record incoming and outgoing vehicle weight;
- A waste monitoring program which screens any prohibited waste from the facility; and
- Random load inspections.

2.5.2 Liner System and Groundwater Collection System

A single composite liner as required by the 6NYCRR Part 360 (Part 360) Regulations was constructed beneath Cells 1, 1A, 2, 3 and 4. Additionally, groundwater collection systems were constructed below the composite liner of Cells 1, 1A, 2, 3 and 4 to ensure that separation between the bottom of the liner and groundwater is maintained. The expansion cells will be constructed similar to the existing cells and as described below.

Figure 3 shows the general site configuration. Cells 1A, 1, 2, 3 and 4 are being filled. Each cell is lined with a composite liner consisting of 2 feet of clay with a specified permeability of 1×10^{-7} centimeters per second (cm/sec) overlain by a 60 mil thick HDPE liner.

The NYSDEC approved a variance from the groundwater separation requirement, Part 360 7.4(b)(5), based on installing a groundwater collection layer beneath the liner system. A geocomposite layer collects groundwater from beneath each cell and discharges it into a groundwater collection pipe. Groundwater in the collection pipes in Cells 1 through 4 flows by gravity to the discharge locations shown on Figure 3. The groundwater collection pipe in Cell 1A flows to a sump in the southeast corner of Cell 1A from where groundwater is pumped to the leachate collection tank.

The leachate collection system above the liner system consists of a 24 inch thick layer of drainage stone. In some cells the upper foot of the drainage stone is replaced with 15 inches of tire chips. The drainage stone slopes from the west to a sump located in the southeast corner of each cell at grades of between 10 and 15 percent. Leachate is pumped from each sump to a leachate header pipe along the east side of the cells. Leachate in the header pipe flows by gravity to the leachate storage tank located in the southeast corner of the site. Tanker trucks transport leachate from the tanks to an off-site wastewater treatment facility. During normal periods, 1 to 2 truckloads of leachate are transported each day. After heavy rainstorms, the number of daily truckloads can increase to approximately 4 to 6 per day.

Plans for the expansion are to continue to construct the liner, groundwater collection system and leachate collection systems in a similar manner to those for the existing cells. Cells 5 and 6 (Figure 4) will slope from west to east to sumps located in the southeast corner of each cell. Cell 7 is a westward extension of Cell 4 and its leachate collection system will drain into the Cell 4 collection system and sump. Cell 8 will slope toward the south to a sump located in its southeast corner. Leachate will be pumped from each of the new sumps to the leachate storage area, which will include an additional tank.

2.5.3 Surface Water Collection System

Control of uncontaminated surface water runoff from undisturbed areas outside the cell area is accomplished through the use of diversion ditches or swales, located where necessary to divert surface runoff away from the disposal and operations areas. Additional ditches within the disturbed areas, collect sediment laden runoff and convey it to on-site detention basins. During construction, internal berms, flaps or tarps may be used to prevent stormwater in constructed, but not yet active, landfill areas from becoming leachate. These structures will reduce the amount of leachate produced by managing the flow of water within the cells.

Runoff from areas within the cells that has not come in contact with waste is directed to sedimentation ponds. Three sedimentation ponds, two located to the east of the existing cell area and one located to the west of the existing cell area, control sediment from the current operations area (see Figure 3). Soil from the cell areas and from the area north of the existing landfill is excavated and processed for use as low permeability soil liner material in the landfill liner system and for intermediate cover. Sediment from the excavation area is controlled by the northern sediment pond located east of the cell area. An additional sedimentation pond is planned for the northeast corner of the expansion area and another south of Cell 1A.

The constructed ditches are lined with stone, or protected from erosion by the use of stone check dams or other appropriate erosion protection measures. These measures are designed to reduce the amount of sediment transported to the sedimentation ponds.

2.5.4 Final Cover System

Regulations contained in 6 NYCRR Part 360 – 7.5 (e) require that final cover be installed within 90 days of the point in time when 3 or more acres of the landfill area reach final grade. Hakes will delay construction of final cover until the outside sideslopes have reached their highest elevations. Intermediate cover will be placed on all surfaces upon reaching top of waste elevations. The purpose of waiting to install final cover is to allow an initial settlement period (after reaching top of waste elevations) to occur prior to construction of the final cover system. Allowing additional settling time will result in a more uniform and stable slope for construction of the final cover. Waiting to apply final cover until the sideslopes have reached maximum elevation reduces the need to create a horizontal seam in the geo-membrane component of the final cover system.

The final cover system for the Hakes landfill will consist of the following components:

For slopes greater than 25 percent:

- Prepared grading layer over the waste

- Geocomposite gas venting layer
- Geomembrane liner
- Geocomposite drainage layer
- 24-inch barrier protection layer
- 6-inch topsoil layer

For 4 percent slopes:

- Prepared grading layer over the waste
- Geocomposite gas venting layer
- Minimum 18-inch barrier soil layer (Permeability less than $1x10^{-6}$ cm/sec. The thickness shall be verified through permeability testing.)
- Geomembrane liner
- Geocomposite drainage layer
- 24-inch barrier protection layer
- 6-inch topsoil layer

The specifications and construction requirements for the final cap materials will meet the requirements of 6 NYCRR Part 360-2.13(r).

2.6 Current Environmental Monitoring Program

The locations of existing monitoring points are shown on Figure 3. Monitoring of the existing facility includes sampling and testing groundwater, surface water and leachate. Groundwater samples are collected from monitoring wells that include upgradient and downgradient wells screened in the overburden till and from the groundwater collection systems that underlie the facility.

2.6.1 Groundwater

Locations of the existing monitoring wells in the monitoring program (upgradient wells MW-A, MW-B and downgradient wells MW-C, MW-D, MW-E, MW-F and MW-G) are shown on Figure 3 and the table in Appendix A provides a summary of the monitoring well details. Samples are collected quarterly and analyzed for the 6 NYCRR Part 360 "baseline" parameters (1 quarter) and for the 6 NYCRR Part 360 "routine" parameters (3 quarters). The monitoring wells have been monitored quarterly for several years resulting in the background water quality information for the site (see Section 2.7 for discussion of background data). The NYSDEC parameter lists are presented in Appendix B.

In addition to the monitoring wells, groundwater collection systems underlie the facility and are monitored to detect potential impacts that might be caused by leakage through the liner system. Figure 3 depicts the groundwater collection system sampling locations for Cells 1, 1A, 2, 3 and 4.

Groundwater is currently collected from Cells 1 (GSS-1), 1A (GSS-1A), 2 (GSS-2), 3 (GSS-3) and 4 (GSS-4). Groundwater samples from Cells 1, 2, 3 and 4 are collected at the location of the groundwater pipes discharge to the east of the respective cell. Currently, groundwater samples from Cell 1A are collected at the location of the groundwater pipe discharge to the spill tank located adjacent to the leachate storage tank. Liquid is periodically pumped from the spill tank into the leachate tank. Samples from the groundwater collection systems are collected quarterly and analyzed for the same parameters as the samples collected from the monitoring wells (i.e., baseline parameters (1 quarter) and routine parameters (3 quarters)).

2.6.2 Surface Water

The locations of the existing surface sampling locations are shown on Figure 3. Surface water samples are collected quarterly from Tributary 4 to Erwin Hollow Creek (upgradient (SW-1) and downgradient (SW-2) of the Hakes C&D Facility) and the discharges from sediment ponds 1 (SW-4), 2 (SW-3) and 3 (SW-5a). The samples are analyzed for the same parameters as the samples collected from the groundwater monitoring wells (i.e., baseline parameters (1 quarter) and routine parameters (3 quarters)). Surface water samples are also collected from Tributary 4 to Erwin Hollow Creek (SW-1A) and Erwin Hollow Creek (SW-2A and SW-7) and analyzed for 6NYCRR Part 360 field parameters. The current surface water sampling is summarized on Table 5.

In addition, samples collected from each of the surface water locations are analyzed for suspended solids concentrations. Air temperature measurements are made at each of the surface water monitoring locations and the contrast of site discharges to the accepting streams is observed and noted at each of the applicable surface water monitoring locations.

2.6.3 Leachate

Composite leachate samples (from Cells 1, 1A, 2, 3 and 4) are collected semi-annually from the leachate collection system at the leachate storage tank and analyzed for the 6 NYCRR Part 360 "expanded" parameters. See Figure 3 for the location of the leachate storage tank.

In order to assess existing leachate radiological conditions, leachate samples will be collected and analyzed over the course of the next three years on a semi-annual basis for radioactivity, following the normal collection procedure for leachate. Once these initial samples are obtained, the leachate sampling frequency for radiological conditions will be reduced to an annual basis. The samples will be obtained in the following manner; first semi-annual sampling event will include sampling each operation landfill cell (1, 1A, 2, 3, 4, 5 and 6, 7 drains into 4) and one leachate tank, second semi-annual sampling event will include only those cells that have received gas well waste (currently only 5 and 6). Sampling events for the following two years will be similar, though should account for the addition of Cells 7 and 8 and location of gas well waste. In addition to the leachate sampling, sediment from the leachate tanks shall be collected during each cleaning event or at least once during the initial three year period if the tanks are not cleaned. After the initial three year period, sediment shall be sampled whenever the tanks are cleaned.

For a normal round of sampling, radionuclide analytes will include:

- Radium-226 per EPA 903.1
- Radium-228 per EPA 904.0
- Total Uranium per EPA 908.0
- Gamma Spectrum per EPA 901.1

If special investigation is necessary, isotopic thorium and/or isotopic uranium may be specified.

Before sampling, the laboratory will be contacted to determine:

- how much water is necessary for analysis of each analyte; and
- if acid (type and and how much) should be added to the water to keep the radionuclides from absorbing to the wall of the container.

After this information is obtained, field technicians will ensure that the proper containers and reagents are available for use in the field. Two sets of samples will be collected, one to be filtered and one sent as unfiltered. "Filtered" samples will be filtered using a 0.45 micron filter via the standard technique. (Note: The presence of sediment or suspended solids in a sample can greatly affect the apparent radionuclide concentration and thus care should be used to ensure filtering is effective.) Once the samples are appropriately obtained, the samples will be sent to the laboratory via ground shipping.

The results of these analyses will be submitted to the NYSDEC Region 8 and Central Office as required.

2.7 Existing Water Quality

The monitoring wells and sampling intervals used to establish the pre-operational water quality values for the site are listed on Table 1.

Existing water quality values were initially discussed in Reference 1. As discussed in Reference 1, elevated turbidity, dissolved solids and metals concentrations observed in samples collected from MW-1, MW-2, MW-3d and MW-6 may be a result of the well screen and filter pack opening sizes, allowing the migration of fine particles from the screened formations into the wells. For this reason, inorganic parameter and turbidity data collected from MW-1, MW-2, MW-3d and MW-6 were not incorporated into the existing water quality values. The locations of MW-1, MW-2, MW-3d and MW-6 are shown on Figure 3. Monitoring well MW-3d was decommissioned in June 2003. There are no future plans to use MW-1, MW-2 and MW-6. These wells will be decommissioned as noted on Table 3.

The existing water quality values were updated in August 2004 to include preoperational data collected from MW-E, MW-F and MW-G. The current preoperational water quality values for the monitoring wells are listed on Table 2.

2.7.1 Site Groundwater Chemistry

MMCE prepared a Piper diagram comparing the analytical data for the monitoring wells at the site (see Figure 5). Piper diagrams (also referred to as tri-linear diagrams) permit the cation and anion composition of many samples to be represented graphically, allowing data trends to be discerned visually. The computer program AqQA by Rockware (2003) was used to plot the diagram presented in Appendix I. Data from MW-A, MW-B, MW-D, MW-E, MW-F, MW-G, MW-H and MW-J (August 2003) and MW-C (August 2004) are plotted on the diagram. See Figure 3 for the well locations.

The diagram indicates that the relative proportion of cation parameters in samples collected from monitoring wells (MW-A, MW-H and MW-J) are similar to those in samples collected from monitoring wells (MW-B, MW-C, MW-D, MW-E, MW-F and MW-G) but the relative proportion of anion parameters are different. These differences are primarily due to the difference in the relative proportion of the sulfate concentrations between the two groups of wells. The final projected positions on the Piper summary diamond plot are also different. This indicates that the water chemistry in the samples collected from monitoring wells MW-A, MW-H and MW-J, located in the southwest area of the site, is different than that of the samples from monitoring wells MW-B, MW-C, MW-D, MW-E, MW-F and MW-G, located on the north and east sides of the site. As described in Section 3, groundwater monitoring and evaluation for the expansion will be divided into two groups in consideration of the difference in groundwater chemistry between these two areas of the site.

3.0 PROPOSED WATER QUALITY MONITORING PROGRAM

The following section describes the proposed water quality monitoring plan to be implemented at the site. This section is structured in accordance with the Part 360 regulations and includes four subsections; proposed site layout, proposed environmental sampling program, contingency water quality and reporting of data.

3.1 Proposed Site Layout

The proposed site plan is shown in Figure 6. This figure shows the existing 23.2-acre cell area, as well as the contiguous 34.7-acre proposed expansion cell area. More detailed drawings of the proposed site layout can be found in the engineering plans, which are part of this 6 NYCRR Part 360 Application for a Solid Waste Permit Modification.

The 34.7-acre development will be constructed beginning with the eastern portion of Cell 5, then the eastern portion of Cell 6, then the western portions of Cells 5 and 6 concurrently, then Cell 7 and finally Cell 8.

3.2 Proposed Environmental Sampling Program

An operational water quality monitoring program will be implemented during operation, closure and post closure of the facility. The following provides a summary of the environmental monitoring points to be employed as a part of the Operational Water Quality Monitoring Program, including the monitoring frequency and parameters for analysis. The locations of the groundwater, surface water and leachate points to be used for the proposed monitoring are shown on Figure 6. The groundwater monitoring well installation and pre-operational sampling schedule (including parameters for analysis) and the decommissioning schedule are summarized on Table 3.

3.2.1 Groundwater Monitoring Wells

The operational groundwater monitoring program will consist of the monitoring wells shown on Figure 6. These monitoring wells will be included in the operational monitoring program in accordance with the schedule presented on Table 3. Each of the monitoring wells will be sampled once for baseline parameters and three times for routine parameters prior to deposition of waste in the adjacent cells. Yearly operational monitoring will then consist of one round of baseline parameters and three rounds of routine parameters, with the baseline parameters rotated to a different quarter each year.

The overburden till is the first water bearing unit of the critical stratigraphic section. 6 NYCRR Part 360-2.11(c)(1)(i) requires that monitoring well spacing in the first water bearing zone not exceed 500 feet along the downgradient perimeter of the facility and that upgradient or crossgradient wells not exceed 1,500 feet. New monitoring wells will be installed in accordance with the Part 360 requirements. Where appropriate, existing monitoring wells will be incorporated into the monitoring program.

Upgradient Wells

Existing upgradient groundwater monitoring wells MW-A and MW-B will continue to be used as upgradient monitoring points until construction of Cell 8. These wells and well MW-6, not currently in the monitoring program, will be decommissioned prior to construction of Cell 8. Existing upgradient groundwater monitoring well MW-H will be incorporated into the monitoring program as described in Section 3.2.5. Additionally, upgradient groundwater monitoring wells MW-L and MW-M, to be constructed upon issuance of the expansion permit, will be utilized to monitor the groundwater upgradient of the cell areas.

Downgradient Wells

As shown on Figure 6 and Table 3, Hakes plans to continue to utilize downgradient monitoring wells MW-C, MW-D, MW-E, MW-F and MW-G to monitor Cells 1A, 2, 3 and 4. Downgradient groundwater monitoring well locations for Cells 5, 6 and 8 were selected by superimposing the groundwater contours, shown Figure 4, on the subgrade plans of the expansion cells (see engineering plans) and placing a well downgradient of the sump. The subgrade in Cell 7 is sloped toward the sump in Cell 4 and will therefore be monitored downgradient in conjunction with Cell 4. New monitoring wells will be installed in accordance with the requirements of 6 NYCRR Part 360-2.11(a)(8)(ii). Wells will be screened across the water table. A groundwater monitoring well installation plan is included in Appendix C.

Downgradient groundwater monitoring well MW-N, to be constructed prior to the placement of waste in Cell 5, will be utilized to monitor the groundwater downgradient of Cell 5. MW-N and MW-G are located approximately 88 feet apart.

Downgradient groundwater monitoring well MW-O, to be constructed prior to the placement of waste in Cell 6, will be utilized to monitor the groundwater downgradient of Cell 6. MW-O and MW-N are located approximately 377 feet apart.

Downgradient groundwater monitoring well MW-P, to be constructed prior to the placement of waste in Cell 8, will be utilized to monitor the groundwater downgradient of Cell 8. MW-P and MW-J are located approximately 224 feet apart and MW-P and MW-C are located approximately 490 feet apart.

Monitoring wells will be added to the monitoring program prior to the disposal of waste in adjacent cells as outlined in Table 3. During the first year, each well that will be used to monitor new cells being constructed will be analyzed such that they have been tested once for baseline parameters and three times for routine parameters (Appendix B). These data will be used to update the existing water quality database as discussed in Section 3.2.5.

Following the first year of monitoring, each monitoring well will be analyzed quarterly, once for baseline parameters and three times for routine parameters, with the baseline sampling event rotated to a different quarter each year. A schedule for completion of each round of sampling is included in Table 4.

MW-I, installed for the expansion hydrogeologic studies is not included in the monitoring program and will be decommissioned prior to construction of the eastern portion of Cell 6. Similarly, MW-K, installed for the expansion hydrogeologic studies is not included in the monitoring program and will be decommissioned prior to construction of Cell 7. MW-1, not in the current monitoring program will be decommissioned prior to construction of the western portion of Cell 6. Groundwater monitoring well decommissioning procedures are included in Appendix D.

3.2.2 Groundwater Collection Systems

Samples of the liquid discharging from the groundwater suppression systems will be collected quarterly and analyzed for the same parameters as the groundwater monitoring well samples.

The groundwater collection systems have been designed to allow for separate sampling of each cell. As discussed in Section 2, monitoring of the groundwater collection systems beneath Cells 1, 1A, 2, 3 and 4 will continue at the locations discussed in Section 2.6.1 and shown on Figure 3.

Similar to the existing groundwater collection system monitoring points, groundwater collected beneath Cells 5 (GSS-5) and 6 (GSS-6) will be discharged to the east of the respective cell (see Figure 6 for sampling locations). Groundwater collected beneath Cell 7 and the northern portion of Cell 8 will be tied into the existing groundwater collection pipes associated with Cells 4 and 3, respectively, resulting in combined groundwater samples from Cells 7 and 4 (GSS-4&7) and from Cells 8 (northern part) and Cell 3 (GSS-3&8N). Groundwater collected beneath the southern part of Cell 8 (GSS-8S) will be discharged to the south.

Sampling of groundwater collected from the groundwater collection system of each cell will begin one quarter prior to placement of waste in the cell. For example, groundwater collected from GSS-5 will begin during the quarter prior to the initial placement of waste in the Cell 5. The current designations of the samples collected from beneath Cells 4 (GSS-4) and 3 (GSS-3) will change as groundwater collected from Cell 7 and Cell 8 (northern part) is combined with groundwater collected from Cells 4 (GSS-4&7) and 3 (GSS-3&8N), respectively.

3.2.3 Surface Water

Surface water samples will be collected quarterly and analyzed for the same parameters as the groundwater monitoring well samples. Samples will be collected from additional surface water locations and analyzed for 6NYCRR Part 360 field parameters, as shown on Table 5. In addition, samples collected from each of the surface water locations will be analyzed for suspended solids concentrations. Air temperature measurements will made at each of the surface water monitoring locations and the contrast of site discharges to the accepting streams will be observed and noted at each of the applicable surface water monitoring locations. Table 5 summarizes the sampling parameters for the surface water locations according to the stage of site development. Proposed surface water monitoring locations are shown on Figure 6.

Throughout site development, samples collected from SW-4 and SW-5A will continue to be tested for the same parameters as the groundwater monitoring well samples and samples collected from SW-7 will continue to be tested for 6NYCRR field parameters. As shown on Table 5, samples collected from SW-1A will be analyzed for the same parameters as the groundwater monitoring well samples and SW-1 will be tested for 6NYCRR Part 360 field parameters upon approval of the expansion permit.

Additional surface water sampling locations to be implemented for the expansion cells and analyzed for the same parameters as the groundwater monitoring wells include the discharge from Pond 4 (SW-6) and the discharge from Pond 5 (SW-3A). Sampling of SW-6 will begin at the completion of Pond 4 construction (during the construction of the eastern portion of Cell 5). Sampling of SW-3A will begin at the completion of Pond 5 construction (during the construction of Cell 7) and will replace sampling at SW-3, which will be eliminated during the construction of Cell 8 and elimination of Pond 2. The locations of the SW-6 and SW-3A are shown on Figure 6.

As shown on Table 5, samples collected from SW-2A will be analyzed for the same parameters as the groundwater monitoring well samples and SW-2 will be tested for 6NYCRR Part 360 field parameters upon the completion of Pond 5 construction (during the construction of Cell 7). The location of SW-2A, downstream of the entire site discharge area, is shown on Figure 6.

Modifications to the EMP were required to account for additional stormwater discharge locations that were created during the 2007 construction season. An additional outfall was constructed to allow stormwater to discharge from Pond #1 through a secondary pond treatment system and ultimately into Tributary #4 of Erwin Hollow Creek. In addition stormwater runoff north of the facility was collected in an upstream diversion ditch and discharged into Tributary #4 of Erwin Hollow Creek. Sampling locations denoted as SW-8 (upstream diversion ditch outfall) and SW-4A (discharge from secondary pond treatment system) have been added to Figure 6 and Table 5. These two locations will be tested for 6NYCRR Part 360 field parameters, air temperature, TSS and visual contrast as shown on Table 5.

The proposed East Pond will be located to the east of Tributary 4 of Erwin Hollow Creek and will be utilized to provide additional water quality improvements to stormwater collected in Pond #1 and Pond #3. Following construction of the East Pond, an additional outfall will be constructed to allow stormwater to discharge to the receiving stream. Sampling location denoted as SW-9 (East Pond) has been added to Figure 6 and Table 5. A surface water sample will be collected quarterly and analyzed for the parameters listed in Table 5. In addition, SW-2 will be moved downgradient of the East Pond outlet (SW-9) as shown on Figure 6.

During initial operation of the East Pond, temperature measurements will be completed every two weeks. Temperature measurements will be made in the pond (micropool), at the pond outlet pipe, and upstream and downstream of the outlet pipe. The measurements will be made through the summer months (July through September) and reported to the NYSDEC at the end of each month. If the East Pond discharge temperature is less than 70 degrees during this period the bi-weekly temperatures will not be made in subsequent years. Quarterly temperature measurements will continue at the East Pond outlet as shown on Table 5.

If the temperature of the East Pond discharge exceeds 70 degrees, during the initial operation or subsequent quarterly monitoring, the cause of the elevated temperature will be evaluated. The following sequence shall be used as a general guide.

1. A water temperature measurement shall be completed downstream in Tributary 4 of Erwin Hollow Creek immediately prior to its intersection (mixing) with Erwin Hollow Creek.

    - If the measured temperature is less than 70 degrees, no thermal impact to Erwin Hollow Creek is occurring and the discharge shall continue and no further evaluation is required.
    - If the measured temperature is 70 degrees or higher, the East Pond outlet valve will be closed to prevent further discharge to the receiving stream.

2. A water temperature measurement shall be completed at the inlet of the East Pond to determine if the stormwater being discharged from Pond #1 and Pond #3 is at an elevated temperature.

    - If the inlet temperature is less than 70 degrees then warming of the stormwater can be attributed to the East Pond. If this is the case the valve from Pond #1 will be closed and the valve to allow discharge directly into the receiving stream will be opened as long as the water quality is suitable.

3. The East Pond discharge can be directed into the secondary pond structure (south end of East Pond) and passed through the sand filter. The sand filter should provide a reduction in water temperature as the water passes through the mass of drainage media. The stormwater discharge temperature shall be measured.

    - If the discharge temperature is less than 70 degrees, discharge can continue.
    - If the discharge temperature is 70 degrees or warmer the stormwater discharge from the East Pond will be stopped.

4. The East Pond, Pond #1 and Pond #3 are equipped with valves to allow temporary storage of stormwater. These valves can be closed to discontinue discharge until the stormwater has had time to cool. This may include leaving the valves closed overnight or until the next stormwater runoff event. Prior to discharging stored stormwater, a temperature measurement shall be completed to verify the discharge temperature is less than 70 degrees.

5. If thermal impacts become an issue, structural measures may be evaluated to try to minimize thermal impacts. All proposed modifications to the ponds shall be submitted to the NYSDEC for review and approval prior to implementation.

3.2.4 Leachate

Composite leachate samples will continue to be collected at the leachate storage tank and analyzed on a semi-annual basis for the same parameters as the current leachate samples. Leachate collection details for the existing cells are discussed in Section 2.6.3.

Similar to the existing cells, the leachate collection pipes for Cells 5 and 6 will convey leachate by gravity from the west to respective sump located on the east side of the cell. Leachate will be pumped from the sumps through a riser to a solid leachate transfer line (currently operational for Cells 1, 1A, 2, 3 and 4) that conveys leachate by gravity to the leachate storage tank. The leachate collection pipes for Cell 7 and the upper portion of Cell 8 tie into the existing leachate collection pipes for Cells 4 and 3. The leachate collection pipes for the lower portion of Cell 8 will convey leachate by gravity from the north to the sump located on the south side of the cell. Leachate will be pumped from the sump through a riser to a solid leachate transfer line that will convey the leachate by gravity to the leachate storage tank.

Detailed drawings of the proposed leachate collection system can be found in the engineering plans.

3.2.5 Data Evaluation

Groundwater Monitoring Wells

Data from the groundwater monitoring wells will be evaluated to determine if a significant increase in the groundwater quality parameters has occurred. Analytical data obtained from surface water sampling, groundwater collection system sampling and leachate sampling will be evaluated on a qualitative basis by comparing data collected quarterly to historical data for the monitoring point.

The quarterly sampling data will be compared to the pre-operational water quality values as shown on Table 2. The water quality values shown in Table 2 are the current values being used to monitor the site and they will be used until the expansion is constructed. Following sampling of the expansion wells as discussed in Section 3.2.1, the water quality values will be updated as discussed below.

As indicated in Section 2.7.1, the water chemistry in the samples collected from monitoring wells MW-A, MW-H and MW-J, located in the southwest area of the site, is different than that of the samples from monitoring wells MW-B, MW-C, MW-D, MW-E, MW-F and MW-G, located on the north and east sides of the site. Because of the difference in groundwater quality between these two areas of the site, Hakes plans to develop two sets of existing water quality values to monitor the groundwater.

Upgradient wells MW-A and MW-H will provide background data for downgradient wells MW-J and proposed well MW-P located in the southwest corner of the site. MW-A will be decommissioned during construction of Cell 8 and MW-H will provide the upgradient monitoring point in this area. If the data collected from MW-P is not similar to the groundwater data collected from the other wells, located in the southwest area of the site (MW-A, MW-H and MW-J) then this will be discussed with the DEC and a different set of background data might be used for MW-P.

Until it is decommissioned during construction of Cell 8, upgradient well MW-B will provide background data for downgradient wells MW-C, MW-D, MW-E, MW-F and MW-G, located on the north and east sides of the site and for proposed wells MW-O and MW-N. Upgradient groundwater monitoring wells MW-L and MW-M are scheduled for construction upon approval of the expansion permit and will supplement, and eventually replace, MW-B. If the chemistry of the samples collected from MW-L and MW-M is similar to that MW-B, a revised set of existing water quality values (including pre-operational data of samples collected from MW-B, MW-C, MW-D, MW-E, MW-F, MW-G, MW-L and MW-M) will be calculated for comparison to operational data collected from downgradient wells MW-C, MW-D, MW-E, MW-F and MW-G.

The groundwater quality data collected for each quarter will be screened for parameters that exceed the existing water quality value for that parameter by three standard deviations.as specified in Part 360-2.11(c)(5)(ii)(d)(2)(i) . If no exceedances are found and there are no significant increases, the results will be reported to the NYSDEC as discussed in Section 3.4.

If exceedances are found for one or more parameters, as identified above, during consecutive sampling events, the data will be evaluated in accordance with one or more of the following procedures. These procedures will form the basis for a determination as to whether the exceedance is a significant increase from the existing water quality value:

- Analytical data obtained from leachate collected from the leachate collection system will be compared to the groundwater quality data. If the parameters identified as indicating a statistically significant difference are not found in the leachate, the increase is not landfill derived and the results are reported to NYSDEC as discussed in Section 3.4. If the parameter(s) of interest are in the leachate, then:

- The parameters of interest will be compared to the mean and mean plus three standard deviations for that parameter as calculated from the existing water quality data collected from that well (i.e. intra-well comparison). If the measured value is below the criteria as presented in Part 360-2.11(c)(5)(ii)(d)(2)(i), there is no significant increase and the results are reported to the NYSDEC as discussed in Section 3.4. If a significant increase is found, then:

- Data from upgradient monitoring wells will be reviewed. An intra-well comparison will be made at each upgradient well location for the parameter of interest. If the intra-well comparison indicates concentrations of the parameter of interest in an upgradient well that exceeds the criteria as presented in Part 360-2.11(c)(5)(ii)(d)(2)(i), then the results will be reported to the NYSDEC as discussed in Section 3.4; or,

- The existing water quality data will be evaluated for normality and prediction limits will be calculated in accordance with the distribution of the data and the number of quantified values. If the measured values are below the calculated prediction limits, there is no significant increase and the results are reported to the NYSDEC as discussed in Section 3.4

If the methods of data evaluation described above indicate a significant increase, the NYSDEC will be notified within 14 days of this finding and baseline monitoring will then be completed (verification sampling) for the monitoring wells in question. If the verification sample results for all parameters of interest do not indicate a significant increase, the NYSDEC will be notified; operational water quality monitoring will then continue. All the data will be reported to the NYSDEC.

If the values measured during the verification sampling are above the prediction limits calculated above, the NYSDEC will be notified within 14 days of this finding and a Contingency Monitoring Program, as described in Section 3.3, will be initiated.

If the data evaluation does not indicate a significant increase, we will use the data collected during the monitoring of the facility to expand the pre-existing database if appropriate. We will revise the pre-existing database and submit the updated values to the department annually.

Groundwater Collection Systems and Surface Water

For each sampling event the results of the groundwater collection systems and surface water quality sampling and analysis will be compared with historic data from the same sampling location using time series analysis to observe overall changes in water quality. Data tables will be completed, listing historic data and the current sampling event data, and reviewed for general concentration trends, abnormal detections and outliers.

If surface water sampling results indicate an exceedance of the State's water quality standards listed in 6NYCRR Part 703 (Surface Water and Groundwater Quality Standards and Groundwater Effluent Standards) the facility shall submit with the surface water monitoring results a plan that discusses the corrective work to be undertaken to address the exceedance.

In a letter to the NYSDEC dated May 1, 2008, the Hakes Facility proposed to discontinue pumping of the Cell 1A groundwater collection system. When pumping of the Cell 1A groundwater is discontinued, quarterly monitoring will continue at sampling point GSS-1A. The results of each quarterly sampling event shall be compared with historic data from this location. Data tables (as described above) will continue to be developed to aid in identifying any trends, abnormal detections and/or outliers. Any significant changes will be reported and discussed with NYSDEC personnel.

3.3 Contingency Water Quality Monitoring

Contingency water quality monitoring will be initiated upon the determination that a significant increase has occurred for one or more of the baseline parameters as described in Section 3.2.5.

Contingency water quality monitoring will be implemented as described below.

3.3.1 Sampling and Analysis

Within 90 days of implementing a contingency water quality monitoring program, groundwater samples will be collected from all monitoring wells which are actively part of the groundwater monitoring system, and analyzed for expanded parameters. If any constituents are detected in the downgradient well(s) as a result of the expanded parameter analysis, a minimum of two independent samples will be collected from each monitoring well within 30 days of obtaining the results of the expanded parameter analysis, and analyzed for the detected constituents. These samples will be collected within two weeks of each other and then compared to the existing groundwater quality values established as discussed in Section 4.1. If an increase in the existing water quality values in the upgradient well(s) is indicated by this comparison, the existing water quality values for these parameters will be revised to be the arithmetic mean of the results of each parameter from the upgradient wells within that flow regime. If it can be shown that selected expanded parameters are not reasonably expected to be in, or derived from, the waste contained in the landfill, based on the leachate sampling discussed in Section 2.5.3, the NYSDEC will be petitioned to delete these parameters from the required analysis.

Within 14 days of receiving the data obtained from the above sampling, the NYSDEC will be notified of the identity of any expanded parameters that have been detected. In addition, quarterly sampling from that point on, for all currently active monitoring wells, will consist of three quarters of baseline parameters plus those expanded parameters detected as a result of the expanded parameter sampling, and one quarter of sampling and analysis for expanded parameters. Groundwater protection standards for the detected expanded parameters will be established in accordance with 6 NYCRR Part 360-2.11(c)(5)(iii)(f).

If the concentrations of any of the expanded parameters, included in the above monitoring program, are shown to be at or below existing water quality values for two consecutive sampling events, the NYSDEC will be notified and a petition to remove that parameter(s) from the contingency water quality monitoring program will be submitted for approval. If the concentrations of all the expanded parameters are shown to be at or below existing water quality values for two consecutive sampling events, the NYSDEC will be notified and a petition to return to operational water quality monitoring will be presented for approval.

If the concentrations of any expanded parameters are above existing water quality values, but all concentrations are below the groundwater protection standard established above, then contingency water quality monitoring will continue as described above.

However, if one or more expanded parameters are detected at significant levels above the groundwater protection standards, in any sampling event, the NYSDEC will be notified within 14 days of this finding to identify the expanded parameters that have exceeded the groundwater protection standard. In addition, in accordance with 6 NYCRR Part 360-2.11(c)(5)(iii)(e), efforts will be undertaken to either: A) characterize the nature and extent of the release by installing additional monitoring wells, install at least one additional well at the facility boundary in the direction of migration, notify all persons who own land or reside over any part of the plume and initiate an assessment of corrective actions or B) submit documentation that a source other than the landfill caused the contamination.

3.4 Reporting of Data

Data obtained from the operational water quality monitoring program will be reported to the NYSDEC with the quarterly report for the facility, unless more rapid reporting is identified as the result of a significant increases discussed above. The reporting of analytical data will be completed in accordance with 6 NYCRR Part 360-2.11(c)(5)(iv) and will include a description of sample collection methodologies, field forms, chain-of-custody, quality assurance/quality control documentation, identification of sampling locations, data summary tables, and a discussion of the collected data, including a data quality assessment report. Data will be reported to both the NYSDEC Division of Solid Waste Bureau of Municipal Waste Permitting in Albany and the Region 8 Solid Waste Engineer in Buffalo. In addition, an annual report will also be submitted which summarizes the data collected over the previous year, including discussions regarding observed changes in groundwater, surface water, leachate, etc.

Copies of the quarterly analytical reports will be kept at the Hakes C&D Disposal, Inc. office in Painted Post, New York.

4.0 REFERENCES

1. McMahon & Mann Consulting Engineers, P.C. letter to New York State Department of Environmental Conservation, August 18, 1999 regarding environmental monitoring.

2. McMahon & Mann Consulting Engineers, P.C., "Hakes Construction and Demolition Debris Landfill, Landfill Expansion Project, 6 NYCRR Part 360 Solid Waste Management Permit Modification Application, Part III Hydrogeologic Report," dated February 2006.

TABLES

Table 1 - Summary of Wells Used for Existing Water Quality

Monitoring Well	Period of Preoperational Data Collection	Number of Quarterly Samples Included in Preoperational Data
Field Parameters (except Turbidity) & Leachate Indicators		
MW-1	March 1994 - June 1999	19
MW-2	March 1994 - June 1999	22
MW-3D	March 1994 - June 1999	22
MW-6	March 1994 - June 1999	22
MW-A	December 1999 - March 2000	2
MW-B	December 1999 - March 2000	2
MW-C	December 1999 - March 2000	2
MW-D	December 1999 - March 2000	2
MW-E	February 2002 - August 2002	3
MW-F	August 2003 - May 2004	3
MW-G	August 2003 - May 2004	3
Inorganic Parameters, Turbidity		
MW-A	December 1999 - March 2000	2
MW-B	December 1999 - March 2000	2
MW-C	December 1999 - March 2000	2
MW-D	December 1999 - March 2000	2
MW-E	February 2002 - August 2002	3
MW-F	August 2003 - May 2004	3
MW-G	August 2003 - May 2004	3

Table 2 - Current Preoperational Water Quality Values

Parameter List:	Number of Times Tested	Number of Times NOT Detected or below Detection limit	Number of Times Detected	Arithmetic Mean	Standard Deviation	Mean + 3(standard deviations)	Water Quality Standards
Field Parameters:							
Conductivity (uMHOS/cm)	102	0	102	422	271	1236	
Sampling Depth (ft)							
Depth to Groundwater (ft)							
Eh (MV)	102	0	102	168	113	506	
pH	102	0	102	7.4	1.26	11.18	6.5-8.5
Temperature (deg. C)	102	0	102	10.1	3.2	19.6	
Turbidity (NTU)	17	0	17	19.67	12.73	57.87	5
Leachate Indicators (mg/L):							
TOC	102	11	91	7	20	68	
Alkalinity as $CaCO_3$	100	0	100	106	72	322	
Ammonia as N	102	37	65	0.2	0.3	1.1	2
Biochemical Oxygen Demand	36	33	3	3	1	6	
Chloride	102	0	102	23.03	29.63	111.93	250
Chemical Oxygen Demand	101	69	32	53.1	135.6	459.9	
Color (Pt. Co. U.)	30	4	26	161	319	1117	15
Nitrate as N	99	38	61	0.276	0.258	1.051	10
Total Hardness as $CaCO_3$	101	0	101	190	132	585	
Kjeldahl Nitrogen as N	35	24	11	2	2	8	
Phenolics	101	77	24	0.01	0.031	0.102	0.001
Dissolved Solids	102	0	102	243	175	769	500
Sulfate as SO_4	102	1	101	59	71	273	250
Bromide	16	16	0	1	0	1	
Inorganic Parameters (mg/L):							
Aluminum	11	3	8	0.488	0.557	2.16	
Antimony	11	10	1	0.05	0.02	0.09	0.003
Arsenic	11	8	3	0.002	0.001	0.004	0.025
Barium	11	1	10	0.04	0.02	0.09	1
Beryllium	11	11	0	0.002	0	0.002	
Boron	11	9	2	0.059	0.03	0.15	1
Cadmium	17	15	2	0.004	0.002	0.009	0.005
Calcium	17	0	17	54.2	55.2	219.9	
Chromium	11	8	3	0.01	0	0.02	0.05
Cobalt	11	10	1	0.01	0	0.01	
Copper	11	11	0	0.02	0	0.02	0.2
Cyanide	11	10	1	0.01	0	0.01	0.2
Hexachromium	11	11	0	0.01	0	0.01	
Iron	17	0	17	1.154	1.17	4.665	0.3
Lead	17	9	8	0.001	0.001	0.003	0.025
Magnesium	17	0	17	16.6	21.5	81	
Manganese	17	0	17	0.395	0.659	2.373	0.3
Mercury	11	11	0	0.0002	0	0.0002	0.0007
Nickel	11	10	1	0.012	0	0.012	0.1
Potassium	17	0	17	3.581	3.966	15.479	
Selenium	11	10	1	0.002	0.001	0.004	0.01
Silver	11	11	0	0.01	0	0.02	0.05
Sodium	17	0	17	16.1	22.5	83.7	20
Thalium	11	11	0	0.001	0	0.001	
Vanadium	11	11	0	0.01	0	0.01	
Zinc	11	7	4	0.02	0.01	0.05	

NOTES:

1. The Water Quality Standards were obtained from the NYSDEC Water Quality Regulations Parts 700-705.

Table 3 - Proposed Monitoring Well Construction and Monitoring

Monitoring Point	Approximate Location Northing (ft)	Easting (ft)	Installation Status	Pre-operational Sampling Status	Operational Sampling Life	Approximate Distance to Limit of Waste (feet)
Upgradient Wells						
MW-A	10407	3365	Installed	Currently sampled (operational)	Current through decommissioning (see Note 1)	
MW-B	10942	3389	Installed	Currently sampled (operational)	Current through decommissioning (see Note 1)	
MW-L	12040	4280	Upon approval of expansion permit	1 baseline parameter and 3 routine parameter events upon completion	Upon completion of pre-operational sampling through site life	
MW-M	12046	3365	Upon approval of expansion permit	1 baseline parameter and 3 routine parameter events upon completion	Upon completion of pre-operational sampling through site life	
MW-H	10865	2859	Installed	1 baseline parameter and 2 routine parameter events prior to MW-A decommissioning	Upon completion of pre-operational sampling through site life	
Downgradient Wells						
MW-C	10088	4114	Installed	Currently sampled (operational)	Current through site life	
MW-D	10377	4196	Installed	Currently sampled (operational)	Current through site life	
MW-E	10645	4274	Installed	Currently sampled (operational)	Current through site life	
MW-F	10912	4356	Installed	Currently sampled (operational)	Current through site life	
MW-G	11183	4424	Installed	Currently sampled (operational)	Current through site life	
MW-J	10021	3402	Installed	1 baseline parameter and 2 routine parameter events prior to waste in Cell 8	Waste in Cell 8 through site life	
MW-N	11263	4462	Prior to waste in Cell 5	1 baseline parameter and 3 routine parameter events prior to waste in Cell 5	Waste in Cell 5 through site life	50
MW-O	11585	4658	Prior to waste in Cell 6	1 baseline parameter and 3 routine parameter events prior to waste in Cell 6	Waste in Cell 6 through site life	38
MW-P	10036	3625	Prior to waste in Cell 8	1 baseline parameter and 3 routine parameter events prior to waste in Cell 8	Waste in Cell 8 through site life	46

Notes:

1. Wells to be decommissioned include:
   MW-I * (during construction of the eastern portion of Cell 6)
   MW-1* (during construction of the western portion of Cell 6)
   MW-K * (during construction of Cell 7)
   MW-A, B, 2* and 6 * (during construction of Cell 8)
   * MW-1, MW-2, MW-6, MW-I and MW-K are not included in monitoring program

Table 4 - Proposed Water Quality Monitoring Schedule

YEAR	QUARTER	PARAMETER LIST
2006	First Quarter[1] Second Quarter Third Quarter Fourth Quarter	Routine Baseline Routine Routine
2007	First Quarter Second Quarter Third Quarter Fourth Quarter	Routine Routine Baseline Routine
2008	First Quarter Second Quarter Third Quarter Fourth Quarter	Routine Routine Routine Baseline
2009	First Quarter Second Quarter Third Quarter Fourth Quarter	Baseline Routine Routine Routine
2010	First Quarter Second Quarter Third Quarter Fourth Quarter	Routine Baseline Routine Routine

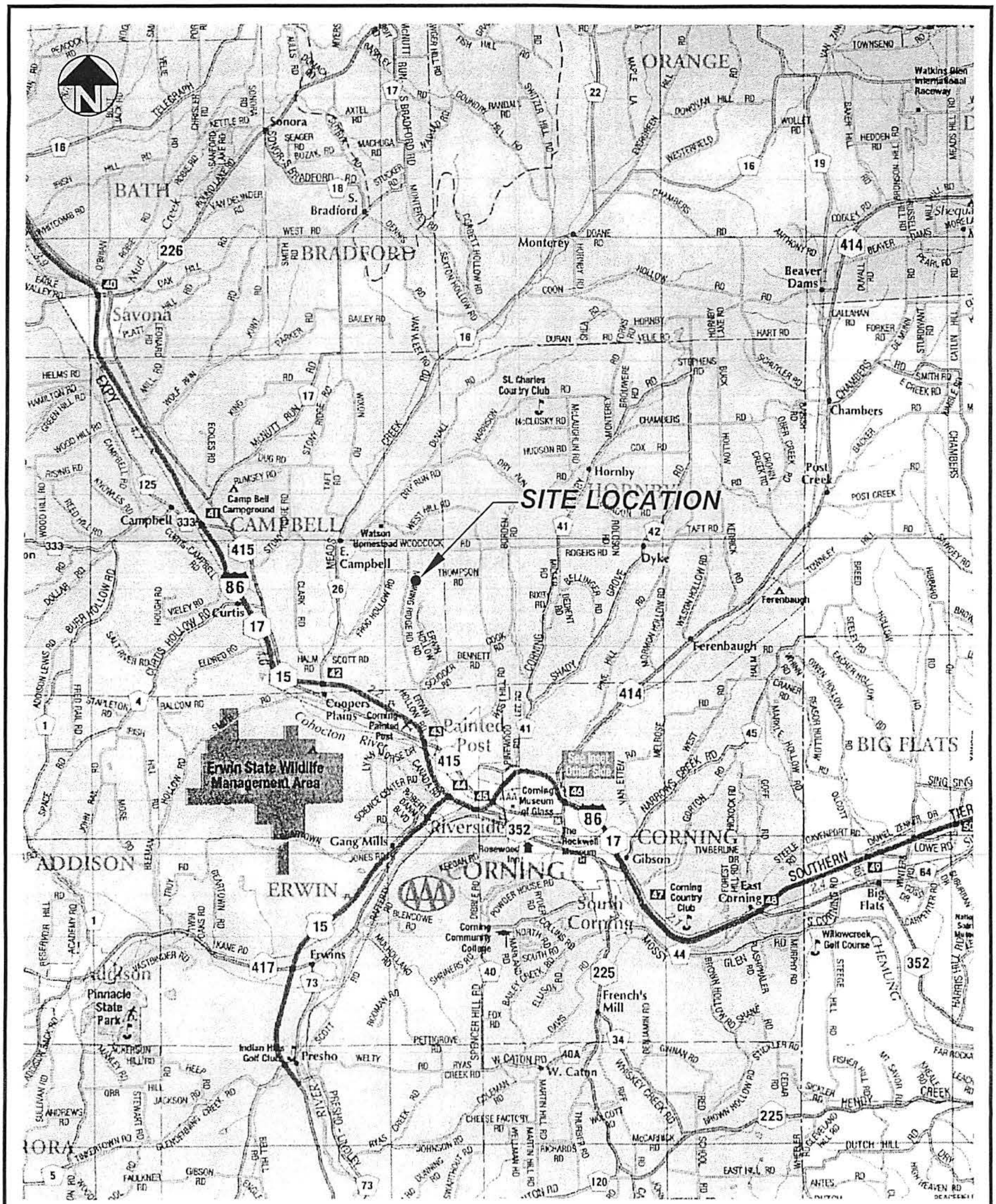
Note:

1. Samples were collected in February 2006 and analyzed for routine parameters.

Table 5 - Proposed Surface Water Monitoring Locations
(Table Revised May 2011)

	Sampling Parameters	
	Same as Groundwater Monitoring Wells (Scheduled 6NYCRR Part 360 Routine or Baseline Parameters), Air Temperature, Total Suspended Solids and Visual Contrast of Discharges Entering Stream	**6NYCRR Part 360 Field Parameters, Air Temperature, Total Suspended Solids and Visual Contrast of Discharges Entering Stream**
Current	SW-1A, SW-2, SW-3, SW-4, SW-5A, SW-6	SW-1, SW-2A, SW-4A, SW-7, SW-8
Upon approval of the East Pond	SW-1A, SW-2, SW-3, SW-4, SW-5A, SW-6	SW-1, SW-2A, SW-4A, SW-7, SW-8, SW-9
At completion of Pond 5 construction	SW-1A, SW-2A, SW-3A, SW-4, SW-5A, SW-6	SW-1, SW-2, SW-4A, SW-7, SW-8, SW-9

FIGURES

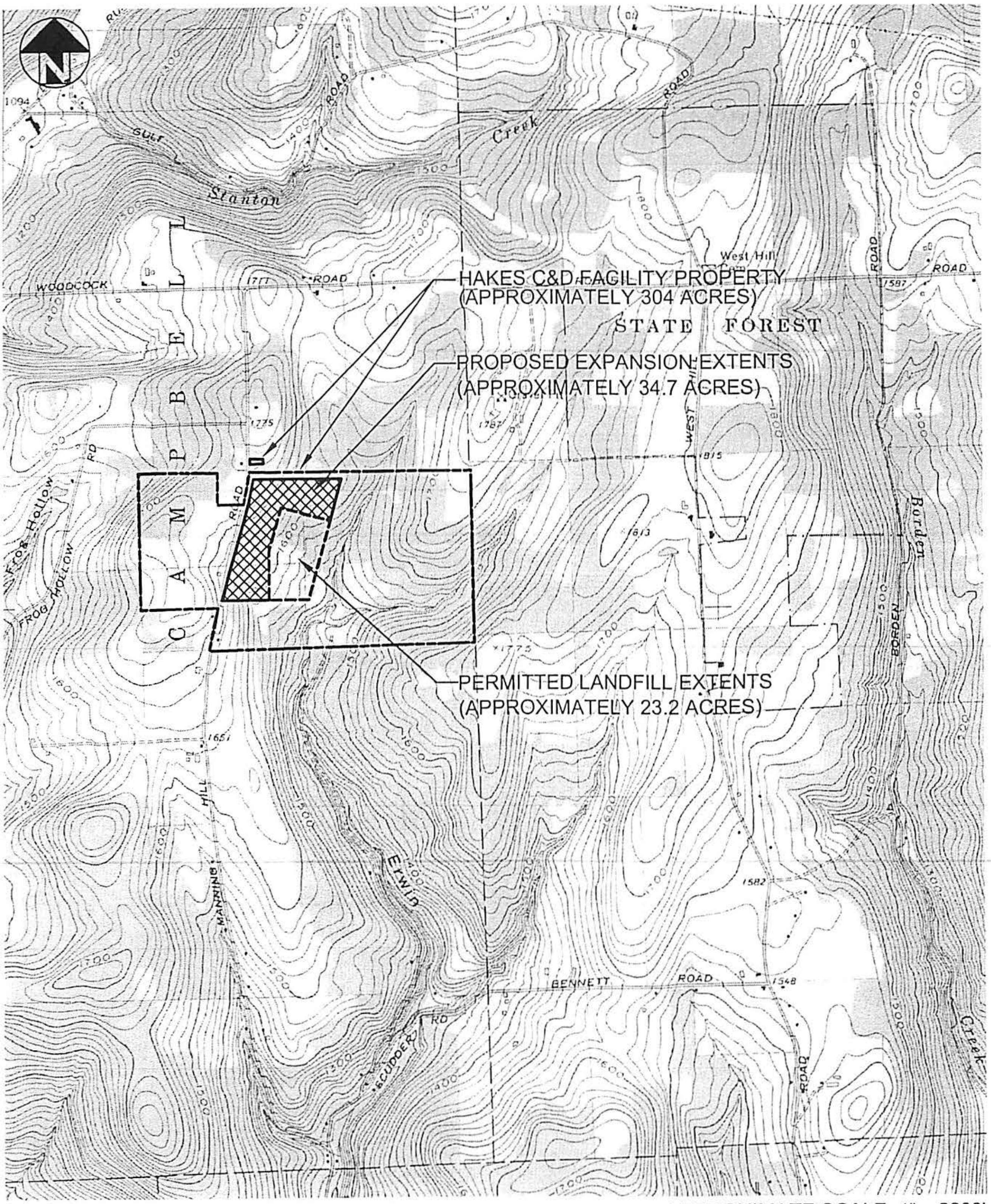


NOTE:

SCALE: N.T.S.

1. Base map created from AAA Special Area Service, Finger Lakes, New York (Map Works, Inc. 2003).

SITE LOCATION MAP	HAKES FACILITY EMP	McMahon & Mann Consulting Engineers, P.C.
DWG. NO. 98047-324		2495 MAIN STREET, SUITE 432 BUFFALO, NY 14214 (716) 834-8932 FAX: (716) 834-8934
FIGURE 1	STEUBEN COUNTY NEW YORK	

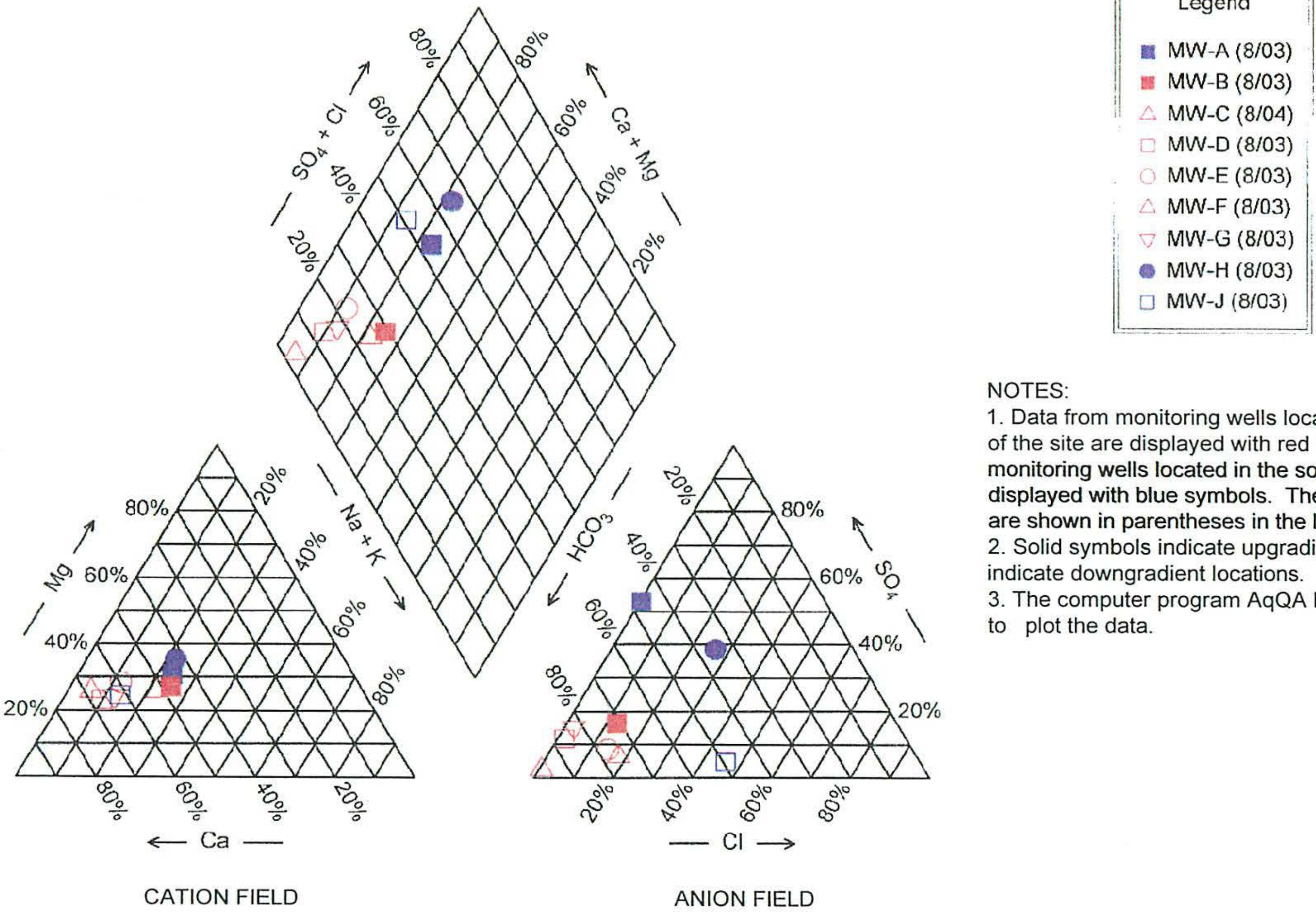


APPROXIMATE SCALE: 1" = 2300'

NOTE:

1. Site map adapted from USGS map titled "Corning, NY," dated 1969.

PROJECT LOCATION PLAN	HAKES FACILITY EMP	McMahon & Mann Consulting Engineers, P.C.
DWG. NO.98047-325		2495 MAIN STREET, SUITE 432 (716) 834-8932 BUFFALO, NY 14214 FAX: (716) 834-8934
FIGURE 2	STEUBEN COUNTY NEW YORK	



NOTES:

1. Data from monitoring wells located in the north and east sides of the site are displayed with red symbols and data from monitoring wells located in the southwest area of the site are displayed with blue symbols. The groundwater sampling dates are shown in parentheses in the legend.
2. Solid symbols indicate upgradient locations and open symbols indicate downgradient locations.
3. The computer program AqQA by Rockware (2003) was used to plot the data.

McMahon & Mann Consulting Engineers, P.C. 2495 MAIN STREET, SUITE 432 BUFFALO, NY 14214 (716) 834-8932 FAX: (716) 834-8934	HAKES FACILITY EMP STEUBEN COUNTY NEW YORK	PIPER DIAGRAM
		DWG. NO. 98047-332
		FIGURE 5

APPENDIX A

SUMMARY OF EXISTING MONITORING WELL DETAILS AND SAMPLING EVENTS

Appendix A
Summary of Monitoring Well Details

Monitoring Well	Global Coordinates (ft.) Northing	Easting	Ground Surface Elevation (ft.)	Top of Steel Casing Elevation (ft.)	Top of 2" PVC Elevation (ft.)	Top of PVC Screen Elevation (ft.)	Bottom of PVC Screen Elevation (ft.)	Hydraulic Conductivity (cm/sec)[4]
MW-A [1]	10407.12	3364.74	1613.14	1614.99	1614.70	1598.1	1578.1	$1.1x10^{-5}$
MW-B [1]	10942.30	3388.67	1639.29	1640.94	1640.70	1631.3	1616.3	$6.9x10^{-5}$
MW-C [1]	10088.05	4113.59	1521.90	1523.82	1523.56	1509.4	1494.4	$4.4x10^{-5}$
MW-D [1]	10377.06	4195.91	1531.43	1532.83	1532.58	1512.9	1497.9	$1.1x10^{-5}$
MW-E [1]	10645.40	4273.88	1543.45	1545.88	1545.63	1530.5	1515.5	$1.7x10^{-5}$
MW-F [1]	10913.19	4354.87	1550.09	1552.81	1552.56	1538.6	1523.6	$2.6x10^{-4}$
MW-F [2]	10912.46	4355.56	1559.4	1562.98	1562.42	--	--	--
MW-G [1]	11184.73	4423.45	1578.81	1580.26	1580.01	1570.8	1555.8	$3.4x10^{-4}$
MW-G [2]	11183.12	4424.16	1591.6	1594.74	1594.68	--	--	--
MW-H [3]	10865.47	2858.68	1686.30	1688.62	1688.42	1678.3	1668.3	$6.2x10^{-4}$
MW-I [3]	11919.37	3705.34	1703.84	1706.56	1706.40	1699.3	1698.3	Not measured
MW-J [3]	10021.16	3402.10	1586.00	1588.57	1588.35	1572.7	1562.7	$9.9x10^{-5}$
MW-K [3]	11305.64	3409.72	1679.50	1682.08	1681.90	1674.2	1672.2	Not measured

NOTES:

1. Survey information (Northing, Easting, Ground Surface, Top of Steel and Top of PVC Elevations) based on survey completed by B&R Surveying, L.L.C. dated February 2000.
2. Survey information (Northing, Easting, Ground Surface, Top of Steel and Top of PVC Elevations) based on survey completed by B&R Surveying, L.L.C. dated September 23, 2004 after wells were raised during construction of Cell 3.
3. Survey information (Northing, Easting, Ground Surface, Top of Steel and Top of PVC Elevations) based on survey completed by B&R Surveying, L.L.C. dated February 27, 2004.
4. Hydraulic conductivity values taken from Hydrogeologic Report, Part III of this Permit Application.

Appendix A

Summary of Operational Water Quality Sampling Events

MW-D (continued)	August-05	Routine Analysis
	November-05	Routine Analysis
	February-06	Routine Analysis
MW-E	November-02	Routine Analysis
	February-03	Routine Analysis
	May-03	Routine Analysis
	August-03	Routine Analysis
	November-03	Baseline Analysis
	February-04	Routine Analysis
	May-04	Routine Analysis
	August-04	Routine Analysis
	November-04	Baseline Analysis
	February-05	Baseline Analysis
	May-05	Routine Analysis
	August-05	Routine Analysis
	November-05	Routine Analysis
	February-06	Routine Analysis
MW-F	August-04	Routine Analysis
	November-04	Baseline Analysis
	February-05	Baseline Analysis
	May-05	Routine Analysis
	August-05	Routine Analysis
	November-05	Routine Analysis
	February-06	Routine Analysis
MW-G	August-04	Routine Analysis
	November-04	Baseline Analysis
	February-05	(dry)
	May-05	Routine Analysis
	August-05	Routine Analysis
	November-05	Routine Analysis
	February-06	Routine Analysis

Appendix A
Summary of Monitoring Well Details

Monitoring Well	Global Coordinates (ft.) Northing	Easting	Ground Surface Elevation (ft.)	Top of Steel Casing Elevation (ft.)	Top of 2" PVC Elevation (ft.)	Top of PVC Screen Elevation (ft.)	Bottom of PVC Screen Elevation (ft.)	Hydraulic Conductivity (cm/sec)[4]
MW-A [1]	10407.12	3364.74	1613.14	1614.99	1614.70	1598.1	1578.1	$1.1x10^{-5}$
MW-B [1]	10942.30	3388.67	1639.29	1640.94	1640.70	1631.3	1616.3	$6.9x10^{-5}$
MW-C [1]	10088.05	4113.59	1521.90	1523.82	1523.56	1509.4	1494.4	$4.4x10^{-5}$
MW-D [1]	10377.06	4195.91	1531.43	1532.83	1532.58	1512.9	1497.9	$1.1x10^{-5}$
MW-E [1]	10645.40	4273.88	1543.45	1545.88	1545.63	1530.5	1515.5	$1.7x10^{-5}$
MW-F [1]	10913.19	4354.87	1550.09	1552.81	1552.56	1538.6	1523.6	$2.6x10^{-4}$
MW-F [2]	10912.46	4355.56	1559.4	1562.98	1562.42	--	--	--
MW-G [1]	11184.73	4423.45	1578.81	1580.26	1580.01	1570.8	1555.8	$3.4x10^{-4}$
MW-G [2]	11183.12	4424.16	1591.6	1594.74	1594.68	--	--	--
MW-H [3]	10865.47	2858.68	1686.30	1688.62	1688.42	1678.3	1668.3	$6.2x10^{-4}$
MW-I [3]	11919.37	3705.34	1703.84	1706.56	1706.40	1699.3	1698.3	Not measured
MW-J [3]	10021.16	3402.10	1586.00	1588.57	1588.35	1572.7	1562.7	$9.9x10^{-5}$
MW-K [3]	11305.64	3409.72	1679.50	1682.08	1681.90	1674.2	1672.2	Not measured

NOTES:

1. Survey information (Northing, Easting, Ground Surface, Top of Steel and Top of PVC Elevations) based on survey completed by B&R Surveying, L.L.C. dated February 2000.
2. Survey information (Northing, Easting, Ground Surface, Top of Steel and Top of PVC Elevations) based on survey completed by B&R Surveying, L.L.C. dated September 23, 2004 after wells were raised during construction of Cell 3.
3. Survey information (Northing, Easting, Ground Surface, Top of Steel and Top of PVC Elevations) based on survey completed by B&R Surveying, L.L.C. dated February 27, 2004.
4. Hydraulic conductivity values taken from Hydrogeologic Report, Part III of this Permit Application.

Appendix A
Summary of Operational Water Quality Sampling Events

Upgradient Wells:

MW-A	June-00	Routine Analysis
	September-00	Routine Analysis
	December-00	Routine Analysis
	February-01	Baseline Analysis
	May-01	Routine Analysis
	August-01	Routine Analysis
	November-01	Routine Analysis
	February-02	Routine Analysis
	May-02	Routine Analysis
	August-02	Baseline Analysis
	November-02	Routine Analysis
	February-03	Routine Analysis
	May-03	Routine Analysis
	August-03	Routine Analysis
	November-03	Baseline Analysis
	February-04	Routine Analysis
	May-04	Routine Analysis
	August-04	Routine Analysis
	November-04	Baseline Analysis
	February-05	Baseline Analysis
	May-05	Routine Analysis
	August-05	Routine Analysis
	November-05	Routine Analysis
	February-06	Routine Analysis
MW-B	June-00	Routine Analysis
	September-00	Routine Analysis
	December-00	Routine Analysis
	February-01	Baseline Analysis
	May-01	Routine Analysis
	August-01	Routine Analysis
	November-01	Routine Analysis
	February-02	Routine Analysis
	May-02	Routine Analysis
	August-02	Baseline Analysis
	November-02	Routine Analysis
	February-03	Routine Analysis
	May-03	Routine Analysis
	August-03	Routine Analysis
	November-03	Baseline Analysis
	February-04	Routine Analysis
	May-04	Routine Analysis
	August-04	Routine Analysis
	November-04	Baseline Analysis
	February-05	Baseline Analysis
	May-05	Routine Analysis
	August-05	Routine Analysis
	November-05	Routine Analysis
	February-06	Routine Analysis

Appendix A

Summary of Operational Water Quality Sampling Events

Downgradient Wells:

MW-C	June-00	(dry)
	September-00	Routine Analysis
	December-00	Routine Analysis (partial)
	February-01	(dry)
	May-01	(dry)
	August-01	(dry)
	November-01	(dry)
	February-02	(dry)
	May-02	(dry)
	August-02	(dry)
	November-02	(dry)
	February-03	(dry)
	May-03	(dry)
	August-03	(dry)
	November-03	(dry)
	February-04	(dry)
	May-04	Routine Analysis
	August-04	Routine Analysis
	November-04	Baseline Analysis
	February-05	Baseline Analysis
	May-05	Routine Analysis
	August-05	Routine Analysis
	November-05	Routine Analysis
	February-06	Routine Analysis
MW-D	June-00	Routine Analysis
	September-00	Routine Analysis
	December-00	Routine Analysis
	February-01	Baseline Analysis
	May-01	Routine Analysis
	August-01	Routine Analysis
	November-01	Routine Analysis
	February-02	Routine Analysis
	May-02	Routine Analysis
	August-02	Baseline Analysis
	November-02	Routine Analysis
	February-03	Routine Analysis
	May-03	Routine Analysis
	August-03	Routine Analysis
	November-03	Baseline Analysis
	February-04	Routine Analysis
	May-04	Routine Analysis
	August-04	Routine Analysis
	November-04	Baseline Analysis
	February-05	Baseline Analysis
	May-05	Routine Analysis

Appendix A
Summary of Operational Water Quality Sampling Events

MW-D (continued)	August-05	Routine Analysis
	November-05	Routine Analysis
	February-06	Routine Analysis
MW-E	November-02	Routine Analysis
	February-03	Routine Analysis
	May-03	Routine Analysis
	August-03	Routine Analysis
	November-03	Baseline Analysis
	February-04	Routine Analysis
	May-04	Routine Analysis
	August-04	Routine Analysis
	November-04	Baseline Analysis
	February-05	Baseline Analysis
	May-05	Routine Analysis
	August-05	Routine Analysis
	November-05	Routine Analysis
	February-06	Routine Analysis
MW-F	August-04	Routine Analysis
	November-04	Baseline Analysis
	February-05	Baseline Analysis
	May-05	Routine Analysis
	August-05	Routine Analysis
	November-05	Routine Analysis
	February-06	Routine Analysis
MW-G	August-04	Routine Analysis
	November-04	Baseline Analysis
	February-05	(dry)
	May-05	Routine Analysis
	August-05	Routine Analysis
	November-05	Routine Analysis
	February-06	Routine Analysis

APPENDIX B

WATER QUALITY PARAMETER LISTS

GROUNDWATER ANALYSIS TABLES

ROUTINE PARAMETERS

Common Name[1]	CAS RN[2]
Field Parameters:	
Static water level........ (in wells and sumps)	
Specific Conductance......	
Temperature..............	
Floaters or Sinkers[3]......	
pH......................	
Eh......................	
Field Observations[4].......	
Turbidity................	
Leachate Indicators:	
Total Kjeldahl Nitrogen...	
Ammonia..................	7664-41-7
Nitrate..................	
Chemical Oxygen Demand....	
Biochemical Oxygen Demand (BOD_5)..................	
Total Organic Carbon......	
Total Dissolved Solids....	
Sulfate..................	
Alkalinity...............	
Phenols..................	108-95-2
Chloride.................	
Bromide..................	
Total hardness as $CaCO_3$...	

ROUTINE PARAMETERS

Common Name[2]	CAS RN[3]
Inorganic Parameters:	
Cadmium..................	(Total)
Calcium..................	(Total)
Iron.....................	(Total)
Lead.....................	(Total)
Magnesium................	(Total)
Manganese................	(Total)
Potassium................	(Total)
Sodium...................	(Total)

Notes

1. Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

2. Chemical Abstracts Service Registry Number. Where "Total" is entered, all species in the groundwater that contain this element are included.

3. Any floaters or sinkers found must be analyzed separately for baseline parameters.

4. Any unusual conditions (colors, odors, surface sheens, etc.) noticed during well development, purging, or sampling must be reported.

BASELINE PARAMETERS

Common Name[1]	CAS RN[2]
Field Parameters:	
Static water level........ (in wells and sumps)	
Specific Conductance......	
Temperature...............	
Floaters or Sinkers[3]......	
pH........................	
Eh........................	
Field Observations[4].......	
Turbidity.................	
Leachate Indicators:	
Total Kjeldahl Nitrogen...	
Ammonia...................	7664-41-7
Nitrate...................	
Chemical Oxygen Demand....	
Biochemical Oxygen Demand (BOD_5)..................	
Total Organic Carbon......	
Total Dissolved Solids....	
Sulfate...................	
Alkalinity................	
Phenols...................	108-95-2
Chloride..................	
Bromide...................	24959-67-9
Total hardness as $CaCO_3$...	
Color.....................	
Boron.....................	7440-42-8

BASELINE PARAMETERS[1]

Common Name[2]	CAS RN[3]
Inorganic Parameters:	
Aluminum..................	(Total)
Antimony..................	(Total)
Arsenic...................	(Total)
Barium....................	(Total)
Beryllium.................	(Total)
Cadmium...................	(Total)
Calcium...................	(Total)
Chromium..................	(Total)
Chromium (Hexavalent)*....	18540-29-9
Cobalt....................	(Total)
Copper....................	(Total)
Cyanide...................	(Total)
Iron......................	(Total)
Lead......................	(Total)
Magnesium.................	(Total)
Manganese.................	(Total)
Mercury...................	(Total)
Nickel....................	(Total)
Potassium.................	(Total)

BASELINE PARAMETERS

Common Name[1]	CAS RN[2]
Selenium.................	(Total)
Silver...................	(Total)
Sodium...................	(Total)
Thallium.................	(Total)
Vanadium.................	(Total)
Zinc.....................	(Total)
Organic Parameters:	
Acetone..................	67-64-1
Acrylonitrile............	107-13-1
Benzene..................	71-43-2
Bromochloromethane........	74-97-5
Bromodichloromethane......	75-27-4
Bromoform; Tribromomethane	75-25-2
Carbon disulfide..........	75-15-0
Carbon tetrachloride......	56-23-5
Chlorobenzene.............	108-90-7
Chloroethane; Ethyl chloride.........	75-00-3

BASELINE PARAMETERS

Common Name[1]	CAS RN[2]
Chloroform; Trichloromethane........	67-66-3
Dibromochloromethane; Chlorodibromomethane....	124-48-1
1,2-Dibromo-3-chloropropane; DBCP..............	96-12-8
1,2-Dibromoethane; Ethylene dibromide; EDB......	106-93-4
o-Dichlorobenzene; 1,2-Dichlorobenzene.....	95-50-1
p-Dichlorobenzene; 1,4-Dichlorobenzene.....	106-46-7
trans-1,4-Dichloro-2-butene...................	110-57-6
1,1-Dichloroethane; Ethylidene chloride.....	75-34-3
1,2-Dichloroethane; Ethylene dichloride.....	107-06-2
1,1-Dichloroethylene; 1,1-Dichloroethene; Vinylidene chloride.....	75-35-4
cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene..	156-59-2
trans-1,2-Dichloroethylene; trans-1,2-Dichloroethene..................	156-60-5
1,2-Dichloropropane; Propylene dichloride.......	78-87-5
cis-1,3-Dichloropropene...	10061-01-5
trans-1,3-Dichloropropene.	10061-02-6

BASELINE PARAMETERS

Common Name[1]	CAS RN[2]
Ethylbenzene	100-41-4
2-Hexanone; Methyl butyl ketone	591-78-6
Methyl bromide; Bromomethane	74-83-9
Methyl chloride; Chloromethane	74-87-3
Methylene bromide; Dibromomethane	74-95-3
Methylene chloride; Dichloromethane	75-09-2
Methyl ethyl ketone; MEK; 2-Butanone	78-93-3
Methyl iodide; Iodomethane	74-88-4
4-Methyl-2-pentanone; Methyl isobutyl ketone	108-10-1
Styrene	100-42-5
1,1,1,2-Tetrachloroethane	630-20-6
1,1,2,2-Tetrachloroethane	79-34-5
Tetrachloroethylene; Tetrachloroethene; Perchloroethylene	127-18-4
Toluene	108-88-3
1,1,1-Trichloroethane; Methylchloroform	71-55-6
1,1,2-Trichloroethane	79-00-5
Trichloroethylene; Trichloroethene	79-01-6
Trichlorofluoromethane; CFC-11	75-69-4

BASELINE PARAMETERS

Common Name[1]	CAS RN[2]
1,2,3-Trichloropropane....	96-18-4
Vinyl acetate.............	108-05-4
Vinyl chloride; Chloroethene..................	75-01-4
Xylenes...................	1330-20-7

Notes

1. Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

2. Chemical Abstracts Service Registry Number. Where "Total" is entered, all species in the groundwater that contain this element are included.

3. Any floaters or sinkers found must be analyzed separately for baseline parameters.

4. Any unusual conditions (colors, odors, surface sheens, etc.) noticed during well development, purging, or sampling must be reported.

*The department may waive the requirement to analyze Hexavalent Chromium provided that Total and Hexavalent and Trivalent Chromium values do not exceed 0.05 mg/l.

EXPANDED PARAMETERS[1]

Common Name[1]	CAS RN[2]
Field Parameters:	
Static water level........ (in wells and sumps)	
Specific Conductance......	
Temperature...............	
Floaters or Sinkers[3]......	
pH........................	
Eh........................	
Field Observations[4].......	
Turbidity.................	
Leachate Indicators:	
Total Kjeldahl Nitrogen...	
Ammonia...................	7664-41-7
Nitrate...................	
Chemical Oxygen Demand....	
Biochemical Oxygen Demand (BOD_5)..................	
Total Organic Carbon......	
Total Dissolved Solids....	
Sulfate...................	
Alkalinity................	
Phenols...................	108-95-2
Chloride..................	
Bromide...................	24959-67-9
Total hardness as $CaCO_3$...	
Color.....................	
Boron.....................	7440-42-8

EXPANDED PARAMETERS

Common Name[1]	CAS RN[2]
Inorganic Parameters:	
Aluminum..................	(Total)
Antimony..................	(Total)
Arsenic...................	(Total)
Barium....................	(Total)
Beryllium.................	(Total)
Cadmium...................	(Total)
Calcium...................	(Total)
Chromium..................	(Total)
Chromium (Hexavalent)*....	18540-29-9
Cobalt....................	(Total)
Copper....................	(Total)
Cyanide...................	(Total)
Iron......................	(Total)
Lead......................	(Total)
Magnesium.................	(Total)
Manganese.................	(Total)
Mercury...................	(Total)

EXPANDED PARAMETERS

Common Name[1]	CAS RN[2]
Nickel....................	(Total)
Potassium................	(TotaL)
Selenium.................	(Total)
Silver...................	(Total)
Sodium...................	(Total)
Sulfide..................	18496-25-8
Thallium.................	(Total)
Tin......................	(Total)
Vanadium.................	Total)
Zinc.....................	(Total)
Organic Parameters:	
Acenaphthene.............	83-32-9
Acenaphthylene...........	208-96-8
Acetone..................	67-64-1
Acetonitrile; Methyl cyanide................	75-05-8
Acetophenone.............	98-86-2
2-Acetylaminofluorene; 2-AAF..................	53-96-3
Acrolein.................	107-02-8
Acrylonitrile............	107-13-1
Aldrin...................	309-00-2
Allyl chloride...........	107-05-1
4-Aminobiphenyl..........	92-67-1
Anthracene...............	120-12-7

EXPANDED PARAMETERS

Common Name[1]	CAS RN[2]
Benzene..................	71-43-2
Benzo[a]anthracene; Benzanthracene..........	56-55-3
Benzo[b]fluoranthene......	205-99-2
Benzo[k]fluoranthene......	207-08-9
Benzo[ghi]perylene........	191-24-2
Benzo[a]pyrene............	50-32-8
Benzyl alcohol............	100-51-6
alpha-BHC.................	319-84-6
beta-BHC..................	319-85-7
delta-BHC.................	319-86-8
gamma-BHC; Lindane........	58-89-9
Bis(2-chloroethoxy)methane	111-91-1
Bis(2-chloroethyl) ether; Dichloroethyl ether.....	111-44-4
Bis-(2-chloro-1-methyl-ethyl) ether; 2,2'-Di-chlorodiisopropylether; DCIP, See note 5.......	108-60-1
Bis(2-ethylhexyl)phthalate	117-81-7
Bromochloromethane; Chlorobromomethane......	74-97-5
Bromodichloromethane; Dibromochloromethane....	75-27-4
Bromoform; Tribromomethane	75-25-2
4-Bromophenyl phenyl ether	101-55-3
Butyl benzyl phthalate; Benzyl butyl phthalate..	85-68-7
Carbon disulfide..........	75-15-0
Carbon tetrachloride......	56-23-5

EXPANDED PARAMETERS

Common Name[1]	CAS RN[2]
Chlordane.................	See Note 6
p-Chloroaniline...........	106-47-8
Chlorobenzene.............	108-90-7
Chlorobenzilate...........	510-15-6
p-Chloro-m-cresol; 4-Chloro-3-methylphenol.	59-50-7
Chloroethane; Ethyl chloride..........	75-00-3
Chloroform; Trichloromethane........	67-66-3
2-Chloronaphthalene.......	91-58-7
2-Chlorophenol............	95-57-8
4-Chlorophenyl phenyl ether............	7005-72-3
Chloroprene...............	126-99-8
Chrysene..................	218-01-9
m-Cresol; 3-methylphenol..	108-39-4
o-Cresol; 2-methylphenol..	95-48-7
p-Cresol; 4-methylphenol..	106-44-5
2,4-D; 2,4-Dichlorophen-oxyaceticacid.........	94-75-7
4,4'-DDD..................	72-54-8
4,4'-DDE..................	72-55-9
4,4'-DDT..................	50-29-3
Diallate..................	2303-16-4
Dibenz[a,h]anthracene.....	53-70-3
Dibenzofuran..............	132-64-9
Dibromochloromethane; Chlorodibromomethane....	124-48-1

EXPANDED PARAMETERS

Common Name[1]	CAS RN[2]
1,2-Dibromo-3-chloro-propane; DBCP...........	96-12-8
1,2-Dibromoethane; Ethylene dibromide; EDB.	106-93-4
Di-n-butyl phthalate......	84-74-2
o-Dichlorobenzene; 1,2-Dichlorobenzene.....	95-50-1
m-Dichlorobenzene; 1,3-Dichlorobenzene.....	541-73-1
p-Dichlorobenzene; 1,4-dichlorobenzene.....	106-46-7
3,3'-Dichlorobenzidine....	91-94-1
trans-1,4-Dichloro-2-butene................	110-57-6
Dichlorodifluoromethane; CFC12..................	75-71-8
1,1-Dichloroethane; Ethyldidene chloride....	75-34-3
1,2-Dichloroethane; Ethylene dichloride.....	107-06-2
1,1-Dichloroethylene; 1,1-Dichloroethene; Vinylidene chloride.....	75-35-4
cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene..	156-59-2
trans-1,2-Dichloroethylene trans-1,2-Dichloroethene	156-60-5
2,4-Dichlorophenol........	120-83-2

EXPANDED PARAMETERS

Common Name[1]	CAS RN[2]
2,6-Dichlorophenol........	87-65-0
1,2-Dichloropropane; Propylene dichloride....	78-87-5
1,3-Dichloropropane; Trimethylene dichloride.	142-28-9
2,2-Dichloropropane; Isopropylidene	594-20-7
chloride.	563-58-6
1,1-Dichloropropene	
cis-1,3-Dichloropropene...	10061-01-5
trans-1,3-Dichloropropene.	10061-02-6
Dieldrin.................	60-57-1
Diethyl phthalate.........	84-66-2
0,0-Diethyl 0-2-pyrazinyl phosphorothioate;	297-97-2
Thionazin...............	60-51-5
Dimethoate................	
p-(Dimethylamino)azo- benzene.................	60-11-7
7,12-Dimethylbenz[a]-	57-97-6
anthracene..............	119-93-7
3,3^{1}-Dimethylbenzidine....	105-67-9
2,4-Dimethylphenol; m-Xylenol...............	131-11-3
Dimethyl phthalate........	
m-Dinitrobenzene..........	99-65-0
4,6-Dinitro-o-cresol 4,6- Dinitro-2-	534-52-1
methylphenol..	51-28-5
2,4-Dinitrophenol.........	
2,4-Dinitrotoluene........	121-14-2
2,6-Dinitrotoluene........	606-20-2
Dinoseb; DNBP; 2-sec- Butyl-4,6-dinitrophenol.	88-85-7
Di-n-octyl phthalate......	117-84-0

EXPANDED PARAMETERS

Common Name[1]	CAS RN[2]
Diphenylamine.............	122-39-4
Disulfoton................	298-04-4
Endosulfan I..............	959-98-8
Endosulfan II.............	33213-65-9
Endosulfan sulfate........	1031-07-8
Endrin....................	72-20-8
Endrin aldehyde...........	7421-93-4
Ethylbenzene..............	100-41-4
Ethyl methacrylate........	97-63-2
Ethyl methanesulfonate....	62-50-0
Famphur...................	52-85-7
Fluoranthene..............	206-44-0
Fluorene..................	86-73-7
Heptachlor................	76-44-8
Heptachlor epoxide........	1024-57-3
Hexachlorobenzene.........	118-74-1
Hexachlorobutadiene.......	87-68-3
Hexachlorocyclopentadiene.	77-47-4
Hexachloroethane..........	67-72-1
Hexachloropropene.........	1888-71-7
2-Hexanone; Methyl butyl ketone..................	591-78-6
Indeno(1,2,3-cd)pyrene....	193-39-5

EXPANDED PARAMETERS

Common Name[1]	CAS RN[2]
Isobutyl alcohol..........	78-83-1
Isodrin..................	465-73-6
Isophorone................	78-59-1
Isosafrole................	120-58-1
Kepone....................	143-50-0
Methacrylonitrile.........	126-98-7
Methapyrilene.............	91-80-5
Methoxychlor..............	72-43-5
Methyl bromide; Bromomethane............	74-83-9
Methyl chloride; Chloromethane...........	74-87-3
3-Methylcholanthrene......	56-49-5
Methyl ethyl ketone; MEK; 2-Butanone..............	78-93-3
Methyl iodide; Iodomethane	74-88-4
Methyl methacrylate.......	80-62-6
Methyl methanesulfonate...	66-27-3
2-Methylnaphthalene.......	91-57-6
Methyl parathion; Parathion methyl........	298-00-0
4-Methyl-2-pentanone; Methyl isobutyl ketone..	108-10-1
Methylene bromide; Dibromomethane..........	74-95-3
Methylene chloride; Dichloromethane.........	75-09-2
Naphthalene..............	91-20-3
1,4-Naphthoquinone........	130-15-4
1-Naphthylamine...........	134-32-7
2-Naphthylamine...........	91-59-8
o-Nitroaniline; 2-Nitroaniline..........	88-74-4

EXPANDED PARAMETERS

Common Name[1]	CAS RN[2]
m-Nitroaniline; 3-Nitroanile	99-09-2
p-Nitroaniline; 4-Nitroaniline	100-01-6
Nitrobenzene	98-95-3
o-Nitrophenol; 2-Nitrophenol	88-75-5
p-Nitrophenol; 4-Nitrophenol	100-02-7
N-Nitrosodi-n-butylamine	924-16-3
N-Nitrosodiethylamine	55-18-5
N-Nitrosodimethylamine	62-75-9
N-Nitrosodiphenylamine	86-30-6
N-Nitrosodipropylamine; N-Nitroso-N-dipropylamine; Di-n-propylnitrosamine	621-64-7
N-Nitrosomethylethalamine	10595-95-6
N-Nitrosopiperidine	100-75-4
N-Nitrosopyrrolidine	930-55-2
5-Nitro-o-toluidine	99-55-8
Parathion	56-38-2
Pentachlorobenzene	608-93-5
Pentachloronitrobenzene	82-68-8
Pentachlorophenol	87-86-5
Phenacetin	62-44-2
Phenanthrene	85-01-8
Phenol	108-95-2
p-Phenylenediamine	106-50-3
Phorate	298-02-2
Polychlorinated biphenyls; PCB's; Aroclors	See Note 7
Polychlorinated dibenzo-p-dioxins; PCDD's	See Note 8
Polychlorinated dibenzofurans; PCDF's	See Note 9
Pronamide	23950-58-5
Propionitrile; Ethyl cyanide	107-12-0
Pyrene	129-00-0

EXPANDED PARAMETERS

Common Name[1]	CAS RN[2]
Safrole	94-59-7
Silvex; 2,4,5-TP	93-72-1
Styrene	100-42-5
2,4,5-T; 2,4,5-trichlorophenoxyacetic acid	93-76-5
1,2,4,5-Tetrachlorobenzene	95-94-3
2,3,7,8-Tetrachlorodibenzo-p-dioxin; 2,3,7,8-TCDD	1746-01-6
1,1,1,2-Tetrachloroethane	630-20-6
1,1,2,2-Tetrachloroethane	79-34-5
Tetrachloroethylene; Tetrachloroethene; Perchloroethylene	127-18-4
2,3,4,6-Tetrachlorophenol	58-90-2
Toluene	108-88-3
o-Toluidine	95-53-4
Toxaphene	See Note 10
1,2,4-Trichlorobenzene	120-82-1
1,1,1-Trichloroethane; Methylchloroform	71-55-6
1,1,2-Trichloroethane	79-00-5
Trichloroethylene; Trichloroethene	79-01-6
Trichlorofluoromethane; CFC-11	75-69-4
2,4,5-Trichlorophenol	95-95-4
2,4,6-Trichlorophenol	88-06-2
1,2,3-Trichloropropane	96-18-4

EXPANDED PARAMETERS

Common Name[1]	CAS RN[2]
0,0,0-Triethyl phosphorothioate.................	126-68-1
sym-Trinitrobenzene.......	99-35-4
Vinyl acetate............	108-05-4
Vinyl chloride; Chloroethene...........	75-01-4
Xylene (total)...........	See Note 11

EXPANDED PARAMETERS[1]

Notes

1. Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

2. Chemical Abstracts Service registry number. Where "Total" is entered, all species in the groundwater that contain this element are included.

3. Any floaters or sinkers found must be analyzed separately for baseline parameters.

4. Any unusual conditions (colors, odors, surface sheens, etc.) noticed during well development, purging, or sampling must be reported.

5. This substance is often called Bis(2-chloroisopropyl) ether, the name Chemical Abstracts Service applies to its noncommercial isomer, Propane, 2,2"-oxybis(2-chloro- (CAS RN 39638-32-9).

6. Chlordane: This entry includes alpha-chlordane (CAS RN 5103-71-9), beta-chlordane (CAS RN 5103-74-2), gamma-chlordane (CAS RN 5566-34-7), and constituents of chlordane (CAS RN 57-74-9 and CAS RN 12789-03-6). PQL shown is for technical chlordane. PQLs of specific isomers are about 20 µg/l by method 8270.

7. Polychlorinated biphenyls (CAS RN 1336-36-3): This category contains congener chemicals, including constituents of Aroclor 1016 (CAS RN 12674-11-2), Aroclor 1221 (CAS RN 11104-28-2), Aroclor 1232 (CAS RN 11141-16-5), Aroclor 1242 (CAS RN 53469-21-9), Aroclor 1248 (CAS RN 12672-29-6), Aroclor 1254 (CAS RN 11097-69-1), and Aroclor 1260 (CAS RN 11096-82-5). The PQL shown is an average value for PCB congeners.

8. Polychlorinated dibenzo-p-dioxins: This category contains congener chemicals, including tetrachlorodibenzo-p-dioxins (see also 2,3,7,8-TCDD), pentachlorodibenzo-p-dioxins, and hexachlorodibenzo-p-dioxins. The PQL shown is an average value for PCDD congeners. Upon request of the applicant, the department may waive the requirement to analyze for dioxins, where appropriate.

9. Polychlorinated dibenzofurans: This category contains congener chemicals, including tetrachlrodibenzofurans, pentachlorodibenzofurans, and hexachlorodibenzofurans. The PQL shown is an average value for PCDF congeners. Upon request of the applicant, the department may waive the requirement to analyze for furans, where appropriate.

10.Toxaphene: This entry includes congener chemicals contained in technical toxaphene (CAS RN 8001-35-2), i.e., chlorinated camphene.

11. Xylene (total): This entry includes o-xylene (CAS RN 96-47-6), m-xylene (CAS RN 108-38-3), p-xylene (CAS RN 106-42-3), and unspecified xylenes (dimethylbenzenes) (CAS RN 1330-20-7). PQLs for method 8021 are 0.2 for o-xylene and 0.1 for m- or p-xylene. The PQL for m-xylene is 2.0 µg/L by method 8020 or 8260.

*The department may waive the requirement to analyze Hexavalent Chromium provided that Total and Hexavalent and Trivalent Chromium values do not exceed 0.05 mg/l.

APPENDIX C

MONITORING WELL INSTALLATION PLAN

APPENDIX C
MONITORING WELL INSTALLATION PLAN

The Environmental Monitoring Plan for the Hakes C&D Facility requires the installation of new monitoring wells to supplement the existing monitoring system. Monitoring wells intended to collect samples from the water table in the till overburden are included in the program. The procedures described below will be used to construct the new monitoring wells. A proposed installation diagram for the new monitoring wells (see Figure C) is included in this appendix.

CONSTRUCTION IN GENERAL

Construction techniques are designed such that groundwater samples and groundwater elevation measurements characterize discrete stratigraphic intervals within the till overburden and to prevent leakage of groundwater or contaminants along the well annulus.

Precautions will be taken during drilling and construction of monitoring wells to avoid introducing contaminants into a borehole. Potable water of known chemistry will be used in drilling monitoring wells. Samples will be collected from the potable water source and sent to a laboratory and analyzed for compounds listed on the NYSDEC "baseline parameter" list. Results of these analyses will be submitted to the NYSDEC prior to drilling activities.

Equipment placed into the boring will be properly decontaminated before use at the site and between boreholes. The initial cleaning at the site will prevent contaminants from the last site drilled from being introduced into the borings. Equipment will be steam cleaned between holes. Drilling muds, air systems and drilling lubricants will not be used.

Well borings will have an inside diameter at least two inches larger than the outside diameter of the casing and screen to allow placement of materials around the well casing with a tremie tube. The borings will be drilled with 4 1/4 inch inside diameter (minimum) hollow stem augers. These drilling methods have been used successfully in the past at the site.

Drilling and monitoring well construction will be done under the on-site supervision of a qualified engineer or geologist who will also prepare the boring logs and well installation diagrams.

CONSTRUCTION OF MONITORING WELLS

Well screens and risers will be constructed of schedule 80 polyvinyl chloride (PVC). Joints, caps, and end plugs are to be secured threads with Teflon tape, or force fittings. Solvents and glues or other adhesives will be prohibited. Caps will be vented to allow for proper pressure equalization. The inside diameter of each well screen or riser pipe will be nominally two inches in diameter to allow for development, survey and sampling equipment to be used within the screen and casing. A permanent mark will be made at the top of the riser pipe to provide a datum for subsequent water level measurements.

Well screens will be factory constructed nonsolvent welded/bonded continuous slot wire wrap screens of a material appropriate for long term monitoring without contributing contaminants to or removing contaminants from the groundwater. The slot size of the screen will be compatible with the sand pack gradation. Water table variations, site stratigraphy, and groundwater flow will be considered in determining the screen length, materials and position.

The sand pack surrounding the well screen will consist of clean, inert, siliceous material. The gradation of the sand pack will be based upon the gradation of the soil to be monitored. The gradation of selected soil samples from test borings MW-1 through MW-5 was measured previously. These data were used to design the filter pack requirements based upon "Standard Practice for Design and Installation of Monitoring Wells in Aquifers", ASTM D5902.

The ASTM filter pack design is based upon the d-30 (i.e., the size where 30 percent by weight of the sample is finer) of the formation soil. The d-30 of the filter is required to be six to ten times the d-10 of the formation and have a uniformity coefficient of 2.5. The d-30 of the soil samples from the Hakes site were less than 0.06 millimeters (mm), a #200 sieve. As such, the d-30 of the filter pack should be less than 0.6 mm. Filter materials designated No. 1 QROK and Morie #00 most closely meet this requirement.

The sand pack will be placed in the annular space around the well screen and extend two feet or 20 percent of the screen length (whichever is greater) above the top, and six inches below the bottom, of the screen. The sand pack material will be placed using the tremie method. The sand pack will be checked for proper placement. A finer grained sand pack material (100 percent passing the No. 30 sieve and less than two percent passing the No. 200 sieve) six inches thick will be placed at the top of the sand pack between the sand and the bentonite seal.

Bentonite chips will be will be slowly poured into the annulus between the PVC well riser and the inside of the in-place augers to form a seal at least three feet thick above the sand pack. If room permits, the bentonite seal may be increased in thickness to help prevent grout contamination of the sand pack around the screen. A 6 to 12 inch fine-grained sand pack will be placed above the bentonite seal to minimize grout infiltration. If pellets or chips are used, sufficient time will be allotted to allow for hydration of the bentonite prior to emplacement of overlying materials. The hydration time for the bentonite is approximately one half of an hour.

Grout of cement/bentonite will fill the remaining annular space to the surface seal. The grout mixture will displace water in the annular space to ensure a continuous seal. The grout mixture, consisting of approximately 94 pounds of Portland cement and approximately 3 to 4 pounds of powdered bentonite mixed with approximately 6.2

gallons of potable water, will be placed using a tremie pipe. Auger flights or casing will be left in the hole before grouting to prevent caving. As the cement-bentonite grout is placed in the annular space through the tremie pipe, the auger flights will be raised and removed from the borehole. The bottom of the deepest auger will not be raised above the top of the grout throughout the procedure.

A protective steel casing, at least two inches larger in diameter than the well casing, will be placed over the well casing or riser pipe and secured in a surface well seal to adequately protect the well casing. A distinctive, readily visible marker will be permanently affixed to the protective casing or near the well to identify the well number and ensure visibility even in periods of high snow cover. A drain hole will be drilled at the base of the protective casing. A vent hole will be located near the top of the protective casing to prevent explosive gas build up and to allow water levels to respond naturally to barometric pressure changes. The annulus of the protective casing will be filled with gravel. A locking cap will be installed with one to two inches clearance between the top of the well cap and the bottom of the locking cap when in the locked position and a weather resistant padlock will be placed on the protective casing and duplicate keys provided to the department.

A concrete surface seal designed to last throughout the planned life of the monitoring well will be constructed. The concrete surface seals, set inside 30" diameter sono tubes, will extend to a minimum depth of 4 feet below ground surface. The seal will be designed to prevent surface runoff from ponding and entering the well casing. In areas where traffic may cause damage to the well, bumperguards or other suitable protection for the well is required. Any damaged or deteriorated surface seals will be reported to the department and repaired or replaced in an appropriate manner.

WELL DEVELPOMENT

Wells will be developed as soon as possible after installation, but not before the well seal and grout have set. Water will not be introduced into the well for development. Wells will be developed by bailing water from the wells. Samples will be collected for turbidity, specific conductance and pH measurement after each well volume is withdrawn. Development will continue until the turbidity of the water is less than 50 NTU and measurements of specific conductance have stabilized to plus or minus 20 percent and pH measurements have stabilized to within plus or minus 0.2 units.

SURVEY

The locations and elevations of the new monitoring wells will be surveyed to obtain their location and plotted on a map. The vertical location of the ground surface and the mark made on the top of the monitoring well and piezometer risers will be accurately measured to the nearest 100th foot.

GEOLOGIC SAMPLING

Overburden material will be sampled continuously to the bottom of the boring. Soil borings will be sampled using the split spoon method and boulders will be sampled by coring with standard size NX or larger diameter core bits. Samples will be retained in labeled glass jars or wooden core boxes. Samples will be securely stored and accessible throughout the life of the facility.

LOGS

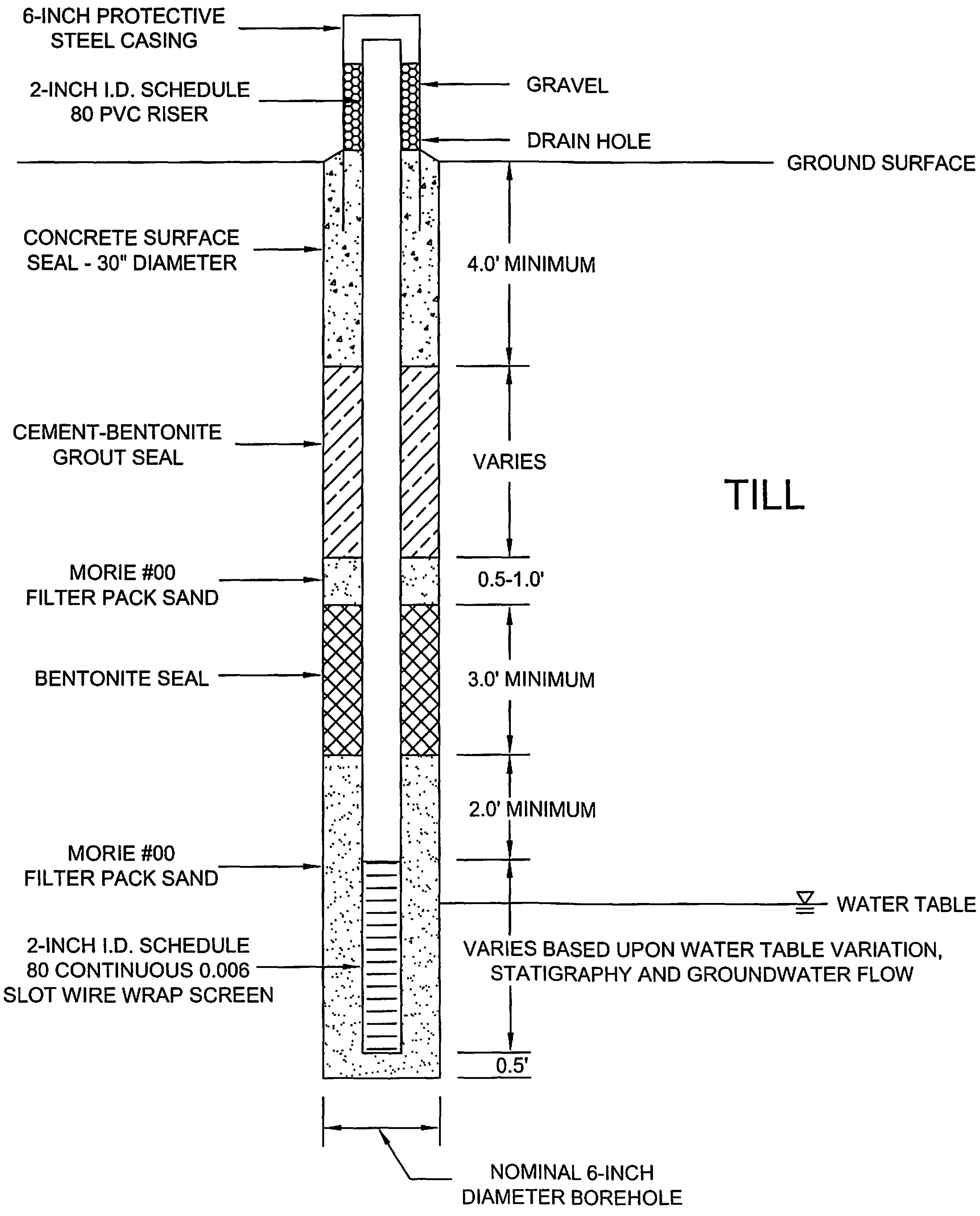
Drilling logs will be provided to NYSDEC for each soil boring. These logs will provide soil classification according to the Unified Soil Classification System (USCS). The USCS visual method will be used on all samples supplemented by the USCS laboratory tests on a representative number of samples from each stratigraphic unit and each screened interval. Logs also will contain a description of matrix and clasts, mineralogy, roundness, color, appearance, odor, and behavior of materials using an appropriate descriptive system. A clear description of the system used will be included with the logs. Well logs will contain drilling information as observed in the field including; moisture content; location of the water table during drilling, water loss during drilling; depth to significant changes in material and rock; sample recovery measured in tenths of a foot; hammer blow counts, and other pertinent comments; the method of drilling, anomalous features such as gas in the well, and the use and description of drilling fluids, including the source, and calculated and actual amounts of materials used.

Rock core logs will describe the lithology, mineralogy, degree of cementation, color, grain size, and any other physical characteristics of the rock; percent recovery and the rock quality designation (RQD); other primary and secondary features, and contain all drilling observations. A clear photograph of all labeled cores will also be taken and submitted with the logs.

Well completion logs will contain a diagram of the completed well, pertinent details on well construction, a description of the materials used, and elevations of well features.

IN-SITU HYDRAULIC CONDUCTIVITY TESTING

In situ hydraulic conductivity testing will be done in each new monitoring well. The testing method used will not introduce contaminants into the well. Hakes will measure the hydraulic conductivity of the new wells at the site. This testing will be done by placing a PVC slug into the well and measuring the subsequent drop in the water level with time. The slug will then be removed and the rise in the water level will be monitored. It is expected that transducers will be used to monitor the head in the wells and an electronic tape water level indicator will be used to measure water levels and correlate transducer readings to elevations.



McMahon & Mann Consulting Engineers, P.C. 2495 MAIN STREET, SUITE 432 (716) 834-8932 BUFFALO, NY 14214 FAX: (716) 834-8934	HAKES C&D LANDFILL EMP STEUBEN COUNTY NEW YORK	TYPICAL MONITORING WELL DETAILS DWG. NO. 98047-330 FIGURE C

APPENDIX D

MONITORING WELL DECOMMISSIONING PROCEDURE

APPENDIX D
MONITORING WELL MODIFICATION AND DECOMMISSIONING PROCEDURE

Monitoring well decommissioning is intended to remove potential pathways for the migration of fluids. According to 6 NYCRR Part 360, the abandoned wells must be fully sealed in a manner appropriate for the geologic conditions to prevent contamination migration through the borehole. The Hakes monitoring well decommissioning procedure is described below.

Monitoring Well Decommissioning Procedure

1. The protective steel casing shall be removed using the drill rig's winch system.
2. A drill rod shall be lowered through the center of the PVC casing to help lead the augers to the bottom of the well.
3. The wells shall then be overdrilled using 6-1/4 inch hollow stem augers to the top of rock (if present).
4. The well materials (PVC, grout, etc.) shall be pulled from the hole using the drill rig's winch system.
5. The hole shall then be tremie grouted to the ground surface.
6. Material meeting the project requirements shall be placed and compacted for subgrade to the ground surface or subgrade elevation.