New York State Department of Environmental Conservation

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COMMISSIONER OF ENVIRONMENTAL CONSERVATION

Designated Representative

Date 8/24/00

ARCADIS
GERAGHTY & MILLER

Groundwater Remediation System Engineering Report

Colesville Landfill, Broome County, New York

704010

PREPARED FOR

Broome County and GAF Corporation

ARCADIS GERAGHTY & MILLER

Groundwater Remediation System Engineering Report

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Disclosure Statement

The laws of New York State require that the corporations which render engineering services in New York be owned by individuals licensed to practice engineering in the State. ARCADIS Geraghty & Miller, Inc. cannot meet that requirement. Therefore, all engineering services rendered to Broome County and GAF Corporation are being performed by GM Consulting Engineers, P.C., a New York Professional corporation qualified to render professional engineering in New York. There is no surcharge or extra expense associated with the rendering of professional services by GM Consulting Engineers, P.C.

ARCADIS Geraghty & Miller, Inc. is performing all those services which do not constitute professional engineering and is providing administrative and personnel support to GM Consulting Engineers, P.C. All matters relating to the administration of the contract with Broome County and GAF Corporation are being performed by ARCADIS Geraghty & Miller, Inc. pursuant to it's Amended and Restated Services Agreement with GM Consulting Engineers, P.C. All communications should be referred to the designated project manager at ARCADIS Geraghty & Miller.

1. Introduction

ARCADIS Geraghty & Miller was retained by Broome County and GAF Corporation (GAF) to prepare this design report for the groundwater remediation system to be installed at the Colesville Landfill in Broome County, New York. The groundwater remedy planned for the site is comprised of a groundwater extraction and treatment system combined with an in-situ enhanced reductive dechlorination (ERD) technology. The objective of this remedial design is to enhance the groundwater component of the remedy documented in the March 29, 1991 Record of Decision (ROD) for the Colesville Landfill which called for groundwater extraction and treatment only. Other components of the ROD remedy associated with groundwater (such as landfill capping [which was completed in 1995], and elimination of groundwater receptors) remain the same. This report describes the conceptual design and how the design objectives and criteria will be met. Detailed plans and specifications necessary to implement the system are also presented.

2. Project Background

The U.S. Environmental Protection Agency (USEPA) and New York State Department of Environmental Conservation (NYSDEC) allowed Broome County and GAF to reevaluate the effectiveness of the pump-and-treat component of the ROD Remedy given the physical limitations of subsurface site conditions, and to propose enhancements to the ROD Remedy. This section provides a summary of the reevaluation effort that led to this revised groundwater remediation approach.

The potential limitations of implementing the groundwater pump-and-treat component of the ROD Remedy with vertical extraction wells was initially recognized after a thorough review of slug test data, soil boring logs, grain size distribution tests, and aquifer and well yield tests. Based upon this information, groundwater flow and contaminant transport modeling was performed to evaluate the effectiveness of the ROD Remedy (ARCADIS Geraghty & Miller 1996). The solute transport simulations predicted that pump-and-treat as a stand-alone remedy would not restore groundwater to maximum contaminant levels in a reasonable timeframe. Factors such as adsorption of contaminants to the aquifer matrix and zones of low permeability where groundwater velocities are extremely slow would result in the inability of pump-and-treat to effectively clean up the aquifer in a reasonable timeframe.

To verify the results of the modeling effort, an aquifer test was conducted using Production Well GMPW-2 and nearby monitoring wells. Production Well GMPW-2 was selected as the pumping well because it was in an area that is representative of the Site hydrogeology. The glacial outwash aquifer in this area consists of silty sand and fine sand, with some clay.

The aquifer test provided reliable data for calculation of the transmissivity and hydraulic conductivity of the glacial outwash aquifer. The hydraulic conductivity of 0.24 feet/ day that was calculated from the time-drawdown data for Production Well GMPW-2 corresponded to the previous hydraulic conductivity value computed from specific capacity data (ARCADIS Geraghty & Miller May 19, 1998).

Biogeochemical sampling was conducted at the landfill to evaluate potential natural biodegradation processes that were believed to be ongoing in groundwater. The results of the biogeochemical sampling rounds showed that anaerobic and moderately reducing conditions were present in groundwater beneath and immediately adjacent to the landfill, but that relatively low concentrations of dissolved organic carbon was a limiting factor in the degree of reductive dechlorination occurring in groundwater. At distances further away from the landfill, the geochemical environment transitions to a primarily aerobic environment. The results of biogeochemical sampling rounds are presented in Appendix A of the Revised Focused Feasibility Study (ARCADIS Geraghty & Miller 1996), and Natural Attenuation Sampling Data Reports (ARCADIS Geraghty & Miller 1997, 1998a, 1998b, and 1998c).

Based upon the data collected during these supplemental investigations, several remedial technologies were evaluated to identify an alternative remedial approach or a method to enhance the existing ROD Remedy. Based upon this review, ARCADIS Geraghty & Miller selected enhanced reductive dechlorination (ERD) as a recommended technology for groundwater remediation, and proposed a six-month pilot study to field test the feasibility of the ERD technology and to collect necessary data for a full-scale remediation system at the Site. The objective of the ERD pilot study was to enhance the anaerobic degradation of VOCs by altering the natural groundwater environment to a more reduced and carbon-rich state, thereby increasing rates of biodegradation and producing innocuous and non-toxic compounds such as ethane, ethene, and carbon dioxide.

The ERD pilot test was highly successful in accomplishing the objectives of enhancing biogeochemical conditions to increase rates of biodegradation at the site (ARCADIS Geraghty & Miller 1999). An overview of the significant results that were achieved during the six-month pilot test is as follows:

- A redox zone was strongly established in and downgradient of the pilot test area.

- Significant concentrations of total organic carbon (TOC) was introduced to groundwater.

- Dechlorination of parent VOCs present at the site was clearly evident.
- An overall reduction in VOC concentrations was achieved.
- A steep decline in VOC concentrations at the downgradient edge of the ERD zone was achieved.
- Some surfactant effects (desorption of VOCs) were evident in close proximity to the injection wells, which indicates that an ERD approach can significantly reduce the remedial timeframe by attacking sorbed contaminant mass.

The pilot test results indicated that the ERD technology could be used to enhance the remediation of VOCs and significantly expedite the timeframe for restoring groundwater quality to MCLs at the Site.

3. Design Analysis

Section 3.0 presents a discussion of the proposed design and the engineering analysis performed to support the design criteria.

3.1 Design Overview

The data collected during the aquifer test (Appendix A) and ERD zone pilot test (Appendix B) were used to design a full-scale groundwater remediation system for the Site. The primary objective of the proposed enhancement to the ROD Remedy is to increase the removal rate (via biodegradation) of VOC mass from the subsurface and expedite the overall timeframe for remediation. The approach is based on using key aspects of the existing pump-and-treat ROD Remedy, and enhancing the beneficial effects of extracting impacted groundwater with a large-scale in-situ reactive zone near the landfill boundary.

Application of an ERD zone near the landfill boundary was selected as an approach for augmenting the ROD Remedy because it would not interfere with groundwater extraction downgradient of the landfill and would address the factors responsible for limiting the effectiveness of pump-and-treat. An ERD enhancement of the pump-and-treat remedy will augment the overall groundwater remediation in the following manner:

- An ERD zone will treat a large volume of aquifer and overcome the fact that the groundwater extraction wells influence only a small aquifer volume.

- An ERD zone will provide in-situ treatment of VOCs associated with extremely low permeability zones, and overcome the fact that the pump-and-treat system is limited by the rate at which VOCs can diffuse from these zones.

- The injection of reagent acts as a surfactant that results in desorption of VOCs from the aquifer matrix, making the VOC mass more available for reductive dechlorination. This process overcomes the fact that pump-and-treat can only address the dissolved component of VOC contamination.

- The pump-and-treat system would continue to extract contaminant mass (from the area within the limiting flowpaths of the highest concentrations of VOCs) that has already migrated beyond the proposed ERD zone.

Therefore, this groundwater remediation system has been designed to complement and enhance the pump-and-treat remedy and provide the most feasible approach to expediting the timeframe for restoring groundwater quality. A description of the design criteria (e.g., number of pumping wells and rates of withdrawal, number of injection wells and reagent concentrations) is provided in the following section.

3.2 Design Criteria

The proposed groundwater remediation system will consist of two components: a groundwater recovery system and an ERD system. The groundwater recovery system is designed to extract a total of one gallon per minute (gpm) from one existing well: PW-3, and two proposed wells: GM-PW-4 and GM-PW-5. The ERD system is designed to create an in-situ reactive zone across the southwest boundary of the landfill by injecting a molasses solution into a series of 17 injection wells.

As previously discussed, the design pumping rates for the groundwater remediation system were based on the results of pumping tests conducted by ARCADIS Geraghty & Miller. The design constituent concentrations for the proposed groundwater treatment system were based on historic groundwater quality (Appendix C). The rationale for the layout of the ERD zone was based on the "Results of the ERD Pilot Study" report dated October 29, 1999 (Appendix B), and an ARCADIS Geraghty & Miller memorandum to the USEPA dated December 17, 1999 (Appendix C).

Additional design goals/parameters include the following:

- Groundwater treatment system will be designed to provide a source of water for mixing the molasses and water solution for the ERD system.
- Groundwater treatment will meet or exceed the NYSDEC effluent quality standards.
- Air discharges will be in conformance with NYSDEC requirements, as specified in NYSDEC Air Guide-1 and its accompanying appendices (NYSDEC 1995).
- Operation of the groundwater treatment and ERD system will allow for automated molasses injections.
- Piping connections, valving, and system controls will provide flexibility in operation of the groundwater recovery and ERD systems.

4. Description of Groundwater Remediation System

This section includes descriptions of the injection wells and piping; the molasses mixing and delivery system; the groundwater pumping wells and recovery piping; the groundwater treatment process; the treatment building; the treated water discharge; and the process controls and operation.

4.1 ERD System

4.1.1 Injection Wells and Piping

The ERD system will utilize the three injection wells currently in use for the ERD pilot study (IW-1, IW-2, GM-MW-1), existing monitoring well PW-6, and 13 new injection wells. The location of the existing and proposed injection wells are shown on Drawing No. 3 of the design drawings submittal. The proposed injection wells will be constructed of 2-inch diameter schedule 40 PVC casing and screen (0.010 slot) with a 1-inch diameter schedule 80 PVC drop tube. The 1-inch diameter drop tube will have 0.25-inch holes on 2-foot centers. The screen intervals of the proposed injection wells will be field determined and fully penetrating from the water table to the base of the glacial outwash aquifer. The details of the proposed and existing injection wells are provided on Drawing No. 8 of the design drawings submittal. A 1-inch diameter SDR 11 high-density polyethylene (HDPE) tube will be bundled and placed in a common trench from the proposed treatment building to each injection well. The tubing will be installed as shown on Drawing No. 8 of the design drawings submittal.

4.1.2 Molasses Delivery System

A portion of the treated water from the groundwater recovery system will be stored in holding tank (HT-500) in the treatment building for use in producing the molasses and water solution. Raw molasses will be delivered to the site every three months and stored in 270-gallon totes in the treatment building. The layout of the molasses delivery system is depicted on Drawings No. 6 and No.7. Pumps will transfer water from the holding tank and molasses from the totes into the mixing tank (MT-800) (at a molasses to water ratio of 1 to 7.5) by transfer pump (TP-600) and molasses pump (MP-700), respectively. The molasses and water solution will then be automatically mixed, and then delivered to the injection wells by transfer pump (TP-900), at three day intervals. Each injection well will then get a predetermined volume of rinse water to flush the injection lines. This process will occur in the injection wells in the following order: IW-15, IW-14, IW-13, IW-12, IW-11, IW-10, IW-9, IW-8, IW-7, IW-6, IW, 5, IW-4, GM-MW-1, IW-2, IW-1, IW-3, and PW-6.

4.2 Groundwater Recovery System

4.2.1 Recovery Wells and Piping

The groundwater recovery system will utilize one existing well PW-3, and two proposed wells, GM-PW-4 and GM-PW-5. The locations of these wells are shown on Drawing No. 3 of the design drawings. The construction details of these wells are as follows:

Well I.D.	Depth (ft)	Screened Interval (ft bls)	Casing Diameter (inches)
PW-3	30	4.7 – 29.7	4
GM-PW-4	35	15 - 30	6
GM-PW-5	35	15 - 30	6

Groundwater will be recovered from each well using submersible pneumatic groundwater pumps. Compressed air will be supplied to each pump from an air compressor (AC-200) located in the treatment building. Each wellhead will be enclosed with a concrete vault along with the associated piping. The extracted groundwater from each well will be conveyed via three 0.75-inch diameter HDPE pipes to the treatment building.

The combined flow from the common header will discharge into the low profile air stripper (AS-100) for treatment. The Process Piping and Instrumentation Diagram (Drawing No. 5 of the design drawings) presents the piping sizes, valves, flow controls, and process flow arrangement for the treatment system.

4.2.2 Treatment Process

Groundwater from the pumping wells will be conveyed via underground piping to a proposed one-story treatment building which will be located as shown on Drawing No. 3. The groundwater will be pumped directly into a low profile air stripper. Once the groundwater has passed through the air stripper, the treated water will be pumped through a series of bag filters and then into a 1,000 gallon holding tank (HT-500). Upon reaching the pre-determined volume of water in HT-500, the treated water will then be routed to the treated water bypass line, and eventually discharged to the North Stream.

The low profile air stripper will be used to reduce VOC concentrations in the recovered groundwater to below NYSDEC effluent standards. Air stripping is an effective means of removing VOCs from water and has the advantage of relatively low operation and maintenance (O&M) requirements. The low profile air stripping unit consists of two trays with numerous aeration holes. The function of the aeration holes is to provide a frothing action that increases the opportunity for air/water mixing, thus enhancing the mass transfer surface area. The VOCs enter the air stream and are then discharged to the atmosphere. The off-gas from the air stripper will be discharged to the atmosphere via a single 6-inch diameter stack.

The low profile air stripper has been designed based on historical concentrations of VOCs and the allowable VOC effluent concentrations listed in Table 1. Because methylene chloride and cis-1,2-dichloroethene have relatively low Henry's Law constants, they control the air stripper design. By meeting the required effluent concentrations for methylene chloride and cis-1,2-dichloroethene, the other VOCs present will also be removed to acceptable levels. The minimum removal efficiencies for the low profile air stripper are summarized in Appendix D along with the design air-to-water ratio, airflow rate, water flow rate, and water temperature. Modeling indicates that two trays will be required to remove methylene chloride and cis 1,2-dichloroethene to less than a target effluent standard of 5 micrograms per liter (μg/L).

4.3 Treatment Building

The treatment building will be designed and constructed in strict conformance with New York State building code requirements. The proposed building will be comprised of a treatment building that will house the influent and effluent piping, a low profile air stripper, holding and mixing tanks, pumps, filters, an air compressor, electrical controls, and molasses storage totes.

The treatment building equipment layout and piping are presented on Drawings 6 and 7 of the design drawings. The building is 20 feet long by 24 feet wide and 12 feet in height, providing approximately 480 square feet of floor space. Access to provide molasses totes (and tanks, if necessary) will be provided through an overhead door on the southern side of the treatment building. A grate covered sump will be provided in the center of the building.

4.4 Treated Water Discharge

The groundwater treatment system is designed for each pumping well to pump intermittently at an optimal flow rate of 0.33 gpm under normal operating conditions. Pumping wells will not be shut down except in the case of a treatment system failure, in an emergency, or as required for normal maintenance. Extracted water will be treated and either stored in HT-500 for use in the injection process or discharged to the North Stream. The 6 NYCRR Chapter X, Section 930.4 – Table 1, entitled, "Classifications and Standards of Quality and Purity which are Assigned to the Waters of the Susquehanna River Bordering or Flowing Through the Counties of Tioga, Broome, Chenango, Delaware and Otsego", was used in the determination of the North Stream classification. The North Stream, which is referenced by the NYSDEC as Tributary 120, has a Fresh Surface Water Classification of C and a Water Quality Standard of C(T). Based on this classification and documented effluent limitations, an application will be submitted to the NYSDEC for the establishment of effluent limitations for the site.

4.5 Air Emissions

The air emission limitations for the air stripper off-gas were derived from NYCRR Part 200 and New York's Air Guide-1. Limitations for the constituents in the air stream were selected using the Air Guide-1 specified Annual Guideline Concentrations (AGCs) and Short-Term Guideline Concentrations (SGCs). The AGCs provide a more conservative (lower) maximum hourly emissions rate and were used as the design limitations. A summary of the air emissions limitations and toxicity information for each constituent in the air stripper off-gas is presented in Table 2. The design loading rates for the air stripper off-gas were calculated for each constituent in the air stream. The results of the modeling are presented in Table 3.

A direct comparison of the resulting emission rate potentials (ERPs) with the maximum allowable emissions rates indicates that all of the constituents in the air stream will be less than their respective AGCs, therefore, off-gas treatment will not be necessary. Air samples will be collected and analyzed during the system start-up period and during monthly operation and maintenance visits to confirm that maximum emission rates are below the AGCs.

4.6 Utility Service

Electric service will be obtained from an existing power pole located on-site. The power will be transferred via underground conduit from the power pole to the proposed treatment building. The on-site utility pole currently provides a 230 Volt, 100 Amp, single phase electrical power. The electric service will be upgraded to 200 Amp in order to satisfy the power requirements of the equipment controls in the proposed treatment building. Controls and instrumentation for the operation of the treatment system and associated recovery wells will be located in the main treatment building.

Phone service will be provided. No potable water supply or sanitary sewer service is available on site.

4.7 Process Controls and Operation

The process control system will be designed with a graphical user interface (GUI) and will provide the necessary alarms and interlocks to ensure that the compressor, blower, pumps, piping, mixer, and recovery and injection systems operate smoothly, efficiently, and as a unit. Additionally, the system will include an autodialer which will notify operator(s) of any system fault. Controls and instrumentation will be interconnected via serial network, utilizing network wiring installed in exposed conduit. The main control panel (MCP), located in the treatment building, will house a programmable logic controller (PLC) to monitor and integrate the operation of the compressor, blower, pumps, piping, mixer, treatment and injection systems, and all treatment system interlocks.

The following sections describe the operation, system monitoring, and alarm conditions.

4.7.1 Operation and Programmable Logic Controller

Under normal operating conditions, the control system will monitor the flow of treated water from holding tank (HT-500) to mixing tank (MT-800), the flow of the molasses from the molasses totes to MT-800, and the flow of the molasses and water solution to the injection wells. The control system will maintain the operating levels within the holding and mixing tanks to ensure an ample supply of treated water and molasses and water solution for the injection system. The system will deliver a predetermined volume of molasses and water solution to each of the seventeen injection wells. The GUI will allow the user to choose the ratio of molasses and water and the volume of solution injected into each well, the injection frequency, and the volume of rinse water injected into each well.

The process equipment will include switches tied to alarms mounted on the MCP. The PLC will be utilized to provide the necessary control logic to coordinate the control signals from the remote switches and instrumentation throughout the treatment system. These interlocks will provide fail-safes and monitor operating conditions to maintain optimum performance of the treatment system.

4.7.2 Monitoring

Flow meters will be provided on the molasses supply line, on the treated water line going into the mixing tank, and on the influent line to the injection wells to monitor flow totalization, as well as to allow adjustment of flow control valve settings. The flow from the molasses totes, treated water to the mixing tank line, and influent to the injection wells will be totaled at the MCP.

4.7.3 Alarms and Interlocks

The transfer pumps, blower, air stripper, compressor, and mixing tank will be interlocked and alarmed to ensure that the water is properly treated, mixed with molasses, and injected. All process equipment motors will have hand-off-auto switches located at the MCP. Operation of the groundwater recovery system components including the transfer pumps will be dependent various pressure switches and level switches located throughout the system. Interlocks will be established such that untreated water will not be discharged from the air stripper system in the event that the blower is not operating.

Level switches will be installed within the holding and mixing tanks, and the low profile air stripper in order to ensure efficient operation of the system. The level switches will include the following:

- Level Switch High High (LSHH)
- Level Switch High (LSH)
- Level Switch Normal (LSN)
- Level Switch Low (LSL)
- Level Switch Low Low (LSLL)
- Pressure Switch Low (PSL)
- Pressure Switch High (PSH)

A description of the level switches is provided below.

As water levels rise within the shallow tray air stripper, the transfer pump (TP-400) will be turned on once the LSH-100 is engaged. At this point, treated water will be pumped from the air stripper until LSH-100 is disengaged where TP-400 will be turned off. If the LSHH-100 is engaged, the compressor (AC-200) and blower (B-300) will be shut down, the autodialer will be engaged, and the system will be reactivated manually.

The pumping well compressed air line will have a pressure switch low (PSL-201). If PSL-201 is engaged, compressor (AC-200) will be turned off and blower (B-300) will be shutdown. The autodialer will then be engaged, and the system will be reactivated manually.

The air stripper blower effluent line will contain PSL-301. If engaged, PSL-301 will turn off the blower (B-300) and compressor (AC-200). The autodialer will then be engaged, and the system will be reactivated manually. A pressure switch high (PSH-402), located before bag filters BF-400 and BF-401 will shut down AC-200 and B-300 and activate the autodialer.

As water rises within holding tank (HT-500), LSH-500 will engage, closing a solenoid to the holding tank and opening a solenoid valve to the treated water bypass line. This will access treated water to discharge to the North Stream. If the LSHH-500 is engaged in the holding tank, the compressor (AC-200) and blower (B-300) will be turned off and the autodialer will be engaged. Once the LSL-500 is engaged, the solenoid allowing treated water to discharge to North Stream will be closed, allowing the tank to refill. In the event LSLL-500 is engaged, the entire groundwater remediation system will be shut off and the autodialer engaged.

Upon reaching LSL-800 in mixing tank (MT-800), transfer pump (TP-600) will be engaged and will pump water into mixing tank MT-800. Once LSN-800 is activated, TP-600 will be turned off and MP-700 will be turned on along with molasses mixer (MM-800). A pulse transmitting flow meter (FE-701) will quantify and regulate the amount of molasses to be pumped into the mixing tank. The molasses line between MP-700 and the mixing tank (MT-800) will have a pressure switch low (PSL-701). When engaged, PSL-701 will shutdown the molasses mixing sequence and engage the autodialer. Once the desired amount of molasses has been pumped into the mixing tank, MP-700 will turn off, TP-600 will be turned on and the remaining water needed for the molasses and water solution will bypass through the molasses line as a rinse. Water will be pumped to fill the tank to LSH-800. In the event that either LSHH-800 or LSLL-800 is engaged, the feed solution mixing and injection sequence will be turned off, the autodialer will be activated, and the system will be reactivated manually. Pressure switch high (PSH-901) will monitor the molasses injection line following transfer pump (TP-900). If PSH-901 is engaged the injection sequence will be shutdown and the autodialer will be activated.

5. Permitting

A completed NYSDEC Air Facility Registration Form is included as Appendix E. A completed State Pollutant Discharge Elimination System (SPDES) industrial application form is included as Appendix F.

6. Construction Schedule

A design and construction schedule for the remediation system is provided in Appendix F. However, construction of the remediation system depends on a number of factors including weather conditions. Should delays be encountered due to occurrences beyond our control (inclement weather conditions, property access difficulties, etc.) the NYSDEC and USEPA will be notified of the change in schedule.

TABLES

Table 1. Air Stripper Design Concentrations, Colesville Landfill, Broome County, New York.

Constituent	Air Stripper Design Influent[1] (ug/L)	Effluent Limit [2] (ug/L)
Tetrachloroethene	3.7	5
Trichloroethene	66	5
1,1-Dichloroethene	56	5
cis-1,2-Dichloroethene	88	5
1,1,1 - Trichloroethane	110	2
Chloroform	5.1	7
Methylene Chloride	50	5

Notes:

ug/L Micrograms per liter.

(1) Values represent highest concentration from historic groundwater quality

(2) Values previously accepted by New York State Department of Environmental Conservation (NYSDEC). Based on Surface/Groundwater Quality Standards and Groundwater Effluent Standards for Class GA groundwater published in 6 NYCRR Part 703; and NYSDEC's October 1993 Division of Water and Technical Operation Guidance Series.

Table 2. Air Stripper Off-Gas Emission Limitations, Colesville Landfill, Broome County, New York.

Constituent	AGC (ug/m^3)	SGC (ug/m^3)	Toxicity
Tetrachloroethene	1.2	40,000	Moderate
Trichloroethene	0.45	33,000	Moderate
1,1-Dichloroethene	0.02	2,000	High
cis-1,2-Dichloroethene	1,900	190,000	Moderate
1,1,1 - Trichloroethane	1000	450,000	Low
Chloroform	0.04	980	Moderate
Methylene Chloride	27	41,000	Moderate

Notes:
ug/m^3 Micrograms per cubic meter of air

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Table 3. New York State Department of Environmental Conservation Air Guide 1 Worksheet, Colesville Landfill, Broome County, New York.

AIR GUIDE 1 - WORKSHEET

Version: Update June 8, 1994 from NYSDEC Air Guide 1 Appendix B (April 4, 1994)

DATE:	01/06/99
JOB NAME:	Colesville Landfill
JOB NUMBER:	NY000949.0013
LOCATION:	Broome County, New York

AIR EMISSION POINT

Proposed Air Stripping System

MAXIMUM VAPOR FLOWRATE:	150	acfm
DISCHARGE TEMPERATURE:	60	Degrees F
AMBIENT TEMPERATURE:	50	Degrees F
BUILDING HEIGHT:	12	feet
MAX BUILDING WIDTH:	20	feet
PHYSICAL STACK HEIGHT:	15	feet
STACK DIAMETER:	6	inches
CAPPED STACK EXIT? (Y/N)	N	
MAXIMUM EXIT VELOCITY:	12.73	feet/sec
STACK / BUILDING RATIO(Hs/Hb):	1.3	
STACK REDUCTION FACTOR:	1.00	
DIST. TO PROP. LINE:	150	feet

note: If greater than 3 times building height ignore cavity impacts.

EFFECTIVE STACK HEIGHT: 15.0 feet

(INCLUDING MOMENTUM AND BUOYANCY RISE CREDITS)

CALCULATED BLDG. CAVITY HEIGHT: 18 feet

THE PHYSICAL STACK HEIGHT IS LESS THAN THE BLDG CAVITY HEIGHT, THEREFORE:

IGNORE CAVITY IMPACTS

CONTAMINANT	CAS #	LOADING (lbs/hr)	(lbs/yr)
Tetrachloroethene		1.85E-06	0.02
Trichloroethene		3.31E-05	0.29
1,1-Dichloroethane		2.80E-05	0.25
cis-1,2-Dichloroethene		4.41E-05	0.39
1,1,1 - Trichloroethane		5.51E-05	0.48
Chloroform		2.55E-06	0.02
Methylene Chloride		2.50E-05	0.22

STANDARD POINT SOURCE DISCHARGE METHOD SUMMARY

(Stack Reduction)

CONTAMINANT	AGC LIMIT (ug/m^3)	Ca (ug/m^3)	CP (ug/m^3)	CST (ug/m^3)	SGC LIMIT (ug/m^3)
Tetrachloroethene	2.00E-02	2.20E-04	2.51E-08	1.63E-06	4.00E+04
Trichloroethene	4.50E-01	3.92E-03	4.48E-07	2.91E-05	3.30E+04
1,1-Dichloroethane	5.00E+02	3.33E-03	3.80E-07	2.47E-05	9.60E+04
cis-1,2-Dichloroethene	1.90E+03	5.23E-03	5.97E-07	3.88E-05	1.90E+05
1,1,1 - Trichloroethane	1.00E+03	6.54E-03	7.46E-07	4.85E-05	4.50E+05
Chloroform	4.00E-02	3.03E-04	3.46E-08	2.25E-06	9.80E+02
Methylene Chloride	2.70E+01	2.97E-03	3.39E-07	2.21E-05	4.10E+04

CALCULATED MOMENTUM FLUX: 9.94 feet^4/sec^2

CALCULATED BUOYANCY FLUX: 0.00 feet^4/sec^2

NO PLUME RISE CREDIT BECAUSE Hs/Hb <1.5

MOMENTUM PLUME RISE CREDIT: 0.00

THERE IS NO BUOYANCY CREDIT BECAUSE Hs/HB<2.5

BUOYANCY FINAL RISE CREDIT: 0.00 feet

APPENDIX A

ARCADIS GERAGHTY & MILLER

Appendix A

"Aquifer Test Results," Colesville Landfill, Colesville, New York

ARCADIS GERAGHTY&MILLER

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Tel 516 249 7600
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George Jacob
U.S. Environmental Protection Agency
26 Federal Plaza
New York, New York 10002

ENVIRONMENTAL

Subject:
Aquifer Test Results, Colesville Landfill, Colesville, New York.

Date,
19 May, 1998

Contact:
Steve Feldman

Extension:
(516) 391-5244

Dear Mr. Jacob:

Aquifer testing was conducted at the Colesville Landfill in accordance with the requirements set forth by the U.S. Environmental Protection Agency (USEPA) and an approved Work Plan. The field effort and methodology for determining hydraulic properties was conducted in accordance with ASTM standards and Suggested Operating Procedures for Aquifer Pumping Tests (USEPA 1993). The wells were screened in the glacial outwash aquifer in an area that is both representative of site hydrogeology and where potential groundwater recovery wells would be best utilized. The following sections describe the aquifer test methodology and results, and document that the low permeability of the formation is not amenable to groundwater remediation via pump-and-treat.

Aquifer Testing Methodology

Aquifer testing was performed on-site after completion of the installation, development and step-drawdown testing of Production Wells GMPW-1, GMPW-2, and GMPW-3. Based on the results of the step-drawdown testing, the three wells had similar well yields and specific capacities, and no well was clearly best suited to serve as the pumping well for the aquifer test. At the request of the U.S. Environmental Protection Agency (USEPA) during a conference call on January 29, 1998, Production Well GMPW-2 was selected as the pumping well for the aquifer test. Once the pumping well was selected, monitoring wells GMMW-2 and GMMW-3 were installed 30 feet (ft) and 15 ft from GMPW-2, respectively. The locations of all production and monitoring wells installed as part of this aquifer testing effort were approved by the USEPA.

The aquifer test was performed from April 2, 1998, through April 9, 1998. The aquifer test was proposed to be conducted in three continuous phases: (1) one 72 hour period of background monitoring, (2) one 72 hour pumping test, however, the pumping phase ended after approximately 53 hours due to an electrical malfunction, and (3) one 24 hour period of recovery monitoring.

Selection of Pumping Well and Observation Points

Although aquifer characteristics suggested that a steep cone of depression of limited areal extent was expected to develop around the pumping well, a total of seven observation wells were selected and used to monitor water levels at varying distances from the pumping well during all three phases of the aquifer test. The pumping well (GMPW-2) and four observation wells were equipped with pressure transducers and a data logger to electronically measure and record changes in water levels. Observation wells used and corresponding distances from Production Well GMPW-2 include: Observation Well GMMW-2 (30 feet cross-gradient), Observation Well GMMW-3 (15 feet cross-gradient), Observation Well W-5 (90 feet upgradient), and Observation Well PW-4 (100 feet downgradient). Water levels in three additional observation wells were measured by hand using an electronic water-level indicator. These wells and the corresponding distances from Production Well GMPW-2 are as follows: Observation Well GMMW-1 (160 feet upgradient), Observation Well PW-3 (300 feet downgradient), and Observation Well W-22S (460 feet downgradient). In addition, one staff gauge, SG-1, was installed in the North Stream. Stream-level measurements were collected by hand at SG-1 during the aquifer test. The locations of all monitoring points on-site are provided on Figure 1 of this report.

Pre-Test Field Activities

Prior to commencement of the pumping test, background water-level monitoring was performed to establish baseline static conditions. An automatic data logger (Hermit 2000SE Data Logger) recorded water levels from the four observation wells and the pumping well that were equipped with pressure transducers. Prior to installation, each pressure transducer was checked for proper factory calibration. The transducers were set in each well near the bottom of the screen zones to allow maximum drawdown to be recorded. A 2-inch diameter variable speed submersible pump was selected for Production Well GMPW-2 due to the anticipated difficulty of maintaining a low flow rate. Prior to installation, the pump was decontaminated using a potable water and detergent solution. To minimize turbulence in the water column resulting from continuous pumping action, the pressure transducer was installed in Production Well GMPW-2 inside a temporary two-inch diameter PVC still-tube. Once the pump was installed, a continuously reading electronic flow meter and totalizer were installed in-line and checked for proper factory calibration using anticipated flow rates and discharge pipe diameter prior to the pump test.

A continuously reading barometer and rain gauge were set up in the test area. Barometric and precipitation data were recorded periodically throughout the test. During the test, the rain gauge was emptied after each measurement in order to accurately calculate the quantity of daily rainfall. These data are provided in Table 1 of this report.

To prevent re-infiltration, flooding, and erosion and to mitigate any contaminant migration, all water generated during the aquifer test was containerized in a temporary stainless steel tank on-site. For details on water disposal methods, please refer to the section entitled **Disposal of Pumped Water.**

Background Monitoring

To establish the pre-pumping water-level trend, background water-level monitoring began on April 2, 1998 at 3:20 p.m. and continued until April 6, 1998 at 10:00 a.m., when the pumping phase of the test began (Table 2). Manual water-level measurements were also collected on April 2, 1998 in the background observation wells not equipped with pressure transducers and from the staff gauge. The background measurements indicated no discernible change in water levels in the days immediately preceding the pumping test.

Pumping Test

The pumping phase of the aquifer test began at 10:00 a.m. (1000 hours) on April 6, 1998. The in-line flow meter used to measure flow rates during the test is based on the principal of rotation of an in-line turbine. Because the low flow rate was insufficient to properly turn the turbine, the in-line flow meter did not register flow readings. Therefore, flow measurements were made manually with a graduated beaker and stop watch. Flow rate measurements during the aquifer test are provided in Table 3. The pumping test was started at a flow rate of approximately 0.31 gallons per minute (gpm). This flow rate was maintained within approximately 19 percent (maximum flow was recorded at 0.37 gpm, and minimum flow was recorded at 0.25 gpm) for the duration of the test. Three instances led to temporary deviations from this range in flow rate. These instances are as follows:

1. On April 7, 1998 at 1400 hours (1,690 minutes into the test), representatives from the USEPA arrived on site. Upon arrival the USEPA was informed of the non-registering flow meter (due to the low flow) and requested that the flow meter be removed. Air was introduced during removal of the meter, which obstructed the discharge of pumped water. The pumping rate had to be increased to 1 gpm to restore flow. The water level in Production Well GMPW-2 had declined to the pump intake before flow could be re-adjusted, leading to a temporary disruption in pumping. After 10 minutes the pump and data logger recording interval were restarted, with the flow rate set at 0.30 gpm.

2. On April 7, 1998 at 2040 hours (2,030 minutes into the test), the water level in the production well declined to the pump intake. It was determined that the pump could be safely lowered further into the screened interval. Therefore the pump was lowered three feet further into the well screen. The pump was then restarted after approximately 30 minutes and these changes were noted.

3. On April 7, 1998 at 2300 hr. (2,150 minutes into the test) the control box for the pump failed due to an electrical problem in the wiring connecting the control box and the pump. The connection was repaired and the pump was restarted after approximately 25 minutes. The flow rate was set to 0.34 gpm.

On April 8, 1998 at 1700 hours (3,200 minutes into the test) the control box failed and could not be repaired. Since the aquifer test at that point was approximately 75 percent complete and no measurable drawdown was recorded at nearby observation wells, the pumping test was considered complete. Drawdown data recorded by the data logger are provided in Table 4 and water-level measurements collected manually are provided in Table 5.

Recovery Monitoring

Upon completion of the pumping phase of the aquifer test on April 8, 1998, the data logger recorded 16 hours of recovery data from Observation Wells GMMW-2, GMMW-3, PW-4, and W-5 and from the pumping well (GMPW-2). The recovery phase was abbreviated because the pumping well achieved 99% recovery in this period. Manual water-level measurements were collected on April 9, 1998 from the background observation wells not equipped with pressure transducers and from the staff gauge.

Disposal of Pumped Water

Upon completion of the aquifer test, the water generated from the test was pumped from the tank on-site into a tanker truck. The tank was then decontaminated using a high temperature steam cleaner. All pumping test water and water generated from decontamination was transported for off-site treatment and disposal at the Nanticoke Leachate Treatment Facility, located in Binghamton, New York. The tanks were then removed from the site.

Aquifer Test Results

Despite the difficulties in conducting an aquifer test at such a low flow rate, the drawdown data obtained from the pumping test provided reliable data for the calculation of aquifer properties. Aquifer test data were analyzed to characterize the drawdown behavior of the glacial outwash aquifer and to estimate the aquifer properties of transmissivity and storage. The aquifer test data were analyzed with the support of the AQTESOLV software program, which is an interactive program that provides graphical curve matching analyses.

Drawdown data were analyzed for transmissivity (T) and aquifer storage (S) using both the Cooper-Jacob (1946) and Theis (1935) methods. These methods were used because the drawdown did not exhibit a delayed water-table response. Prior to analysis using these methods, the drawdown data are corrected as follows:

$$S' = S-(S^2/2M)$$

where:

S' = equivalent confined aquifer drawdown
S = observed drawdown under unconfined conditions
M = aquifer thickness under static conditions

With the Cooper-Jacob method, drawdowns in the pumped well are plotted against the logarithm of time after pumping started on semi-logarithmic paper. The time-drawdown graph yields a straight-line plot in the region where the coefficient $\mu \leq 0.01$, and the slope of the straight line is used to determine the transmissivity. Deviation from a straight line becomes appreciable when μ exceeds about 0.02, and the method would not be valid in this area where the data would actually plot as a gentle curve.

The calculated transmissivity for the time-drawdown data from Production Well GMPW-2 is 4.72 square feet per day [ft^2/day] (Figure 2). As a check of the appropriate use of the Cooper-Jacob method, the region of the data where $\mu \leq 0.02$ was calculated and compared with the region of data through which the straight line was drawn. The time that must elapse before the straight-line method can be applied to aquifer test data is determined from the following equation presented in Walton (1962):

$$t_{sl} = 1.35x10^5 r^2 S/T$$

where:

t_{sl} = time after pumping starts before a semi-log time drawdown plot will yield a straight-line graph, in min

r = distance from pumped well to observation well (in this case, radial distance to the extent of sand pack), in ft

T = transmissivity, in gpd/ft

S = coefficient of storage, fraction

Inserting the data for the glacial outwash aquifer (S=0.0563, T=35.30gpd/ft, and r=0.417 ft) results in a t_u of 37.4 minutes. Therefore, the straight line was drawn through the appropriate region of data because it was after an elapsed time of 37.4 minutes.

Based on a saturated thickness of 19.8 ft for the glacial outwash aquifer, the calculated value for hydraulic conductivity is 0.24 ft/day. This value is in close agreement with the estimate of 0.28 ft/day calculated from specific capacity data that was collected from Production Well GMPW-2 during the step-drawdown testing (ARCADIS Geraghty & Miller 1997).

As a check of the Cooper-Jacob solution, the Theis curve fitting method was used to calculate the transmissivity and storage coefficient. This method is typically used for drawdown measured at observation wells because they depict the true water level in the aquifer. The water level in a pumping well may reflect the combination of aquifer drawdown and well loss. However, because the GMPW-2 well screen has a high open area (capable of yielding 97.5 gpm) but was only pumping 0.3 gpm, the well loss is probably negligible. Therefore, the Theis solution provided a reliable estimate of transmissivity when the curve was fitted to the data on logarithmic paper (Figure 3).

The storage coefficient calculated from the time-drawdown data was 0.056. However, it should be noted that the storage coefficient cannot be determined with a high degree of accuracy from data for the pumped well because the effective radius of the pumped well is seldom precisely known (Walton 1962).

In summary, the aquifer test provided reliable data for calculation of the transmissivity and hydraulic conductivity in the glacial outwash aquifer. The hydraulic conductivity of 0.24 ft/day calculated from time-drawdown data for Production Well GMPW-2 corresponded to the previous hydraulic conductivity computed from specific capacity data. The step-drawdown and aquifer testing program indicated that the glacial outwash aquifer in the area of interest has a low permeability (approximately 0.2 to 0.3 ft/day) and poor ability to yield water (0.25 to 0.5 gpm).

Given the low permeability and poor yield of the glacial outwash formation, pump-and-treat would be ineffective at this site for the following reasons:

- The production wells have an extremely limited area of influence, as noted by the fact that no drawdown was recorded at a monitoring well located 15 feet from the production well.

- Groundwater velocities would be increased only in the immediate vicinity of a production well due to the extremely limited areal extent of drawdown.

- Due to geologic heterogeneities, cleanup times would be determined by the rate that contaminants either flush or diffuse from low permeability zones. Contaminant diffusion from low permeability zones is an extremely slow process.

- Pump-and-treat at this site will not speed up the process of contaminant desorption from the aquifer solids.

This field program further supports the grain size distribution testing, slug testing, and groundwater flow and contaminant transport modeling results which concluded that a groundwater pump-and-treat remedy is not warranted given the site-specific conditions (Wehran 1992; Geraghty & Miller 1996).

If you have any questions or comments, please do not hesitate to contact us.

Sincerely,

ARCADIS Geraghty & Miller, Inc.

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Principal Scientist/Project Manager

Thomas LoBasso
Vice President/Project Officer

Copies:
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Given the low permeability and poor yield of the glacial outwash formation, pump-and-treat would be ineffective at this site for the following reasons:

- The production wells have an extremely limited area of influence, as noted by the fact that no drawdown was recorded at a monitoring well located 15 feet from the production well.

- Groundwater velocities would be increased only in the immediate vicinity of a production well due to the extremely limited areal extent of drawdown.
- Due to geologic heterogeneities, cleanup times would be determined by the rate that contaminants either flush or diffuse from low permeability zones. Contaminant diffusion from low permeability zones is an extremely slow process.
- Pump-and-treat at this site will not speed up the process of contaminant desorption from the aquifer solids.

This field program further supports the grain size distribution testing, slug testing, and groundwater flow and contaminant transport modeling results which concluded that a groundwater pump-and-treat remedy is not warranted given the site-specific conditions (Wehran 1992; Geraghty & Miller 1996).

If you have any questions or comments, please do not hesitate to contact us.

Sincerely,

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Table 1. Rain Gauge and Barometer Readings Collected During the April 1998 Aquifer Test, Colesville Landfill, Colesville, New York.

Date	Time (hours)	Rain Gauge Reading (inches)	Barometer Reading (mb)	Comment
4/2/98	1100	0.00	979	Dry, clear
4/6/98	0841	0.07	NR	Dry, clear
	1108	NR	979	Dry, clear
	1300	NR	979	Dry, clear
	1700	0.00	979	Dry, clear
	1900	0.00	979	Dry, clear
4/7/98	0700	0.00	979	Dry, clear
	1700	0.00	986	Dry, clear
4/8/98	0700	trace	985	Light Rain
	1700	0.26	NR	Rain
4/9/98	0850	0.11	980	Dry, clear

Note: Rain gauge emptied after each reading.

mb Millibars
NR Not recorded

Table 2. Background Water-Level Measurements Recorded By Data Logger From Pumping and Observation Wells During the April 1998 Aquifer Test, Colesville Landfill, Colesville, New York.

Date & Time Since Start of Test (minutes)	Pumping Well GMPW-2 (ft bmp)	Observation Well GMMW-2 (30 ft cross-gradient) (ft bmp)	Observation Well GMMW-3 (15 ft cross-gradient) (ft bmp)	Observation Well W-5 (90 ft upgradient) (ft bmp)	Observation Well PW-4 (100 ft downgradient) (ft bmp)
April 2, 1998					
0	0.000	-0.012	-0.006	-0.012	-0.006
5	0.000	-0.006	-0.006	-0.006	0.000
10	0.000	-0.012	-0.006	-0.006	0.000
15	0.006	-0.006	0.000	0.000	0.012
20	0.000	-0.006	-0.006	-0.006	0.000
25	0.000	-0.006	0.000	0.006	0.012
145	0.000	-0.006	-0.006	0.012	0.006
265	-0.006	-0.012	-0.012	0.006	0.012
385	-0.012	-0.012	-0.012	0.000	0.006
April 3, 1998					
505	-0.024	-0.031	-0.025	-0.018	-0.006
625	-0.024	-0.037	-0.025	-0.012	-0.006
745	-0.024	-0.094	-0.025	-0.018	-0.012
865	-0.024	-0.126	-0.025	-0.012	-0.006
985	-0.024	-0.170	-0.025	-0.006	-0.006
1105	-0.024	-0.050	-0.025	-0.018	-0.006
1225	-0.031	-0.050	-0.031	-0.018	-0.012
1345	-0.018	-0.031	-0.018	0.000	0.000
1465	-0.037	-0.050	-0.031	-0.025	-0.031
1585	-0.037	-0.044	-0.031	-0.025	-0.012
1705	-0.037	-0.044	-0.025	-0.018	-0.012
1825	-0.037	-0.044	-0.031	-0.018	-0.012
April 4, 1998					
1945	-0.056	-0.056	-0.044	-0.050	-0.025
2065	-0.062	-0.056	-0.044	-0.044	-0.025
2185	-0.062	-0.056	-0.050	-0.044	-0.031
2305	-0.049	-0.056	-0.044	-0.044	-0.025

Note: Positive "+" values indicate a decrease in water level
Negative "-" values indicate an increase in water level.

ft bmp feet below measuring point.

Table 2. Background Water-Level Measurements Recorded By Data Logger From Pumping and Observation Wells During the April 1998 Aquifer Test, Colesville Landfill, Colesville, New York.

Date & Time Since Start of Test (minutes)	Pumping Well GMPW-2 (ft bmp)	Observation Well GMMW-2 (30 ft cross-gradient) (ft bmp)	Observation Well GMMW-3 (15 ft cross-gradient) (ft bmp)	Observation Well W-5 (90 ft upgradient) (ft bmp)	Observation Well PW-4 (100 ft downgradient) (ft bmp)
April 4, 1998					
2425	-0.043	-0.050	-0.037	-0.025	-0.025
2545	-0.056	-0.050	-0.044	-0.037	-0.031
2665	-0.056	-0.050	-0.044	-0.037	-0.025
2785	-0.056	-0.050	-0.044	-0.037	-0.025
2905	-0.056	-0.050	-0.050	-0.037	-0.031
3025	-0.056	-0.050	-0.044	-0.031	-0.018
3145	-0.056	-0.044	-0.044	-0.025	-0.012
3265	-0.056	-0.044	-0.044	-0.031	-0.012
April 5, 1998					
3385	-0.062	-0.050	-0.050	-0.044	-0.012
3505	-0.074	-0.056	-0.063	-0.050	-0.025
3625	-0.074	-0.063	-0.069	-0.063	-0.025
3745	-0.068	-0.056	-0.063	-0.050	-0.018
3865	-0.062	-0.050	-0.063	-0.044	-0.012
3985	-0.062	-0.044	-0.063	-0.031	-0.006
4105	-0.068	-0.050	-0.063	-0.044	-0.012
4225	-0.074	-0.063	-0.075	-0.056	-0.018
4345	-0.068	-0.056	-0.075	-0.056	-0.025
4465	-0.074	-0.056	-0.069	-0.050	-0.012
4585	-0.074	-0.050	-0.075	-0.044	-0.012
4705	-0.074	-0.056	-0.075	-0.050	-0.006
April 6,1998					
4825	-0.081	-0.063	-0.082	-0.056	-0.012
4945	-0.087	-0.069	-0.088	-0.063	-0.012
5065	-0.093	-0.069	-0.088	-0.069	-0.012
5185	-0.087	-0.069	-0.094	-0.069	-0.012
5305	-0.081	-0.063	-0.088	-0.050	-0.006
5425	-0.074	-0.063	-0.088	-0.050	0.000

Note: Positive " + " values indicate a decrease in water level
Negative "-" values indicate an increase in water level.

ft bmp feet below measuring point.

Table 3. Flow Rates and Drawdown Recorded at Production Well GMPW-2 During the April 1998 Aquifer Test, Colesville Landfill, Colesville, New York.

Date	Time of Day (hours)	Time Since Start of Pumping (min)	Drawdown (feet)	Instantaneous Pumping Rate (gpm)	Cumulative Volume Pumped (gallons)
4/6/98	1018	18	3.26	0.32	5.8
	1030	30	3.80	0.32	9.6
	1100	60	4.07	0.32	19.2
	1130	90	4.48	0.32	28.8
	1200	120	5.19	0.32	38.4
	1230	160	5.60	0.33	51.6
	1300	180	5.80	0.35	58.6
	1330	200	5.90	0.35	65.6
	1400	240	6.16	0.35	79.6
	1430	270	6.32	0.37	90.7
	1500	300	6.42	0.37	101.8
	1530	330	6.44	0.25	109.3
	1600	360	5.15	0.26	117.1
	1700	420	5.15	0.26	132.7
	1800	480	6.72	0.34	153.1
	1830	510	8.74	0.32	162.7
	2130	690	8.12	0.32	220.3
	2230	750	8.15	0.34	240.7
4/7/98	0100	840	8.12	0.34	285.6
	0500	1080	7.61	0.3	357.6
	0700	1200	6.79	0.24	386.4
	0730	1230	6.95	0.26	394.2
	0900	1300	7.06	0.23	410.3
	0922	1320	8.95	0.29	416.1
	0940	1340	9.21	0.28	421.7
	1100	1480	9.28	0.26	458.1
	1130	1510	9.40	0.26	465.9
	1200	1540	9.48	0.32	475.5
	1230	1570	9.76	0.26	483.3
	1245	1585	10.57	0.32	488.1
4/7/98	1300	1600	10.75	0.27	432.0
	1330	1630	11.35	0.27	440.1
	1400	1660	13.45	0.37	451.2
	1530	1750	12.24	0.30	478.2
	1600	1780	12.27	0.30	487.2
	1630	1810	12.15	0.29	495.9
	1700	1840	12.10	0.28	504.3
	1720	1860	12.23	0.30	510.3
	2030	2050	13.76	0.30	567.3
	2144	2164	13.64	0.32	603.8

Table 3. Flow Rates and Drawdown Recorded at Production Well GMPW-2 During the April 1998 Aquifer Test, Colesville Landfill, Colesville, New York.

Date	Time of Day (hours)	Time Since Start of Pumping (min)	Drawdown (feet)	Instantaneous Pumping Rate (gpm)	Cumulative Volume Pumped (gallons)
4/7/98	2200	2220	13.71	0.30	620.6
	2230	2250	13.20	0.29	629.3
	2325	2305	10.82	0.34	648.0
4/8/98	2400	2340	12.35	0.29	678.6
	0030	2370	12.96	0.30	687.6
	0100	2400	12.91	0.29	696.3
	0130	2430	12.84	0.28	704.7
	0140	2440	13.40	0.31	707.8
	0200	2460	13.45	0.30	713.8
	0230	2490	13.40	0.29	722.5
	0300	2520	13.34	0.29	731.2
	0330	2550	13.31	0.29	739.9
	0400	2580	13.25	0.28	748.3
	0430	2610	13.65	0.29	757.0
	0500	2640	13.67	0.28	765.4
	0530	2670	13.75	0.28	773.8
	0600	2700	14.97	0.30	782.8
	0630	2730	15.01	0.29	791.5
	0700	2760	14.99	0.30	800.5
	0730	2790	14.99	0.28	808.9
	0800	2820	15.68	0.29	817.6
4/8/98	0830	2850	15.64	0.29	826.3
	0900	2880	15.67	0.32	835.9
	0930	2910	15.65	0.32	845.5
	1100	3000	15.80	0.33	875.2
	1130	3030	15.82	0.32	884.8
	1200	3060	15.77	0.31	894.1
	1230	3090	15.73	0.31	903.4
	1300	3110	15.82	0.31	909.6
	1400	3170	15.74	0.31	928.2
	1500	3230	15.77	0.31	946.8
	1600	3290	15.73	0.31	965.4
	1630	3310	15.72	0.31	971.6
				Total Flow (gpm):	971.6
				Average Flow (gpm):	0.29

gpm gallons per minute
min minutes

Table 4. Drawdown and Recovery Measurements Recorded by Data Logger From Pumping and Observation Wells During the April 1998 Aquifer Test, Colesville Landfill, Colesville, New York.

Date & Time Since Start of Pumping (minutes)	Pumping Well GMPW-2 (ft bmp)	Observation Well GMMW-2 (30 ft cross-gradient) (ft bmp)	Observation Well GMMW-3 (15 ft cross-gradient) (ft bmp)	Observation Well W-5 (90 ft upgradient) (ft bmp)	Observation Well PW-4 (100 feet downgradient) (ft bmp)
April 6, 1998					
0.01	-0.187	-0.056	-0.094	-0.050	-0.006
0.02	-0.187	-0.056	-0.094	-0.044	-0.006
0.03	-0.187	-0.056	-0.094	-0.050	-0.006
0.03	-0.187	-0.056	-0.094	-0.050	-0.006
0.04	-0.187	-0.056	-0.094	-0.050	-0.006
0.05	-0.162	-0.056	-0.094	-0.044	-0.006
0.06	-0.162	-0.056	-0.094	-0.050	-0.006
0.07	-0.156	-0.056	-0.094	-0.044	-0.006
0.08	-0.156	-0.056	-0.094	-0.044	-0.006
0.08	-0.137	-0.056	-0.094	-0.044	-0.006
0.09	-0.143	-0.056	-0.094	-0.044	-0.006
0.10	-0.112	-0.056	-0.094	-0.050	-0.006
0.11	-0.099	-0.056	-0.094	-0.044	-0.006
0.12	-0.099	-0.056	-0.094	-0.050	-0.006
0.13	-0.093	-0.056	-0.094	-0.050	-0.006
0.13	-0.074	-0.056	-0.094	-0.044	-0.006
0.14	-0.062	-0.056	-0.094	-0.050	-0.012
0.15	-0.049	-0.056	-0.094	-0.050	-0.006
0.16	-0.043	-0.056	-0.094	-0.044	-0.012
0.17	-0.037	-0.063	-0.094	-0.044	-0.012
0.18	-0.024	-0.056	-0.094	-0.050	-0.006
0.18	-0.018	-0.056	-0.094	-0.050	-0.012
0.19	-0.006	-0.056	-0.094	-0.050	-0.012
0.20	-0.012	-0.063	-0.094	-0.044	-0.012
0.21	0.000	-0.056	-0.094	-0.050	-0.012
0.22	0.000	-0.063	-0.094	-0.050	-0.012
0.23	0.006	-0.056	-0.094	-0.044	-0.012
0.23	0.006	-0.056	-0.094	-0.050	-0.012
0.24	0.018	-0.056	-0.094	-0.050	-0.012
0.25	0.018	-0.056	-0.094	-0.050	-0.012
0.26	0.031	-0.056	-0.094	-0.050	-0.012
0.27	0.031	-0.063	-0.094	-0.050	-0.012
0.27	0.043	-0.056	-0.094	-0.050	-0.012
0.28	0.043	-0.056	-0.094	-0.050	-0.012
0.29	0.049	-0.056	-0.094	-0.050	-0.018

Note: Positive " + " values indicate a decrease in water level
Negative "-" values indicate an increase in water level.

ft bmp feet below measuring point

Table 4. Drawdown and Recovery Measurements Recorded by Data Logger From Pumping and Observation Wells During the April 1998 Aquifer Test, Colesville Landfill, Colesville, New York.

Date & Time Since Start of Pumping (minutes)	Pumping Well GMPW-2 (ft bmp)	Observation Well GMMW-2 (30 ft cross-gradient) (ft bmp)	Observation Well GMMW-3 (15 ft cross-gradient) (ft bmp)	Observation Well W-5 (90 ft upgradient) (ft bmp)	Observation Well PW-4 (100 feet downgradient) (ft bmp)
April 6, 1998					
0.30	0.056	-0.063	-0.094	-0.050	-0.012
0.31	0.056	-0.063	-0.094	-0.050	-0.012
0.32	0.056	-0.056	-0.094	-0.050	-0.012
0.32	0.062	-0.056	-0.094	-0.050	-0.018
0.33	0.068	-0.056	-0.094	-0.050	-0.018
0.35	0.081	-0.056	-0.094	-0.050	-0.018
0.37	0.087	-0.063	-0.094	-0.050	-0.018
0.38	0.099	-0.056	-0.094	-0.050	-0.018
0.40	0.099	-0.063	-0.094	-0.050	-0.018
0.42	0.106	-0.056	-0.094	-0.044	-0.018
0.43	0.106	-0.063	-0.094	-0.050	-0.018
0.45	0.106	-0.063	-0.094	-0.050	-0.018
0.47	0.099	-0.063	-0.094	-0.050	-0.018
0.48	0.099	-0.056	-0.094	-0.050	-0.018
0.50	0.099	-0.056	-0.094	-0.050	-0.018
0.52	0.099	-0.056	-0.094	-0.050	-0.018
0.53	0.106	-0.063	-0.094	-0.050	-0.018
0.55	0.106	-0.063	-0.094	-0.050	-0.018
0.57	0.118	-0.056	-0.094	-0.050	-0.018
0.58	0.112	-0.063	-0.094	-0.050	-0.018
0.60	0.118	-0.056	-0.094	-0.050	-0.018
0.62	0.118	-0.056	-0.094	-0.050	-0.018
0.63	0.118	-0.056	-0.094	-0.050	-0.018
0.65	0.112	-0.063	-0.094	-0.050	-0.018
0.67	0.118	-0.063	-0.094	-0.050	-0.018
0.68	0.118	-0.056	-0.094	-0.050	-0.018
0.70	0.112	-0.063	-0.094	-0.050	-0.018
0.72	0.112	-0.063	-0.094	-0.050	-0.018
0.73	0.118	-0.063	-0.094	-0.050	-0.012
0.75	0.112	-0.063	-0.094	-0.050	-0.018
0.77	0.106	-0.063	-0.094	-0.050	-0.018
0.78	0.112	-0.063	-0.094	-0.050	-0.012
0.80	0.124	-0.056	-0.094	-0.050	-0.012
0.82	0.131	-0.063	-0.094	-0.050	-0.012
0.83	0.156	-0.063	-0.094	-0.050	-0.012

Note: Positive " + " values indicate a decrease in water level
Negative "-" values indicate an increase in water level.

ft bmp feet below measuring point

Table 4. Drawdown and Recovery Measurements Recorded by Data Logger From Pumping and Observation Wells During the April 1998 Aquifer Test, Colesville Landfill, Colesville, New York.

Date & Time Since Start of Pumping (minutes)	Pumping Well GMPW-2 (ft bmp)	Observation Well GMMW-2 (30 ft cross-gradient) (ft bmp)	Observation Well GMMW-3 (15 ft cross-gradient) (ft bmp)	Observation Well W-5 (90 ft upgradient) (ft bmp)	Observation Well PW-4 (100 feet downgradient) (ft bmp)
April 6, 1998					
0.85	0.174	-0.056	-0.094	-0.050	-0.012
0.87	0.187	-0.063	-0.094	-0.050	-0.018
0.88	0.205	-0.063	-0.094	-0.050	-0.012
0.90	0.218	-0.063	-0.094	-0.050	-0.012
0.92	0.218	-0.056	-0.094	-0.050	-0.012
0.93	0.230	-0.056	-0.094	-0.050	-0.012
0.95	0.243	-0.056	-0.094	-0.050	-0.012
0.97	0.249	-0.063	-0.094	-0.050	-0.012
0.98	0.262	-0.063	-0.094	-0.050	-0.012
1.0	0.274	-0.063	-0.094	-0.050	-0.006
1.2	0.318	-0.056	-0.094	-0.056	-0.006
1.4	0.368	-0.056	-0.094	-0.056	-0.006
2.0	0.636	-0.063	-0.094	-0.056	0.000
2.2	0.661	-0.063	-0.094	-0.056	-0.006
2.4	0.649	-0.063	-0.094	-0.063	-0.006
2.6	0.680	-0.063	-0.094	-0.056	0.000
2.8	0.699	-0.063	-0.094	-0.056	0.000
3.0	0.761	-0.063	-0.094	-0.050	0.006
3.2	0.855	-0.056	-0.094	-0.050	0.000
3.4	0.973	-0.056	-0.088	-0.050	0.000
3.6	1.098	-0.056	-0.094	-0.050	0.006
3.8	1.217	-0.056	-0.094	-0.050	0.000
4.0	1.229	-0.056	-0.094	-0.050	0.000
4.2	1.273	-0.056	-0.088	-0.050	0.000
4.4	1.310	-0.056	-0.094	-0.050	0.000
4.6	1.360	-0.063	-0.094	-0.050	-0.006
4.8	1.404	-0.063	-0.094	-0.056	-0.006
5.0	1.454	-0.056	-0.094	-0.050	0.000
5.2	1.485	-0.056	-0.088	-0.056	0.000
5.4	1.516	-0.056	-0.088	-0.056	0.000
5.6	1.554	-0.056	-0.088	-0.056	-0.006
5.8	1.578	-0.056	-0.088	-0.056	0.000
6.0	1.610	-0.056	-0.088	-0.056	0.000
6.2	1.628	-0.056	-0.088	-0.056	0.000
6.4	1.653	-0.056	-0.088	-0.050	0.006

Note: Positive " + " values indicate a decrease in water level
Negative "-" values indicate an increase in water level.

ft bmp feet below measuring point

Table 4. Drawdown and Recovery Measurements Recorded by Data Logger From Pumping and Observation Wells During the April 1998 Aquifer Test, Colesville Landfill, Colesville, New York.

Date & Time Since Start of Pumping (minutes)	Pumping Well GMPW-2 (ft bmp)	Observation Well GMMW-2 (30 ft cross-gradient) (ft bmp)	Observation Well GMMW-3 (15 ft cross-gradient) (ft bmp)	Observation Well W-5 (90 ft upgradient) (ft bmp)	Observation Well PW-4 (100 feet downgradient) (ft bmp)
April 6, 1998					
6.6	1.678	-0.056	-0.088	-0.050	0.006
6.8	1.691	-0.056	-0.088	-0.050	0.006
7.0	1.716	-0.056	-0.088	-0.050	0.006
7.2	1.734	-0.056	-0.088	-0.050	0.006
7.4	1.753	-0.056	-0.088	-0.050	0.000
7.6	1.766	-0.056	-0.088	-0.050	0.000
7.8	1.784	-0.056	-0.088	-0.050	0.000
8.0	1.797	-0.056	-0.088	-0.050	0.006
8.2	1.809	-0.056	-0.088	-0.050	0.000
8.4	1.822	-0.056	-0.088	-0.050	0.000
8.6	1.834	-0.056	-0.088	-0.050	-0.006
8.8	1.847	-0.050	-0.088	-0.056	-0.006
9.0	1.853	-0.056	-0.088	-0.050	-0.006
9.2	1.872	-0.056	-0.088	-0.056	-0.006
9.4	1.890	-0.056	-0.088	-0.056	-0.012
9.6	1.897	-0.050	-0.082	-0.050	-0.012
9.8	1.872	-0.050	-0.082	-0.056	-0.018
10	1.853	-0.050	-0.082	-0.056	-0.012
12	2.028	-0.050	-0.075	-0.050	0.000
14	3.026	-0.044	-0.075	-0.037	-0.006
16	3.088	-0.044	-0.075	-0.044	-0.006
18	3.257	-0.044	-0.075	-0.050	-0.018
20	3.388	-0.044	-0.069	-0.050	0.000
22	3.481	-0.044	-0.069	-0.050	0.006
24	3.562	-0.037	-0.063	-0.050	0.000
26	3.600	-0.037	-0.063	-0.050	-0.006
28	3.656	-0.031	-0.063	-0.037	0.006
30	3.699	-0.031	-0.063	-0.044	-0.006
32	3.743	-0.031	-0.063	-0.044	0.006
34	3.780	-0.031	-0.056	-0.050	0.000
36	3.818	-0.037	-0.056	-0.044	0.000
38	3.843	-0.031	-0.056	-0.044	0.000
40	3.868	-0.031	-0.056	-0.044	0.006
42	3.886	-0.025	-0.056	-0.050	0.000
44	3.911	-0.025	-0.050	-0.037	0.012

Note: Positive "+" values indicate a decrease in water level
Negative "-" values indicate an increase in water level.

ft bmp feet below measuring point

Table 4. Drawdown and Recovery Measurements Recorded by Data Logger From Pumping and Observation Wells During the April 1998 Aquifer Test, Colesville Landfill, Colesville, New York.

Date & Time Since Start of Pumping (minutes)	Pumping Well GMPW-2 (ft bmp)	Observation Well GMMW-2 (30 ft cross-gradient) (ft bmp)	Observation Well GMMW-3 (15 ft cross-gradient) (ft bmp)	Observation Well W-5 (90 ft upgradient) (ft bmp)	Observation Well PW-4 (100 feet downgradient) (ft bmp)
April 6, 1998					
46	3.930	-0.025	-0.050	-0.044	-0.012
48	3.943	-0.025	-0.050	-0.050	0.012
50	3.949	-0.031	-0.050	-0.056	-0.025
52	3.974	-0.018	-0.044	-0.037	0.000
54	3.992	-0.037	-0.056	-0.063	-0.025
56	4.024	-0.031	-0.050	-0.056	-0.006
58	4.049	-0.018	-0.050	-0.037	0.031
60	4.074	-0.025	-0.050	-0.050	-0.018
62	4.098	-0.025	-0.050	-0.037	0.031
64	4.123	-0.031	-0.044	-0.056	-0.050
66	4.148	-0.031	-0.044	-0.063	-0.025
68	4.180	-0.025	-0.044	-0.044	0.006
70	4.204	-0.025	-0.050	-0.056	0.006
72	4.229	-0.031	-0.044	-0.069	-0.018
74	4.267	-0.025	-0.044	-0.056	0.000
76	4.279	-0.025	-0.044	-0.056	0.012
78	4.304	-0.018	-0.044	-0.050	0.000
80	4.335	-0.025	-0.044	-0.044	-0.006
82	4.360	-0.025	-0.044	-0.056	-0.012
84	4.379	-0.025	-0.044	-0.056	-0.025
86	4.410	-0.018	-0.044	-0.050	0.012
88	4.435	-0.012	-0.044	-0.044	0.031
90	4.448	-0.031	-0.044	-0.069	-0.025
92	4.473	-0.006	-0.037	-0.025	0.044
94	4.485	-0.018	-0.037	-0.044	-0.018
96	4.504	-0.025	-0.044	-0.063	-0.050
98	4.572	0.000	-0.037	-0.031	0.050
100	4.710	-0.018	-0.037	-0.037	0.012
120	5.190	-0.018	-0.037	-0.063	-0.050
140	5.507	-0.018	-0.031	-0.069	-0.044
160	5.651	0.000	-0.018	-0.044	0.018
180	5.825	-0.006	-0.025	-0.050	0.006
200	5.888	0.000	-0.018	-0.056	0.012
220	6.006	0.006	-0.012	-0.025	0.031
240	6.162	0.012	-0.012	-0.056	0.000

Note: Positive " + " values indicate a decrease in water level
Negative "-" values indicate an increase in water level.

ft bmp feet below measuring point

Table 4. Drawdown and Recovery Measurements Recorded by Data Logger From Pumping and Observation Wells During the April 1998 Aquifer Test, Colesville Landfill, Colesville, New York.

Date & Time Since Start of Pumping (minutes)	Pumping Well GMPW-2 (ft bmp)	Observation Well GMMW-2 (30 ft cross-gradient) (ft bmp)	Observation Well GMMW-3 (15 ft cross-gradient) (ft bmp)	Observation Well W-5 (90 ft upgradient) (ft bmp)	Observation Well PW-4 (100 feet downgradient) (ft bmp)
April 6, 1998					
260	6.280	0.012	-0.012	-0.031	0.044
280	6.411	0.006	-0.012	-0.050	0.012
300	6.417	-0.018	-0.018	-0.056	-0.006
320	6.430	-0.006	-0.018	-0.050	0.012
340	6.449	0.000	-0.012	-0.056	0.006
360	5.146	-0.012	-0.025	-0.063	0.000
380	5.059	-0.012	-0.031	-0.056	0.000
400	5.084	-0.012	-0.031	-0.063	0.000
420	5.146	-0.012	-0.031	-0.063	0.000
440	5.177	-0.018	-0.025	-0.063	0.006
460	5.190	-0.012	-0.025	-0.056	0.006
480	6.723	-0.012	-0.025	-0.063	0.006
500	8.723	0.006	0.000	-0.050	0.012
520	8.766	0.012	0.006	-0.050	0.012
540	8.716	0.012	0.006	-0.044	0.006
560	8.654	0.012	0.006	-0.056	0.012
580	8.579	0.018	0.006	-0.050	0.012
600	8.498	0.018	0.006	-0.050	0.018
620	8.417	0.012	0.000	-0.056	0.012
640	8.318	0.012	0.000	-0.056	0.012
660	8.243	0.012	0.000	-0.056	0.012
680	8.137	0.012	0.000	-0.063	0.018
700	8.081	0.006	-0.006	-0.063	0.012
720	8.031	0.006	-0.006	-0.063	0.012
740	8.062	0.006	-0.006	-0.063	0.012
760	8.212	0.006	-0.006	-0.069	0.012
780	8.218	0.006	-0.006	-0.069	0.018
800	8.212	0.006	-0.006	-0.069	0.012
820	8.199	0.012	-0.006	-0.069	0.018
April 7, 1998					
840	8.118	0.006	-0.006	-0.063	0.018
860	8.025	0.006	-0.012	-0.069	0.012
880	7.963	0.006	-0.006	-0.069	0.012

Note: Positive "+" values indicate a decrease in water level
Negative "-" values indicate an increase in water level.

ft bmp feet below measuring point

Table 4. Drawdown and Recovery Measurements Recorded by Data Logger From Pumping and Observation Wells During the April 1998 Aquifer Test, Colesville Landfill, Colesville, New York.

Date & Time Since Start of Pumping (minutes)	Pumping Well GMPW-2 (ft bmp)	Observation Well GMMW-2 (30 ft cross-gradient) (ft bmp)	Observation Well GMMW-3 (15 ft cross-gradient) (ft bmp)	Observation Well W-5 (90 ft upgradient) (ft bmp)	Observation Well PW-4 (100 feet downgradient) (ft bmp)
April 7, 1998					
900	7.925	0.006	-0.012	-0.069	0.018
920	7.857	0.006	-0.012	-0.069	0.018
940	7.776	0.000	-0.012	-0.069	0.012
960	7.701	0.000	-0.012	-0.075	0.012
980	7.608	0.000	-0.018	-0.075	0.018
1000	7.533	0.000	-0.018	-0.075	0.012
1030	7.433	0.000	-0.018	-0.069	0.012
1060	7.626	0.000	-0.018	-0.075	0.012
1090	7.608	0.006	-0.018	-0.069	0.018
1120	7.452	0.006	-0.018	-0.069	0.018
1150	7.271	0.000	-0.025	-0.069	0.018
1180	7.109	0.000	-0.025	-0.069	0.025
1210	7.003	0.000	-0.018	-0.069	0.025
1240	6.879	0.006	-0.025	-0.063	0.025
1270	6.760	0.000	-0.025	-0.063	0.025
1300	7.028	0.006	-0.018	-0.056	0.025
1330	7.016	0.006	-0.018	-0.056	0.025
1360	7.078	0.006	-0.025	-0.063	0.025
1390	8.853	0.012	-0.012	-0.056	0.025
1420	9.327	0.018	-0.006	-0.056	0.031
1450	9.333	0.025	-0.006	-0.063	0.031
1480	9.302	0.031	0.000	-0.050	0.037
1510	9.395	0.031	0.000	-0.050	0.031
1540	9.488	0.025	0.006	-0.056	0.031
1570	9.762	0.037	0.006	-0.044	0.037
1600	10.759	0.044	0.012	-0.044	0.025
1630	11.269	0.050	0.018	-0.050	0.025
1660	13.459	0.050	0.018	-0.056	0.018
1690.00	13.708	0.050	0.018	-0.063	0.018
1690.01	11.356	0.044	0.025	-0.056	0.031
1690.02	11.350	0.044	0.025	-0.063	0.031
1690.03	11.350	0.044	0.031	-0.056	0.031
1690.03	11.344	0.044	0.031	-0.063	0.025
1690.04	11.344	0.044	0.025	-0.056	0.025
1690.05	11.337	0.044	0.025	-0.056	0.025

Note: Positive "+" values indicate a decrease in water level
Negative "-" values indicate an increase in water level.

ft bmp feet below measuring point

Table 4. Drawdown and Recovery Measurements Recorded by Data Logger From Pumping and Observation Wells During the April 1998 Aquifer Test, Colesville Landfill, Colesville, New York.

Date & Time Since Start of Pumping (minutes)	Pumping Well GMPW-2 (ft bmp)	Observation Well GMMW-2 (30 ft cross-gradient) (ft bmp)	Observation Well GMMW-3 (15 ft cross-gradient) (ft bmp)	Observation Well W-5 (90 ft upgradient) (ft bmp)	Observation Well PW-4 (100 feet downgradient) (ft bmp)
April 7, 1998					
1690.06	11.331	0.044	0.025	-0.063	0.031
1690.07	11.331	0.044	0.025	-0.063	0.031
1690.08	11.331	0.044	0.025	-0.063	0.025
1690.08	11.325	0.044	0.025	-0.063	0.031
1690.09	11.319	0.044	0.025	-0.056	0.025
1690.10	11.319	0.044	0.031	-0.063	0.031
1690.11	11.319	0.044	0.025	-0.063	0.025
1690.12	11.313	0.044	0.025	-0.063	0.025
1690.13	11.306	0.044	0.025	-0.063	0.025
1690.13	11.306	0.037	0.031	-0.063	0.025
1690.14	11.306	0.044	0.025	-0.063	0.025
1690.15	11.306	0.044	0.025	-0.063	0.031
1690.16	11.300	0.037	0.025	-0.063	0.025
1690.17	11.300	0.037	0.025	-0.063	0.025
1690.18	11.294	0.044	0.025	-0.063	0.025
1690.18	11.294	0.037	0.025	-0.063	0.025
1690.19	11.288	0.037	0.025	-0.063	0.025
1690.20	11.288	0.037	0.025	-0.063	0.025
1690.21	11.281	0.037	0.025	-0.063	0.025
1690.22	11.281	0.037	0.025	-0.063	0.025
1690.23	11.275	0.037	0.025	-0.063	0.025
1690.23	11.275	0.037	0.025	-0.063	0.025
1690.24	11.269	0.037	0.025	-0.063	0.025
1690.25	11.269	0.037	0.025	-0.063	0.025
1690.26	11.263	0.037	0.025	-0.063	0.025
1690.27	11.263	0.037	0.025	-0.063	0.025
1690.28	11.257	0.037	0.025	-0.063	0.025
1690.28	11.257	0.037	0.025	-0.063	0.025
1690.29	11.257	0.037	0.025	-0.063	0.025
1690.30	11.250	0.037	0.025	-0.063	0.025
1690.31	11.250	0.037	0.025	-0.063	0.025
1690.32	11.244	0.037	0.025	-0.063	0.025
1690.33	11.244	0.037	0.025	-0.063	0.025
1690.33	11.238	0.037	0.025	-0.063	0.025
1690.35	11.238	0.037	0.025	-0.063	0.025

Note: Positive " + " values indicate a decrease in water level
Negative "-" values indicate an increase in water level.

ft bmp feet below measuring point

Table 4. Drawdown and Recovery Measurements Recorded by Data Logger From Pumping and Observation Wells During the April 1998 Aquifer Test, Colesville Landfill, Colesville, New York.

Date & Time Since Start of Pumping (minutes)	Pumping Well GMPW-2 (ft bmp)	Observation Well GMMW-2 (30 ft cross-gradient) (ft bmp)	Observation Well GMMW-3 (15 ft cross-gradient) (ft bmp)	Observation Well W-5 (90 ft upgradient) (ft bmp)	Observation Well PW-4 (100 feet downgradient) (ft bmp)
April 7, 1998					
1690.37	11.232	0.037	0.018	-0.063	0.025
1690.38	11.219	0.037	0.025	-0.063	0.025
1690.40	11.219	0.037	0.025	-0.063	0.025
1690.42	11.213	0.037	0.025	-0.063	0.025
1690.43	11.207	0.037	0.018	-0.063	0.025
1690.45	11.201	0.037	0.018	-0.063	0.025
1690.47	11.194	0.037	0.018	-0.063	0.025
1690.48	11.188	0.037	0.025	-0.063	0.025
1690.50	11.182	0.037	0.018	-0.063	0.025
1690.52	11.176	0.037	0.025	-0.063	0.025
1690.53	11.169	0.037	0.025	-0.063	0.025
1690.55	11.169	0.037	0.025	-0.063	0.025
1690.57	11.157	0.037	0.025	-0.063	0.025
1690.58	11.157	0.037	0.018	-0.063	0.025
1690.60	11.151	0.037	0.025	-0.063	0.025
1690.62	11.144	0.037	0.025	-0.063	0.025
1690.63	11.138	0.037	0.018	-0.063	0.025
1690.65	11.132	0.037	0.018	-0.063	0.025
1690.67	11.126	0.037	0.018	-0.063	0.025
1690.68	11.120	0.037	0.018	-0.063	0.018
1690.70	11.113	0.037	0.018	-0.063	0.025
1690.72	11.107	0.037	0.018	-0.063	0.025
1690.73	11.101	0.037	0.025	-0.063	0.025
1690.75	11.095	0.037	0.018	-0.063	0.018
1690.77	11.088	0.037	0.025	-0.063	0.018
1690.78	11.082	0.037	0.018	-0.063	0.018
1690.80	11.076	0.037	0.018	-0.063	0.018
1690.82	11.070	0.037	0.025	-0.063	0.018
1690.83	11.070	0.037	0.025	-0.063	0.018
1690.85	11.057	0.037	0.025	-0.063	0.018
1690.87	11.057	0.037	0.018	-0.063	0.018
1690.88	11.051	0.037	0.025	-0.063	0.018
1690.90	11.045	0.037	0.025	-0.056	0.018
1690.92	11.039	0.037	0.025	-0.063	0.018
1690.93	11.032	0.037	0.018	-0.063	0.018

Note: Positive " + " values indicate a decrease in water level
Negative "-" values indicate an increase in water level.

ft bmp feet below measuring point

Table 4. Drawdown and Recovery Measurements Recorded by Data Logger From Pumping and Observation Wells During the April 1998 Aquifer Test, Colesville Landfill, Colesville, New York.

Date & Time Since Start of Pumping (minutes)	Pumping Well GMPW-2 (ft bmp)	Observation Well GMMW-2 (30 ft cross-gradient) (ft bmp)	Observation Well GMMW-3 (15 ft cross-gradient) (ft bmp)	Observation Well W-5 (90 ft upgradient) (ft bmp)	Observation Well PW-4 (100 feet downgradient) (ft bmp)
April 7, 1998					
1690.95	11.026	0.037	0.025	-0.056	0.018
1690.97	11.026	0.031	0.018	-0.056	0.018
1690.98	11.014	0.037	0.025	-0.056	0.018
1691.0	11.014	0.037	0.025	-0.063	0.018
1691.2	10.939	0.037	0.025	-0.063	0.018
1691.4	10.871	0.037	0.018	-0.056	0.018
1691.6	10.802	0.037	0.025	-0.063	0.018
1691.8	10.734	0.044	0.025	-0.056	0.018
1692.0	10.665	0.037	0.018	-0.056	0.018
1692.2	10.603	0.037	0.018	-0.063	0.018
1692.4	10.534	0.037	0.018	-0.063	0.018
1692.6	10.466	0.044	0.018	-0.056	0.012
1692.8	10.460	0.044	0.018	-0.056	0.012
1693.0	10.466	0.044	0.018	-0.056	0.012
1693.2	10.715	0.044	0.018	-0.056	0.018
1693.4	10.920	0.044	0.018	-0.056	0.018
1693.6	10.858	0.044	0.018	-0.050	0.012
1693.8	10.777	0.044	0.018	-0.050	0.012
1694.0	10.703	0.044	0.018	-0.050	0.012
1694.2	10.703	0.044	0.018	-0.050	0.012
1694.4	10.765	0.044	0.025	-0.056	0.018
1694.6	10.958	0.044	0.018	-0.056	0.012
1694.8	11.120	0.044	0.018	-0.056	0.018
1695.0	11.356	0.044	0.018	-0.063	0.018
1695.2	11.642	0.044	0.018	-0.063	0.018
1695.4	11.885	0.037	0.018	-0.063	0.018
1695.6	12.059	0.037	0.012	-0.063	0.012
1695.8	11.997	0.044	0.018	-0.063	0.006
1696.0	11.960	0.037	0.012	-0.063	0.012
1696.2	11.985	0.044	0.012	-0.063	0.012
1696.4	12.010	0.044	0.018	-0.063	0.018
1696.6	12.034	0.044	0.018	-0.056	0.018
1696.8	12.059	0.044	0.018	-0.056	0.018
1697.0	12.072	0.044	0.018	-0.056	0.025
1697.2	12.034	0.037	0.018	-0.056	0.018

Note: Positive " + " values indicate a decrease in water level
Negative "-" values indicate an increase in water level.

ft bmp feet below measuring point

Table 4. Drawdown and Recovery Measurements Recorded by Data Logger From Pumping and Observation Wells During the April 1998 Aquifer Test, Colesville Landfill, Colesville, New York.

Date & Time Since Start of Pumping (minutes)	Pumping Well GMPW-2 (ft bmp)	Observation Well GMMW-2 (30 ft cross-gradient) (ft bmp)	Observation Well GMMW-3 (15 ft cross-gradient) (ft bmp)	Observation Well W-5 (90 ft upgradient) (ft bmp)	Observation Well PW-4 (100 feet downgradient) (ft bmp)
April 7, 1998					
1697.4	11.991	0.044	0.018	-0.056	0.018
1697.6	11.954	0.044	0.018	-0.056	0.012
1697.8	11.922	0.037	0.018	-0.056	0.012
1698.0	11.879	0.037	0.018	-0.063	0.012
1698.2	11.860	0.037	0.018	-0.063	0.018
1698.4	11.842	0.044	0.018	-0.056	0.018
1698.6	11.823	0.044	0.025	-0.056	0.025
1698.8	11.804	0.044	0.018	-0.050	0.025
1699.0	11.786	0.044	0.018	-0.050	0.025
1699.2	11.767	0.050	0.018	-0.050	0.018
1699.4	11.748	0.044	0.018	-0.056	0.006
1699.6	11.730	0.044	0.018	-0.050	0.012
1699.8	11.711	0.044	0.018	-0.056	0.012
1700.0	11.698	0.044	0.018	-0.056	0.012
1702	11.792	0.044	0.018	-0.063	0.006
1704	11.922	0.031	0.018	-0.056	0.025
1706	12.022	0.037	0.018	-0.063	0.018
1708	12.090	0.037	0.018	-0.056	0.012
1710	12.140	0.037	0.012	-0.063	0.018
1712	12.178	0.044	0.025	-0.056	0.025
1714	12.202	0.044	0.018	-0.056	0.025
1716	12.215	0.037	0.018	-0.056	0.018
1718	12.227	0.037	0.012	-0.063	0.018
1720	12.246	0.044	0.018	-0.050	0.025
1722	12.252	0.044	0.018	-0.056	0.031
1724	12.240	0.044	0.018	-0.056	0.018
1726	12.252	0.050	0.025	-0.050	0.031
1728	12.252	0.044	0.018	-0.050	0.025
1730	12.252	0.044	0.018	-0.056	0.031
1732	12.240	0.031	0.012	-0.069	0.025
1734	12.240	0.037	0.018	-0.063	0.018
1736	12.240	0.037	0.018	-0.063	0.025
1738	12.234	0.037	0.018	-0.063	0.025
1740	12.227	0.044	0.018	-0.056	0.031
1742	12.221	0.037	0.018	-0.063	0.018

Note: Positive " + " values indicate a decrease in water level
Negative "-" values indicate an increase in water level.

ft bmp feet below measuring point

Table 4. Drawdown and Recovery Measurements Recorded by Data Logger From Pumping and Observation Wells During the April 1998 Aquifer Test, Colesville Landfill, Colesville, New York.

Date & Time Since Start of Pumping (minutes)	Pumping Well GMPW-2 (ft bmp)	Observation Well GMMW-2 (30 ft cross-gradient) (ft bmp)	Observation Well GMMW-3 (15 ft cross-gradient) (ft bmp)	Observation Well W-5 (90 ft upgradient) (ft bmp)	Observation Well PW-4 (100 feet downgradient) (ft bmp)
April 7, 1998					
1744	12.227	0.044	0.018	-0.056	0.031
1746	12.234	0.037	0.018	-0.069	0.025
1748	12.234	0.037	0.012	-0.063	0.025
1750	12.240	0.037	0.012	-0.063	0.018
1752	12.234	0.031	0.012	-0.075	0.018
1754	12.246	0.037	0.018	-0.069	0.025
1756	12.246	0.037	0.012	-0.063	0.012
1758	12.252	0.037	0.012	-0.069	0.025
1760	12.252	0.037	0.012	-0.063	0.018
1762	12.258	0.037	0.012	-0.069	0.025
1764	12.258	0.037	0.012	-0.069	0.031
1766	12.265	0.037	0.012	-0.069	0.025
1768	12.252	0.031	0.012	-0.075	0.025
1770	12.252	0.031	0.012	-0.075	0.025
1772	12.234	0.037	0.012	-0.069	0.012
1774	12.221	0.037	0.012	-0.069	0.025
1776	12.202	0.037	0.006	-0.075	0.031
1778	12.178	0.031	0.006	-0.081	0.018
1780	12.171	0.037	0.012	-0.069	0.018
1782	12.159	0.037	0.012	-0.075	0.025
1784	12.140	0.031	0.006	-0.081	0.018
1786	12.146	0.037	0.012	-0.069	0.031
1788	12.140	0.037	0.012	-0.069	0.025
1790	12.140	0.037	0.012	-0.069	0.018
1810	12.128	0.037	0.012	-0.075	0.025
1830	12.103	0.037	0.006	-0.075	0.025
1850	12.271	0.037	0.012	-0.075	0.031
1870	12.258	0.037	0.012	-0.069	0.025
1890	12.252	0.031	0.006	-0.075	0.018
1910	12.134	0.031	0.006	-0.075	0.031
1930	12.140	0.037	0.012	-0.075	0.031
1950	12.178	0.031	0.006	-0.075	0.031
1970	12.171	0.031	0.006	-0.075	0.037
1990	12.395	0.037	0.006	-0.075	0.031
2010	13.758	0.037	0.012	-0.075	0.031

Note: Positive " + " values indicate a decrease in water level
Negative "-" values indicate an increase in water level.

ft bmp feet below measuring point

Table 4. Drawdown and Recovery Measurements Recorded by Data Logger From Pumping and Observation Wells During the April 1998 Aquifer Test, Colesville Landfill, Colesville, New York.

Date & Time Since Start of Pumping (minutes)	Pumping Well GMPW-2 (ft bmp)	Observation Well GMMW-2 (30 ft cross-gradient) (ft bmp)	Observation Well GMMW-3 (15 ft cross-gradient) (ft bmp)	Observation Well W-5 (90 ft upgradient) (ft bmp)	Observation Well PW-4 (100 feet downgradient) (ft bmp)
April 7, 1998					
2030	13.919	0.037	0.018	-0.075	0.031
2050	7.757	0.025	0.000	-0.075	0.037
2070	5.813	0.000	-0.037	-0.075	0.031
2090	13.198	0.025	0.000	-0.069	0.037
2110	13.708	0.037	0.012	-0.075	0.037
2130	13.733	0.037	0.012	-0.075	0.037
2150	13.727	0.037	0.012	-0.075	0.031
2170	8.149	0.031	0.000	-0.075	0.037
2190	7.072	0.006	-0.025	-0.081	0.031
2210	11.456	0.012	-0.012	-0.088	0.025
2230	12.594	0.025	-0.006	-0.088	0.031
2250	12.949	0.025	0.000	-0.088	0.037
2270	12.937	0.031	0.000	-0.088	0.031
April 8, 1998					
2290	12.906	0.025	0.000	-0.088	0.031
2310	12.862	0.025	-0.006	-0.088	0.031
2330	13.403	0.031	-0.006	-0.088	0.037
2350	13.453	0.031	0.000	-0.088	0.031
2370	13.428	0.031	-0.006	-0.088	0.031
2390	13.378	0.031	0.000	-0.088	0.031
2410	13.347	0.025	-0.006	-0.094	0.031
2430	13.329	0.025	-0.006	-0.094	0.031
2450	13.304	0.025	-0.006	-0.088	0.037
2470	13.260	0.025	-0.006	-0.094	0.025
2490	13.229	0.025	-0.012	-0.094	0.025
2510	13.646	0.025	-0.006	-0.100	0.031
2530	13.689	0.025	-0.006	-0.094	0.025
2550	13.689	0.018	-0.006	-0.100	0.025
2570	13.758	0.025	-0.006	-0.100	0.031
2590	14.983	0.037	0.006	-0.088	0.044
2610	15.045	0.044	0.006	-0.081	0.037
2630	15.014	0.037	0.006	-0.075	0.037
2650	15.008	0.044	0.006	-0.075	0.037

Note: Positive " + " values indicate a decrease in water level
Negative "-" values indicate an increase in water level.

ft bmp feet below measuring point

Table 4. Drawdown and Recovery Measurements Recorded by Data Logger From Pumping and Observation Wells During the April 1998 Aquifer Test, Colesville Landfill, Colesville, New York.

Date & Time Since Start of Pumping (minutes)	Pumping Well GMPW-2 (ft bmp)	Observation Well GMMW-2 (30 ft cross-gradient) (ft bmp)	Observation Well GMMW-3 (15 ft cross-gradient) (ft bmp)	Observation Well W-5 (90 ft upgradient) (ft bmp)	Observation Well PW-4 (100 feet downgradient) (ft bmp)
April 8, 1998					
2670	15.002	0.037	0.006	-0.081	0.037
2690	15.306	0.044	0.012	-0.075	0.044
2720	15.679	0.031	0.000	-0.088	0.025
2750	15.710	0.037	0.006	-0.081	0.044
2780	15.673	0.037	0.000	-0.088	0.037
2810	15.673	0.044	0.006	-0.088	0.037
2840	15.642	0.044	0.012	-0.081	0.044
2870	15.791	0.050	0.012	-0.081	0.044
2900	15.835	0.044	0.006	-0.081	0.044
2930	15.822	0.044	0.006	-0.081	0.037
2960	15.754	0.037	0.000	-0.088	0.037
2990	15.735	0.031	0.000	-0.094	0.025
3020	15.785	0.037	0.000	-0.094	0.031
3050	15.760	0.031	-0.006	-0.107	0.031
3080	15.741	0.031	0.000	-0.100	0.037
3110	15.797	0.031	0.000	-0.100	0.031
3140	15.785	0.037	0.006	-0.088	0.044
3170	15.766	0.044	0.006	-0.088	0.050
3200	15.735	0.031	0.000	-0.088	0.037
3230	5.576	-0.006	-0.050	-0.100	0.025
3260	1.635	-0.031	-0.082	-0.088	0.050
3290	0.474	-0.056	-0.107	-0.081	0.037
3320	0.586	-0.056	-0.107	-0.088	0.037
3350	0.337	-0.063	-0.113	-0.081	0.037
3380	0.305	-0.063	-0.120	-0.081	0.037
3410	0.293	-0.069	-0.126	-0.088	0.031
3440	0.280	-0.069	-0.126	-0.088	0.031
3470	0.280	-0.063	-0.120	-0.081	0.044
3500	0.280	-0.056	-0.120	-0.075	0.044
3530	0.268	-0.069	-0.126	-0.075	0.037
3560	0.249	-0.069	-0.132	-0.081	0.031
3590	0.243	-0.075	-0.139	-0.094	0.031
3620	0.237	-0.081	-0.139	-0.100	0.025
3650	0.230	-0.081	-0.139	-0.100	0.031
3680	0.224	-0.081	-0.145	-0.107	0.025
3710	0.224	-0.075	-0.145	-0.100	0.025

Note: Positive " + " values indicate a decrease in water level
Negative "-" values indicate an increase in water level.

ft bmp feet below measuring point

Table 5. Manual Water-Level Measurements Collected from Background Observation Wells and Pumping Well During the April 1998 Aquifer Test, Colesville Landfill, Colesville, New York.

Measuring Point Designation	Date of Measurement	Time of Measurement (hours)	Depth to Water (ft bmp)	Measuring Point Elevation (ft msl)	Water Level Elevation (ft msl)
WELLS					
GMMW-2	4/2/98	1100	36.82	1030.95	994.13
GMMW-3	4/2/98	1100	34.70	1028.02	993.32
GMPW-2	4/2/98	1100	32.20	1028.80	996.60
W-5	4/2/98	1100	51.57	1051.41	999.84
W-22S	4/2/98	1100	9.02	965.05	956.03
		1420	9.00		956.05
	4/6/98	0841	9.42		955.63
		1108	9.40		955.65
		1300	9.42		955.63
		1500	9.42		955.63
		1700	9.44		955.61
		1900	9.45		955.60
		2100	9.42		955.63
		2300	9.45		955.60
	4/7/98	0100	9.48		955.57
		0300	9.48		955.57
		0500	9.48		955.57
		0700	9.49		955.56
		0930	9.50		955.55
		1100	9.50		955.55
		1300	9.50		955.55
		1500	9.50		955.55
		1700	9.48		955.57
		1900	9.50		955.55
		2100	9.50		955.55
		2300	9.52		955.53
	4/8/98	0100	9.54		955.51
		0300	9.54		955.51
		0500	9.55		955.50
		0700	9.55		955.50
		0900	9.56		955.49
		1100	9.56		955.49

Table 5. Manual Water-Level Measurements Collected from Background Observation Wells and Pumping Well During the April 1998 Aquifer Test, Colesville Landfill, Colesville, New York.

Measuring Point Designation	Date of Measurement	Time of Measurement (hours)	Depth to Water (ft bmp)	Measuring Point Elevation (ft msl)	Water Level Elevation (ft msl)
W-22S	4/8/98	1300	9.56	965.05	955.49
		1500	9.58		955.47
	4/9/98	0830	9.55		955.50
PW-3	4/2/98	1100	9.02	988.92	979.90
		1920	9.00		979.92
		0841	9.30		979.62
		1108	9.30		979.62
		1300	9.30		979.62
		1500	9.30		979.62
		1700	9.32		979.60
		1900	9.32		979.60
		2100	9.34		979.58
		2300	9.32		979.60
	4/7/98	0100	9.32		979.60
		0300	9.32		979.60
		0500	9.34		979.58
		0700	9.36		979.56
		0930	9.34		979.58
		1100	9.34		979.58
		1300	9.34		979.58
		1500	9.34		979.58
		1700	9.33		979.59
		1900	9.34		979.58
		2100	9.34		979.58
		2300	9.36		979.56
	4/8/98	0100	9.36		979.56
		0300	9.36		979.56
		0500	9.36		979.56
		0700	9.37		979.55
		0900	9.38		979.54
		1100	9.34		979.58
		1300	9.36		979.56
		1500	9.34		979.58
	4/9/98	0830	9.36		979.56

Table 5. Manual Water-Level Measurements Collected from Background Observation Wells and Pumping Well During the April 1998 Aquifer Test, Colesville Landfill, Colesville, New York.

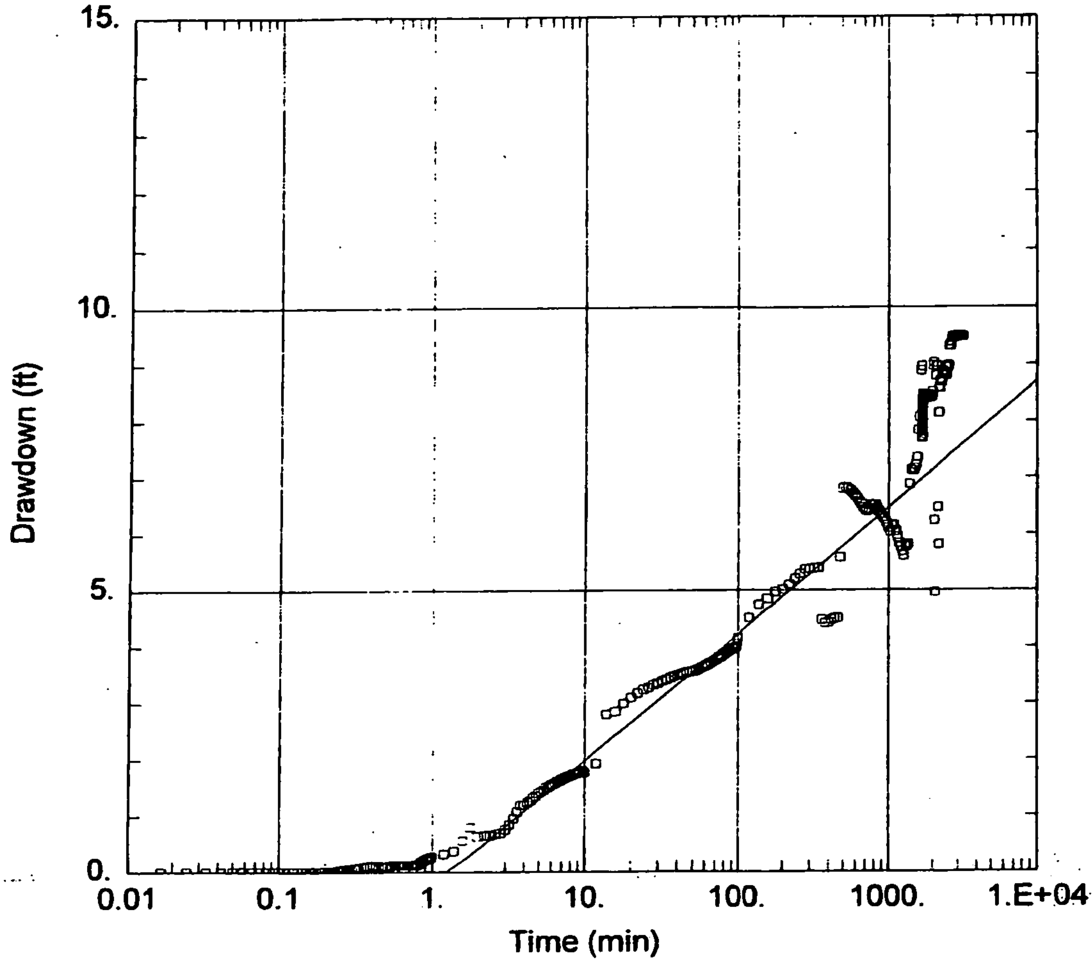
Measuring Point Designation	Date of Measurement	Time of Measurement (hours)	Depth to Water (ft bmp)	Measuring Point Elevation (ft msl)	Water Level Elevation (ft msl)
GMMW-1	4/2/98	1100	46.90	1043.59	996.69
		1920	46.85		996.74
	4/6/98	0841	46.92		996.67
		1108	46.90		996.69
		1300	46.89		996.70
		1500	46.90		996.69
		1700	46.90		996.69
		1900	46.92		996.67
		2100	46.94		996.65
		2300	46.92		996.67
	4/7/98	0100	46.90		996.69
		0300	46.88		996.71
		0500	46.87		996.72
		0700	46.88		996.71
		0930	46.90		996.69
		1100	46.90		996.69
		1300	46.88		996.71
		1500	46.84		996.75
		1700	46.82		996.77
		1900	46.84		996.75
		2100	46.85		996.74
		2300	46.85		996.74
	4/8/98	0100	46.86		996.73
		0300	46.84		996.75
		0500	46.85		996.74
		0700	46.87		996.72
		0900	46.87		996.72
		1100	46.85		996.74
		1300	46.86		996.73
		1500	46.86		996.73
	4/9/98	0830	46.83		996.76
STAFF GAUGE					
SG-1 [a]	4/2/98	1100	0.00	NS	--
		1420	0.00		--
	4/6/98	0841	-0.18		--

Table 5. Manual Water-Level Measurements Collected from Background Observation Wells and Pumping Well During the April 1998 Aquifer Test, Colesville Landfill, Colesville, New York.

Measuring Point Designation	Date of Measurement	Time of Measurement (hours)	Depth to Water (ft bmp)	Measuring Point Elevation (ft msl)	Water Level Elevation (ft msl)
STAFF GAUGE					
SG-1 [(a)]	4/7/98	1700	-0.18	NS	--
		1900	-0.18		--
		0700	-0.2		--
		1700	-0.22		--
	4/8/98	0700	-0.23		--
		1700	-0.16		--
	4/9/98	0830	-0.12		--

Note: Negative "-" values indicate a rise in water level.

ft msl Feet relative to mean sea level
ft bmp Feet below measuring point
(a) Values refer to change in stage of North Stream
NS Not surveyed



WELL GMPW-2

Data Set: G:\APROJECT\BROOME\NY0949.010\003\DATA\GMPW2.AQT
Date: 05/01/98 Time: 15:02:17

PROJECT INFORMATION

Test Location: Colesville Landfill
Test Date: April 6, 1998

AQUIFER DATA

Saturated Thickness: 19.8 ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW 2	0	0

Observation Wells

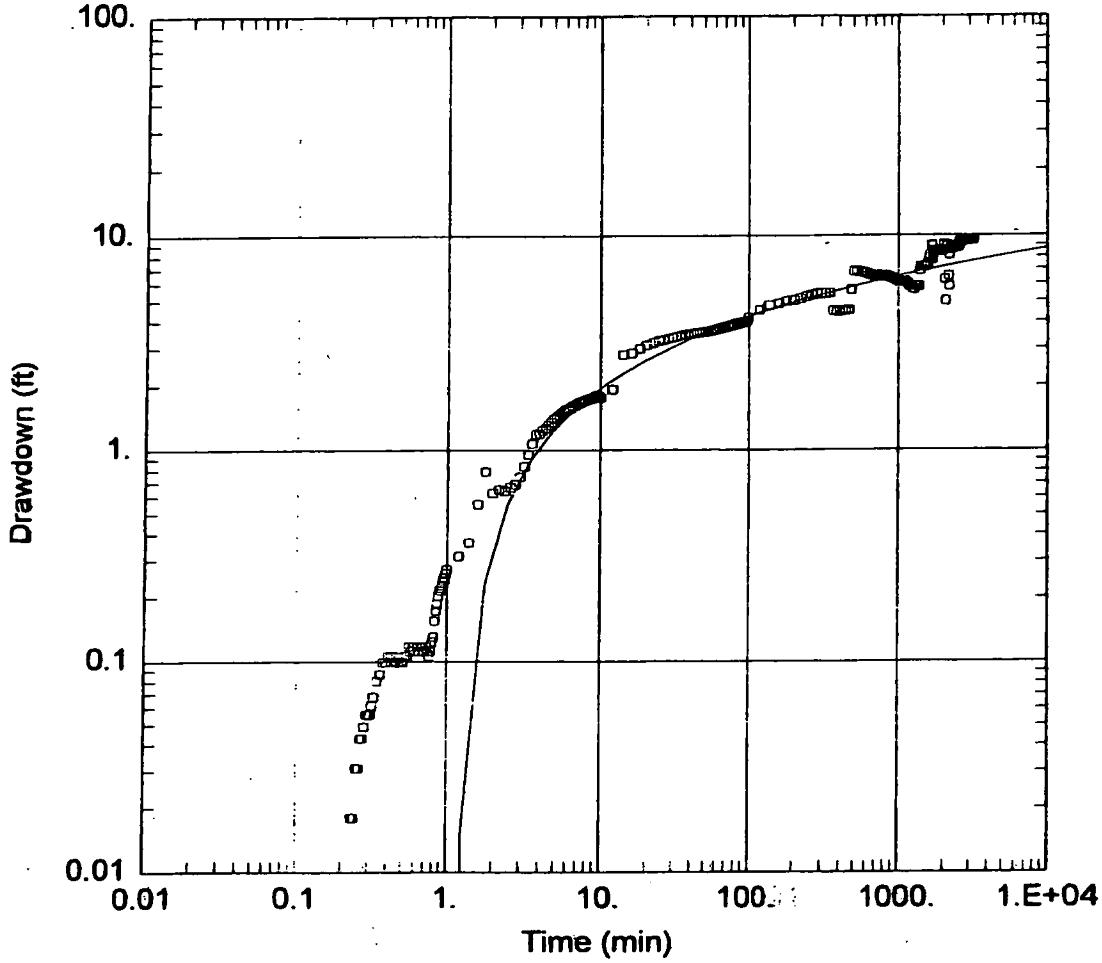
Well Name	X (ft)	Y (ft)
▫ OW 1	0.417	0

SOLUTION

Aquifer Model: Unconfined
Solution Method: Cooper-Jacob

T = 4.72 ft^2/day
S = 0.0563

Figure 2



WELL GMPW-2

Data Set: G:\APROJECT\BROOME\NY0949.010\003\DATA\GMPW2.AQT
Date: 05/01/98 Time: 14:55:52

PROJECT INFORMATION

Test Location: Colesville Landfill
Test Date: April 6, 1998

AQUIFER DATA

Saturated Thickness: 19.8 ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW 2	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
▫ OW 1	0.417	0

SOLUTION

Aquifer Model: Unconfined T = 4.72 ft^2/day **Figure 3**

Solution Method: Theis S = 0.0[illegible]

APPENDIX B

ARCADIS GERAGHTY&MILLER

Appendix B

"Results of Enhanced Reductive Dechlorination Zone Pilot Test," Colesville Landfill, Broome County, New York

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Results of Enhanced Reductive Dechlorination Pilot Study, Colesville Landfill, Broome County, New York

PREPARED FOR

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Results of Enchanced Reductive Dechlorination Pilot Study, Colesville Landfill, Broome County, New York

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Our Ref.:
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Date:
29 October 1999

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1. Introduction

ARCADIS Geraghty & Miller, Inc., was retained by Broome County and GAF Corporation to prepare this summary of the Enhanced Reductive Dechlorination (ERD) Pilot Test conducted at the Colesville Landfill, located in Broome County, New York. This summary is intended to present the results of the pilot test and critical design data that would be necessary to implement the design-related activities for a larger scale ERD approach at the Colesville Landfill. Preliminary information regarding the progress of the pilot test has been submitted to the United States Environmental Protection Agency (USEPA) in progress reports dated March 31 and June 15, 1999.

The Pilot Test was initiated in the northwestern portion of the site in an area adjacent to the landfill where historically the highest concentrations of volatile organic compounds (VOCs) have been observed (Figure 1). The ERD Pilot Test was conducted for six months between December 1998 and July 1999. This test involved supplying the impacted groundwater with a carbon source in the form of a mixture of molasses and water. This molasses reagent induces an anaerobic and reducing environment in the groundwater (an in-situ reactive zone), which is conducive to enhancing the natural biodegradation of chlorinated aliphatic hydrocarbons or VOCs present in groundwater at the site. The target VOCs at the Colesville Landfill include tetrachloroethene (PCE) and 1,1,1 trichloroethane (TCA) and their associated degradation (daughter) products. The biodegradation mechanisms that are enhanced are reductive dechlorination (or dehalogenation) processes. Evidence of an anaerobic and reducing groundwater environment in portions of the site was previously presented in Appendix A of the Revised Focused Feasibility Study (ARCADIS Geraghty & Miller 1996), and Natural Attenuation Sampling Data Reports (ARCADIS Geraghty & Miller 1997, 1998a, 1998b, 1998c).

The ERD Pilot Test was highly successful in accomplishing the objectives of enhancing biogeochemical conditions to dramatically increase rates of biodegradation at the site. An overview of the significant results that were achieved during the six month pilot test is as follows:

- A redox zone was strongly established in and downgradient of the pilot test area.
- Significant concentrations of total organic carbon (TOC) have been introduced.
- Degradation of VOCs to more lightly chlorinated compounds is clearly evident.

- An overall reduction in VOC concentrations was achieved.
- A steep decline in VOC concentrations at the downgradient edge of the ERD zone was achieved.
- Some surfactant effects (desorption of VOCs) are evident in close proximity to the injection wells, which indicates that an ERD approach can significantly reduce the remedial timeframe by attacking sorbed contaminant mass.

2. Site Background and Conditions

Waste disposal operations were conducted at the Site from 1969 until it was closed in 1984. The landfill was primarily used for the disposal of municipal solid waste. Historical data indicate that waste was not placed below the water table during operation of the landfill. Installation of the landfill cap as a source control measure, which was completed on November 1, 1995, will essentially eliminate the generation of landfill leachate over time. In addition to the expected improvement in groundwater quality resulting from the landfill caps, VOC mass removal via natural attenuation processes are ongoing at the Site. Groundwater samples collected from beneath and downgradient of the landfill since 1995 indicate that the areal extent of VOC-impacted groundwater is static, and total VOC concentrations are stable to decreasing with time. The following sections present details regarding the groundwater chemistry and hydrogeology of the site and pilot test area.

2.1 Groundwater Chemistry

Several classes of VOCs are present in the site groundwater, including aromatics such as benzene, toluene, and chlorobenzene; chlorinated aliphatics, such as trichloroethene (TCE) and its degradation products, including cis-1,2-DCE, and vinyl chloride (VC); and 1,1,1-trichloroethane (TCA) and its degradation products, including 1,1 dichloroethane (1,1-DCA), chloroethane (CA) and the transformation product 1,1-dichloroethene (1,1-DCE). Additional chlorinated intermediates are also present in the groundwater, such as chlorinated methanes and substituted benzenes.

The chlorinated VOCs present in the site groundwater can be degraded both biotically (i.e., through biologically mediated processes) and also through abiotic (or chemical, non-biological processes). The following sequences show some of the general transformation sequences for the VOCs on site (with "a" indicating an abiotic pathway; and "b" indicating a biotic pathway).

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- 1,1,1-trichloroethane (TCA) →[a] 1,1-dichloroethene (1,1-DCE) →[b] vinyl chloride (VC) →[b] ethene →[b] ethane
- TCA →[a] acetic acid
- TCA →[b] 1,1-dichloroethane (1,1-DCA) →[b] chloroethane (CA) →[b] ethanol / →[b] ethane
- 1,2-dichloroethane (1,2-DCA) →[b] ethane
- tetrachloroethene (PCE) →[b] trichloroethene (TCE) →[b] cis-1,2-dichloroethene (1,2-DCE) →[b] VC →[b] ethene →[b] ethane
- carbon tetrachloride (CT) →[b] chloroform (CF) →[b] dichloromethane[methylene chloride (MC)] →[b] chloromethane (CM) →[b] methane

The primary constituents on site are TCA and PCE and their transformation products.

Groundwater data collected prior to June 1996 indicated that the areal extent of VOC-impacted groundwater at the site had remained static, with some wells showing decreasing concentrations with time. These results prompted an investigation in June 1996 to collect biogeochemical parameters from groundwater at the site in order to evaluate potential natural, (or intrinsic) biodegradation processes that were believed to be ongoing. Additional rounds of biogeochemical sampling data collected in July 1997 and quarterly in 1998 (March, June, September, and December) provided further evidence of ongoing biodegradation mechanisms at the site.

The results of the biogeochemical sampling rounds showed that anaerobic and reducing environments were present in groundwater beneath and immediately adjacent to the landfill. These conditions are necessary for natural biological processes to effectively degrade the chlorinated VOCs. At distances further away from the landfill, the geochemical environment transitions to a primarily aerobic environment.

Chlorinated compounds can be subject to anaerobic reductive dehalogenation reactions in groundwater, whereby a chlorine atom is removed and substituted with a hydrogen atom. The reductive process is usually through co-metabolism. Reductive dechlorination mechanisms involving cometabolic processes contribute to the degradation of the VOCs present in groundwater at the site (such as TCE and 1,1,1-TCA).

The reductive dechlorination of chlorinated VOCs involves naturally occurring subsurface microbes which utilize organic carbon in the groundwater as a primary substrate for obtaining energy. During this process, the microbes use the chlorinated VOCs as electron donors, and oxygen, nitrate, and/or iron/manganese, sulfate, and carbon dioxide, as electron acceptors. Enzymes produced by microbes during the more strongly reducing reactions fortuitously degrade the source chlorinated VOCs. The organic carbon necessary for cometabolic degradation can either be natural (i.e., present in the aquifer matrix) or anthropogenic (such as in the form of other groundwater contaminants, such as benzene, and toluene).

The presence of organic carbon is necessary for the anaerobic dechlorination processes to occur. At the Colesville site the presence of organic carbon (as dissolved total organic carbon [DOC]) in the wells in or near the landfill allows for reductive dechlorination to occur. The occurrence of reductive dechlorination mechanisms is evidenced by relatively elevated concentrations of ethene and ethane (final degradation products) in these wells. However, the relatively low concentrations of dissolved organic carbon in the area downgradient of the landfill are a limiting factor in the degree of reductive dechlorination in groundwater. The basic goal of the pilot study was to enhance a carbon-depleted portion of the site groundwater in order to stimulate degradation processes.

2.2 Site Hydrogeology

The target hydrogeologic unit at the Colesville Landfill is the glacial outwash aquifer. This aquifer has a thickness of approximately 20 ft in the pilot test area. Glacial outwash deposits consist of a heterogeneous mixture of gravel, sand, clay and silt. The average hydraulic conductivity of these materials is approximately 0.3 ft/day (ARCADIS Geraghty & Miller 1998). Depths to water in the pilot area are approximately 40 feet (within sands and silty sand lithologies). Groundwater elevations measured over successive events in monitoring wells during the pilot study indicate that groundwater is flowing in a westerly to southwesterly direction (Figure 2). The horizontal hydraulic gradient in the immediate vicinity of the pilot test is approximately 0.5 feet per foot. Assuming an effective porosity of 20 percent for the silty sand lithology, the average linear groundwater velocity in this localized area is approximately 0.75 feet per day (ft/day) or approximately 274 feet per year.

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Glaciolacustrine deposits ranging in thickness from 6 to 225 ft were encountered throughout the site directly beneath the glacial outwash deposits. This unit, consisting predominantly of silt and clayey silt, acts as a confining unit between the glacial outwash aquifer and the underlying bedrock aquifer.

3. Objectives of the ERD Technology

The application of Enhanced Reductive Dechlorination (ERD) is intended to address the chlorinated VOCs present in the glacial outwash aquifer in the vicinity of the landfill. By creating an in-situ reactive zone it is possible to remove VOC mass from the subsurface at a rate much greater than that which could be achieved through groundwater extraction alone. The ERD approach would ultimately degrade VOCs to innocuous compounds such as carbon dioxide, water, and chloride. The in-situ reactive zone technology will not generate air emissions, thereby eliminating the potential for transfer into another media, as well as the need to pretreat an air discharge vapor stream (as in the case of the SVE system).

The large scale effectiveness of an ERD approach at this site will be dependent on the efficacy of the resulting in-situ reactive zone in desorbing VOCs from the aquifer media and then degrading the VOCs dissolved in groundwater. The pilot study was therefore targeted for an area of the site where relatively elevated concentrations of VOCs have been detected in groundwater (approximately 2 to 4 mg/L). An overview of the Pilot Test approach is presented in Section 5.

4. Detailed Description of the ERD Technology

This section of the report contains a detailed description of the ERD technology.

4.1 Overview of Enhanced Reductive Dechlorination (ERD)

The prevalent chlorinated solvents found at the Colesville Site are PCE and TCA. PCE and TCA are both transformed by naturally occurring chemical and biological processes in the subsurface to form a variety of other VOCs (daughter products). PCE is transformed primarily through biotic processes (i.e. biologically mediated), while TCA is capable of both biotic and significant abiotic processes (i.e. non- biological, or chemical).

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4.1.1 Reductive Dechlorination Processes

Reductive dechlorination is a general term that describes the sequential removal of a chlorine atom from a chlorinated VOC and the substitution with a hydrogen atom. The degradation sequence for PCE is as follows: PCE → TCE → DCE→ VC → ethene→ ethane → carbon dioxide, water and chloride.

The later steps of this process, such as the degradation of DCE (cis-and trans-isomers) to VC, and the degradation of VC to ethene, generally require more strongly reducing conditions than do the initial degradation steps. The more highly chlorinated compounds are most susceptible to reductive dechlorination because of their higher state of oxidation (McCarty 1996). Often the groundwater environment is not reducing enough (i.e., the oxidation-reduction potential is not negative enough) to allow for the complete degradation of a chlorinated VOC to occur, which can result in an accumulation of daughter products (such as DCE and VC). Generally, stronger reducing conditions, and the depletion of electron acceptors, are needed to foster the latter processes in this sequence. Under transitional to oxidizing conditions (ORP measurements above 0 mV) in groundwater, most anaerobic reductive reactions are not favorable.

Reductive dechlorination mechanisms are primarily co-metabolic processes that occur in anaerobic (oxygen-deficient) environments. Once oxygen is depleted from the groundwater environment, microbes can utilize alternate electron acceptors for respiration, such as nitrate, iron, manganese, sulfate, and carbon dioxide. Organic carbon serves as an energy substrate and is oxidized during this process. Enzymes and co-factors produced during these reactions fortuitously degrade the source chlorinated volatile organic compounds (McCarty 1996).

4.1.2 Applying ERD for Groundwater Treatment through In-Situ Reactive Zones

ERD is founded on the concept of enhancing the natural conditions in the subsurface system in order to drive the conditions to a state that is more conducive to degradation of the VOCs. Often, natural degradation is limited or stalled at a site due to one or more of the following limiting conditions:

- Aerobic or oxidizing conditions.
- Weak reducing conditions.
- Deficiency of organic carbon.
- Deficiency of electron acceptors.
- Deficiency of nutrients.

- Stressed bacterial population.

The most common rate-limiting factors that result in slow or little degradation are a lack of organic carbon and relatively mild redox conditions (often slightly aerobic). It has been reported that concentrations of TOC in excess of 100 times the contaminant concentration are needed for optimal co-metabolic degradation rates (Bouwer 1994).

In order to overcome the lack of adequate natural carbon and ensure a strongly reducing environment for the reductive dechlorination of the parent chlorinated solvents and their daughter products, the use of ERD through molasses injection was proposed at the Colesville site. The application of ERD result in the faster rates of reductive dechlorination of VOCs by sequentially lower redox environments in groundwater, with greater utilization of sulfate and carbon dioxide as electron acceptors.

An advantage of ERD utilizing organic carbon substrates is the ability to treat mass that is adsorbed to the subsurface soil matrix. More traditional groundwater treatment technologies rely on physical flushing of this mass from the aquifer, which requires multiple pore volumes of the aquifer to be removed, often with only a small percent of the total mass removed. The ability of ERD technology to treat adsorbed mass is due to several factors:

1. In a carbon-rich aqueous environment, hydrophobic constituents will tend to partition from the soil matrix into the aqueous environment;

2. A flourishing microbial community produces natural surfactants (consisting of carbohydrates and lipids) which aid in desorbing mass from the soil matrix; and

3. Fermentative conditions created in the subsurface via the ERD produce low concentrations of alcohols which can have a co-solvency effect, making mass accessible to the microbial population for treatment.

One of the goals of the Pilot Test at the Colesville Site was to determine the amount of desorption that the ERD would create and to ensure that this influx of mass could be effectively treated via ERD.

5. Pilot Test: Overview of Approach

A plan to conduct the pilot test at the Colesville Site was proposed to the USEPA and New York State Department of Environmental Conservation (NYDEC) in November 1998. This test involved the installation of an additional two injection wells and two monitoring wells. Molasses-based reagents were delivered to the impacted aquifer through a network of three injection wells for a period of approximately 6 months (December 1998 to July 1999), while periodically monitoring the groundwater in the test area for VOCs and select biogeochemical parameters. The following sections present an overview of the rationale, goals and scope of work for the Pilot Test.

5.1 Pilot Test Rationale

The Pilot Study was implemented in the northwestern portion of the site near existing wells GM-PW-1 and GM-MW-1. Groundwater in this portion of the site showed concentrations of chlorinated VOCs in the 2 to 4 mg/L range and also showed significant evidence of the degradation of these VOCs. This area was selected under the premise that if ERD could be successful in this area of historically high concentrations of VOCs, it could be successful as a site-wide remedy.

5.2 Pilot Test Goals

Ultimately, the goals of the pilot test were to gather information that can be used to estimate the long-term treatment effectiveness, the remedial timeframe and costs associated with the full scale system. Specifically, the goals of the Pilot Test were as follows:

- Demonstrate the ability of the ERD to desorb the mass of VOCs that is adsorbed to the aquifer matrix. VOC mass adsorbed to the aquifer would lengthen the duration of traditional treatment techniques for the site. Identifying the relative concentrations (or influx) of VOCs as a result of the ERD Pilot Test is an important first step in evaluating the efficacy of ERD.

- Evaluate the degradation of VOCs along groundwater flow paths. Develop degradation rates for groundwater so that long-term effectiveness and treatment life span can be evaluated.

Determine the optimal strengths and frequency of reagent delivery for the site.

5.3 Pilot Test Scope of Work

The scope of work associated with the implementation of the Pilot Test consisted of the following elements:

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1. Well Installation: Two injection wells were installed in the glacial outwash aquifer to a depth of approximately 65 feet below land surface (ft bls). The injection wells were located approximately 15 and 30 feet northwest of existing well GM-MW-1, respectively (identified as IW-1 and IW-2 on Figure 2). These wells were installed using hollow stem auger techniques, and are constructed of 2-inch diameter .006-inch slotted PVC screen. Two additional monitoring wells were also installed prior to initiation of the pilot test, using similar installation techniques and construction specifications: Monitoring Wells GMMW-4 and GMMW-5 were installed approximately 15 and 25 feet southeast of existing Well GW-PW-1. Additionally, existing wells GM-MW-1 and GM-PW-1 were used as injection and monitoring wells, respectively. The distance between individual injection and monitoring wells in each row varied between five and fifteen feet. This configuration was selected to allow for some variability in the induced flowpath created during the pilot test and also to collect data in the early stages of the pilot test.

2. Groundwater Monitoring: A baseline monitoring event consisting of VOCs and biogeochemical parameters was conducted at the three pilot monitoring wells (GM-PW-1, GMMW-4 and GMMW-5) in December 1998 prior to the initiation of molasses injections. Field parameters and total and dissolved organic carbon were also collected from the three injection wells during the baseline event. To evaluate pilot test performance, a complete set of biogeochemical parameters and VOCs were also collected from these three wells in April and July 1999. Additionally, reduced sets of field parameters and DOC/TOC were also collected periodically from injection and monitoring wells. In addition, samples were also collected from GM-PW-2 (located approximately 180 feet downgradient of injection well GM-MW-1) during the baseline and July 1999 monitoring events. Monitoring of other downgradient wells (GMMW-2, PW-4, and PW-5) in future sampling events will also be conducted. All monitoring events consisted of monitoring of both water levels and groundwater quality. The results of the baseline and performance monitoring events are discussed in further detail in Section 7.

3. Injections: A molasses and water reagent (mixed at a ratio of 1:100) was initially targeted for each injection well utilized in the pilot test. Given the results of initial water level and field parameter monitoring, the strength of this reagent was later increased to approximately 5 gallons of molasses per 27 gal of water, and the injections were conducted weekly. In order to implement a bi-weekly injection schedule, the solution strength was subsequently doubled to 10 gal of molasses

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per 27 gal of water. The reagent was delivered primarily via gravity feed due to the approximately 40 foot depths to groundwater. Injection wells were monitored periodically for TOC (as an indicator of carbon loading), and for field parameters (particularly pH –in order to monitor for extreme fermentative conditions). Actual delivery volumes varied between 23 and 37 gallons per bi-weekly injection event per well.

Reporting: Two progress reports, dated March 26 and June 4, 1999, were submitted to the USEPA to report groundwater quality data collected during the Pilot Test. These progress reports also reported any changes in scope or operation and maintenance issues which arose during the test. This report is intended to summarize and evaluate the final results collected during the pilot study.

6. Pilot Test Delivery System

6.1 Injection Wells/Operation and Maintenance

Three injection wells were used to deliver the molasses reagent to the groundwater and create an in-situ reactive zone. Injection wells IW-1, IW-2 and GMMW-1 received 15 bi-weekly injections throughout the course of the six month pilot test. Injections in these three wells have continued on a voluntary basis since completion of the six month test. An initial molasses to water ratio of 1:100 was utilized for the first six injection events. Sampling of the injection wells indicated that the molasses feed rate was too low.

Beginning on February 23, 1999, the molasses-to-water ratio was increased to a solution strength of 5 gal of molasses to 27 gal of water per well per week. Beginning on April 6, 1999, the injections were conducted on a bi-weekly schedule, and the solution strength was increased to 10 gal of molasses to 27 gal of water so that the same mass of molasses was delivered. The increased ratio was necessary to conform to field conditions based on TOC measurements and calculations of hydraulic gradients and groundwater velocities. The water table configuration in the vicinity of the pilot test area is shown on Figure 1.

Minimal additional operation and maintenance (O&M) of the injection wells was required as part of the pilot test. The screen zones of IW-2 and IW-1 were swabbed and surged in April 1999 to break up and remove suspected bacterial growth or viscous molasses residue which was creating unusually high water level elevations within these wells.

Field parameters were initially collected on a monthly basis from the injection wells in order to document the establishment of the ERD zone. Following an increase in reagent injection strength (February 1999), the pH measured in groundwater from Injection Well IW-2 was too low (4.5) and the TOC loading too elevated (36,000 mg/L). Variables which limit reagent deliverability (such as well or screen clogging or low aquifer permeability) can allow for elevated levels of reagent (carbohydrates) near the well which can lower the pH and create fermentative conditions (and unwanted intermediates). In order to alleviate the condition in IW-2, reagent injections were temporarily alternated with clean water injections on 2 injection (see Appendix A) events in order to push the reagent away from the well, and allow the TOC and pH levels to rebound.

7. Pilot Test Performance Monitoring

A monitoring program was developed to (1) assess whether the injection program was delivering adequate concentrations of organic carbon to groundwater beneath the test area, (2) monitor how biogeochemical conditions were affected by the injection, and (3) evaluate the overall objective of the pilot test in degrading VOCs in groundwater. The monitoring program consisted of the following elements.

- Baseline sampling to characterize biogeochemical conditions and VOC concentrations at the start of the test. Initial sampling during the early phase of the injection program to monitor field parameters and TOC/DOC concentrations is discussed along with the baseline sampling in Section 7.1.

- Sampling and analysis of select biogeochemical parameters and VOCs at the approximate midpoint of the test in April 1999.

- Sampling and analysis of select biogeochemical parameters and VOCs at the conclusion of the test in July 1999.

A discussion of these sampling events is provided below.

7.1 Baseline and Initial Sampling Events

The primary objective of the initial data collection effort was to document baseline conditions in groundwater in the pilot test area and to evaluate whether the injection of a carbohydrate solution (sucrose in the form of food-grade molasses) was establishing a more strongly anaerobic and reducing environment. This was accomplished by collecting an initial round of groundwater samples from the pilot monitoring wells, and also by collecting field parameters and TOC/DOC from injection and monitoring wells in the initial stages of the program.

Prior to the first injection on December 8, 1998, samples were collected from the test monitoring wells (GM-PW-1, GM-MW-4, and GM-MW-5) and downgradient well GM-PW-2 (on December 10, 1998) to document baseline concentrations of VOCs and biogeochemical indicator parameters. The results of field parameters measured at both the monitoring wells and the injection wells (GM-MW-1, IW-1, and IW-2) is presented in Table 1. Table 2 presents the results of biogeochemical analyses for the monitoring wells. The results of VOC analyses are provided in Table 3. Additional laboratory analytical data for total organic carbon (TOC) and dissolved organic carbon (DOC) measurements were also collected during the initial stages of the pilot study and are provided in Table 2. Baseline conditions in the pilot test area are summarized on Figure 3 and can be characterized as follows:

- The primary VOCs in groundwater are trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), chlorobenzene, and chloroethene.
- Dissolved oxygen was detected in groundwater in the range of 0.9 to 2.0 mg/L.
- Oxidation-reduction (redox) potential was measured in groundwater in the range of -139.3 to -6.5 mv.
- DOC and TOC were detected in groundwater in the range of 5.5 to 8.5 mg/L and 5.0 to 7.4 mg/L, respectively.
- Ferrous iron was detected in groundwater in the range of 0.27 to 2.66 mg/L.

These baseline data indicate a moderately reducing environment with some organic carbon present in groundwater to support bacterial growth. Concentrations of ferrous iron in GM-PW-1 (2.66 mg/L) and GM-MW-4 (2.32 mg/L) provide a relative indication of the presence of a reducing environment in the test area (as compared to background levels of ferrous iron measured in areas of the site not impacted by the landfill).

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Field parameter measurements and laboratory analytical results for TOC and DOC were collected on a monthly basis during the initial stages of the pilot test between December 1998 and April 1999. The purpose of these monthly events was to collect preliminary data to determine when the ERD Zone was established and when more thorough groundwater analysis would be warranted. The initial measurements indicated that the ERD zone was being established by March 1999 and was expanding outward to encompass the area of the test monitoring wells. Initial measurements of field parameters and TOC/DOC analysis is discussed below.

Injection Wells

Biogeochemical indicator parameters measured in February and March 1999 indicated that a strongly reducing environment with high levels of organic carbon was being achieved. This was a result of increasing the reagent solution strength after injection event #6 (see molasses injection logs in Appendix A). An increased reagent strength was found to have the following effects on groundwater quality at the injection wells themselves.

- Dissolved oxygen (DO) decreased to the range of 0.2 to 0.37 mg/L.
- Oxidation-reduction (redox) potential was lowered to the range of -513.1 to -376.3 mv.
- DOC and TOC were effectively increased to the range of 445 to 1230 mg/L and 804 to 1540 mg/L, respectively.
- Ferrous iron levels increased to the range of 2.78 to 32.0 mg/L.
- Sulfide concentrations increased to a range of 0.169 to 0.222 mg/L.

Monitoring Wells

Indicator parameters collected from the monitoring wells on a monthly basis during the early stages of the test also indicated a trend toward more strongly reducing conditions. The data collected in February and March 1998 indicated the following:

- Redox potential decreased to a range of –51.7 to –121.1 mv, from a range of –1.3 to –1.7 mv

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- DO had decreased to a range between 0.48 and 1.03 mg/L.

- Ferrous iron concentrations in GM-MW-4 and GM-MW-5 increased by an order of magnitude.

In summary, the baseline data and initial monthly monitoring results showed that changes made to the injection strength were beneficial in beginning to establish a strongly reducing environment in groundwater within the pilot area.

7.2 April 1999 Performance Monitoring

The first extensive performance monitoring event was conducted in April 1999 after initial measurements indicated that an ERD zone had been established. Three pilot test monitoring wells (GM-PW-1, GM-MW-4, and GM-MW-5) were sampled for biogeochemical indicator parameters and VOCs on April 6, 1999. The results of this monitoring event showed that geochemical conditions were being effectively modified in the pilot test area and transformations of VOCs were occurring in groundwater. The data also confirm that the increase in reagent injection strengths that began on February 23, 1999 were effective in optimizing and maintaining an adequate carbon load in the groundwater. The following sections summarize the results of the first performance monitoring event conducted in April 1999. The data are also presented in Tables 1, 2 and 3. Mass histograms for chlorinated VOCs detected in individual wells are also presented in Appendix B.

Injection Wells

- Biogeochemical indicator parameters measured in groundwater from the injection wells in April 1999 indicated a strongly reducing environment was created in the groundwater with high levels of organic carbon. A summary of key observations is as follows:

- DO concentrations indicated that the groundwater in the vicinity of the injection wells was anaerobic (in the range of 0.2 to 1.24 mg/L).

- ORP measurements indicate that the groundwater was reducing near the injection wells (in the range of -78 to -376 mv).

- DOC and TOC concentrations showed that organic carbon was being delivered to groundwater near the injection wells at concentrations significantly above

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background (in the range of 445 to 39,900 mg/L and 804 to 36,400 mg/L, respectively).

- Elevated ferrous iron concentrations detected since initiation of the injections demonstrated that ferric iron was being reduced to ferrous iron via iron-reducing bacteria (in the range of 2.78 to 32.0 mg/L).

- Elevated sulfide concentrations measured in groundwater from the injection wells (in the range of 0.169 to 0.222 mg/L) indicated that sulfate was being reduced by sulfate reducing bacteria.

- pH was measured in the range of 4.5 to 6.2 SU, indicating that conditions were generally amenable to subsurface microbes. However, the pH measurement of 4.5 indicated that injection well IW-2 contained conditions that were becoming acidic and TOC loading was therefore decreased at this well.

In comparison to the baseline data collected in December 1998, the April 1999 results showed that groundwater was driven toward a more reduced state, with evidence of the utilization of alternate electron acceptors, and production of reduced by-products. These conditions are more amenable to more efficient rates of reductive dechlorination then the baseline conditions.

Monitoring Wells

Biogeochemical indicator parameters measured from groundwater samples collected from the monitoring wells in April 1999 indicated a continued trend toward more strongly reducing conditions:

- A continued decrease in ORP measurements (ranging from -120 to -188 mV) shows that the area downgradient of the injection wells continued to evolve towards a more reduced state.

- DO concentrations also decreased in the area downgradient of the injection wells (ranging between 0.57 and .93 mg/L), indicating that anaerobic environments were being maintained.

- Total organic carbon levels increased to between 4.4 and 11.3 mg/L. This showed that a TOC gradient was being developed between the injection wells and downgradient groundwater.

VOCs collected from the monitoring wells in April 1999 showed an increase in degradation products that is significant when compared to baseline or historical trends. The following sections summarize the results of the first VOC analysis following the initiation of reagent injections during the pilot study.

GMMW-4

Monitoring Well GMMW-4 is located in the center of the pilot test area and is downgradient of both Injection Wells IW-1 and IW-2. Key observations based on data from this well are as follows:

- Decreased in concentrations of benzene, chlorobenzene, chloroform, 1,2-dichloroethane (1,2-DCA), 1,1-dichloroethene (1,1-DCE), 1,3-dichloropropane (1,3-DCP), and ethylbenzene evident in the April sampling data indicate that the enhanced anaerobic and carbon-rich environments aided in the degradation of these compounds.

- Increased PCE and DCE degradation, as evidenced by a lack of PCE (from 15 ug/L to ND), and increases in TCE (from non-detect (ND) to 64 ug/L) and VC concentrations (from ND to 34 ug/L). Concentrations of cis-1,2-DCE were reduced significantly (634 ug/L to 35 ug/L). An overall reduction in VOC mass was observed in groundwater at GMMW-4 (see histograms in Appendix B).

- Increased TCA degradation, as evidenced by decreases in TCA concentrations (from 13.1 ug/L to ND) and increases in DCA concentrations (from ND to 31 ug/L).

GMMW-5

Monitoring Well GMMW-5 is the southernmost monitoring well in the pilot test located approximately 20 feet downgradient of Injection Well IW-2, and fifteen feet (west) and side gradient of Injection Well GMMW-1. Key observations based on data from this well are as follows:

- Decreased concentrations of xylenes, toluene, ethylbenzene, benzene and chlorobenzene indicate that the induced anaerobic and carbon-rich environments have aided in the degradation of these aromatic compounds.

- Increased TCE and DCE degradation was observed as evidenced by decreasing concentrations of TCE (588 ug/L to 240 ug/L), and associated increases in DCE (from 462 to 860 ug/L) and VC (143 to 360 ug/L) concentrations. The overall mass of VOCs in groundwater near this well increased during the April sampling event; however, this mass is comprised of more lightly chlorinated daughter products (see mass histograms in Appendix B).

- Increased TCA and DCA degradation was observed, as evidenced by increases in the concentrations of DCA (227 to 580 ug/L) and CA (130 to 350 ug/L).

- Increased MC concentrations (from 87 to 240 ug/L) may indicate a desorption effect, since very little chloroform was present in the groundwater (approximately 11 ug/L) to serve as a source.

GMPW-1

Monitoring well GMPW-1 is the northern most monitoring point associated with the pilot test and is located approximately ten feet downgradient of Injection Well IW-1. Key observations based on data from this well are as follows:

- Decreased concentrations of benzene, chlorobenzene, bromodichloromethane, 1,2-DCA, toluene and isopropylbenzene may indicate that the enhanced groundwater conditions are more amenable to degradation of these compounds.

- Increased concentrations of TCA (from 98 to 140 ug/L) are most likely due to desorption resulting from a natural surfactant effect. Adsorbed VOCs are commonly desorbed from saturated aquifer materials during the initial phases of an in-situ reactive zone approach. Hydrophobic compounds will tend to desorb due to the presence of dissolved organic carbon in the groundwater and also through the presence of materials which are naturally produced by the enhanced microbial population (e.g., enzymes, lipids). These effects are pronounced due to the proximity of the monitoring wells to the injection wells, but are expected to wane in later stages of the test as a larger microbial population develops.

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- Increased TCA and DCA degradation was observed, as evidenced by significant increases in concentrations of DCA (from 147 to 490 ug/L) and CA (83 to 150 ug/L). This well showed an overall increase in the mass of VOCs detected in groundwater. However, the majority of the mass consisted of degradation products (see mass histograms in Appendix B).

- Increased PCE, TCE, and DCE degradation was observed, as evidenced by a decrease in PCE (from 7 ug/L to nd) and TCE (219 to 91 ug/L) concentrations, and the relatively greater predominance of DCE and VC over the other more chlorinated source VOCs.

In summary, the April 1999 VOC data collected downgradient of the injection wells showed a shift to a predominance of degradation products (DCE, VC, DCA and CA) rather then source-type VOCs (PCE, TCE, and TCA). The elimination of aromatic VOCs combined with differing rates of daughter product accumulation or depletion suggests that these changes are a result of the transformation of the VOCs rather than the effects of dilution.

7.3 July 1999 Performance Monitoring

On July 14, 1999, a complete set of biogeochemical parameters and VOC analyses was performed on groundwater samples collected from the three downgradient monitoring wells associated with the pilot test (GMMW-4, GMMW-5 and GMPW-1). Additionally, due to the greater localized groundwater velocity in the pilot test area, an additional distal downgradient well was added to the July sampling event, GM-PW-2. This data was collected following approximately 6 months of molasses reagent injections at the site.

The results of the July 1999 sampling event show continued evidence that the groundwater environment is maintaining an anaerobic and reduced state, and that carbon gradients remain in the pilot area. Indicator parameters and general redox environments are shown on Figure 4.

The results of VOC sampling in July also showed that continued transformation of the VOCs is occurring, with a lower amount of mass present in some monitoring wells (see Appendix B) and a greater percentage of degradation products present in all of the monitoring wells. The results obtained from the distal monitoring well GMPW-2 were particularly encouraging, showing that the areal extent of the reactive zone is much greater than expected. Some desorption effects are still evident from the results;

however, this is magnified due to the close proximity of the monitoring wells to the injection area.

The following sections summarize the results of the biogeochemical and VOC analyses for the monitoring wells used in the pilot study.

GMPW-1

Key observations based on data collected from this well are as follows.

- VOC concentrations have been reduced by 50 percent in this well since the initiation of the pilot test. A greater percentage of degradation intermediates (as compared with source VOCs) is now present in groundwater near this well. The mass of VOCs in groundwater at this well has also been reduced through the course of the pilot study (see mass histogram in Appendix B).

- A continued decrease in the concentrations of benzene, chlorobenzene, bromodichloromethane, 1,2-DCA, toluene and isopropyl benzene has been observed at this location (between 50 and 100 percent).

- The predominant VOCs in groundwater near this well are DCA (490 ug/L) and DCE (440 ug/L), with an observed increase in the degradation of TCA, TCE and DCE.

- TOC levels indicate that a significant carbon gradient has been established. TOC levels were two orders of magnitude greater than baseline at this well location.

- Carbon dioxide, and dissolved and ferrous iron concentrations indicate that anaerobic activity is significantly above baseline conditions. The ORP has also been lowered significantly throughout the pilot test.

GMMW-5

Key observations based on data collected from this well are as follows.

- Overall VOC concentrations have only been reduced by approximately 5 percent,. However, reductive dechlorination has resulted in a lowering of TCE concentrations from 588 ug/L to 11 ug/L, while DCA, CA, DCE and VC concentrations have increased. The mass of VOCs in groundwater at this well is

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slightly greater than observed during the baseline event. The majority of this mass is attributed to greater TCE degradation and the formation of DCE (see mass histograms in Appendix B).

- A significant TOC gradient has been developed at this well location.

- Carbon dioxide and methane concentrations are elevated significantly, while dissolved oxygen concentrations have decreased and dissolved and ferrous iron concentrations have increased. These observations provide evidence that significant anaerobic activity is ongoing in the pilot area.

GMMW-4

Key observations based on data collected from this well are as follows.

- VOC concentrations are elevated by approximately 200 percent as compared to the baseline analysis. Previously this well had shown a decrease in VOCs of 85 percent. The 200 percent increase is most likely due to desorption resulting from injections in the two upgradient injection points that are in close proximity to this well.

- Significant production of ethene and ethane was observed at this location, which provides evidence of ongoing reductive dechlorination of VOCs.

- ORP measurements and dissolved and ferrous iron and carbon dioxide concentrations indicate that this area has transitioned toward a more anaerobic environment.

GMPW-2

GMPW-2 is located approximately 180 feet downgradient of the pilot injection area. Due to its distance from the injection wells, data was collected only during the baseline sampling event and the final performance monitoring event.

- VOCs have been reduced by two orders of magnitude or approximately 95 percent at this well location. Similarly, the total mass of VOCs at this well has also been reduced significantly (see mass histograms in Appendix B). Less then 3 ug/l of DCE, DCA, TCE and TCA now remain in groundwater near this well. These results are significant, because they demonstrate the areal extent of the reactive

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zone that has been established during the pilot study. Whereas the results obtained from the monitoring wells that are directly adjacent to an injection location will tend to show more transient effects of desorption, data collected from GMPW-2 show the full effects of ERD due to the longer residence time of VOCs being subjected to conditions in the ERD zone.

- Increases in specific conductance, TOC, sulfides, and dissolved and ferrous iron all provide evidence that the ERD zone has spread this far downgradient and induced an anaerobic and reducing groundwater environment.

8. Strategy for Enhancing the Groundwater Remedy

Based on the results of the Pilot Test and other studies (e.g., aquifer test, biogeochemical sampling) conducted since issuance of the groundwater remedy described in the Record of Decision (ROD), ARCADIS Geraghty & Miller has developed an approach to enhance the removal of VOC mass and expedite the overall timeframe for remediation. The approach is based on utilizing key aspects of the existing pump-and-treat ROD Remedy, and enhancing the overall remedy through application of the ERD technology. The following sections describe the limitations of the ROD Remedy and how enhancing the remedy with an ERD zone can optimize the overall groundwater remediation effort.

8.1 Limitations of ROD Remedy

The potential limitations of implementing pump-and-treat as a stand-alone groundwater remedy was initially recognized after a thorough review of slug test data, boring logs, grain size distribution tests, and well yield tests. Based upon this information, groundwater flow and contaminant transport modeling was performed to evaluate the effectiveness of the ROD Remedy (ARCADIS Geraghty & Miller 1996). The solute transport simulations predicted that restoration of groundwater to maximum contaminant levels (MCLs) for all VOCs would be attainable in a timeframe of approximately 65 years for both pump-and-treat and natural attenuation. Factors such as sorption of contaminants to the aquifer matrix and zones of low permeability where groundwater velocities are extremely slow will result in the inability of pump-and-treat to clean up the aquifer more quickly than natural attenuation.

In order to more rigorously evaluate hydraulic properties used in the modeling effort, an aquifer test was conducted using Production Well GMPW-2 and nearby monitoring wells. Production Well GMPW-2 was selected as the pumping well because it was in an area that is representative of the site hydrogeology and was requested by the USEPA. The glacial outwash aquifer in this area consists of silty sand and fine sand, with some clay.

The aquifer test provided reliable data for calculation of the transmissivity and hydraulic conductivity of the glacial outwash aquifer. The hydraulic conductivity of 0.24 feet/day that was calculated from the time-drawdown data for Production Well GMPW-2 corresponded to the previous hydraulic conductivity computed from specific capacity data. The step-drawdown and aquifer testing program supported the grain size distribution testing, slug testing, and groundwater flow and contaminant transport results which concluded that groundwater pump-and-treat would not be effective given the site specific conditions.

The primary factors that limit the effectiveness of pump-and-treat at the site are as follows:

- The glacial outwash aquifer has a poor ability to yield water, and production wells can be expected to pump at a rate of approximately 0.25 to 0.5 gallons per minute (gpm).
- The production wells induce a steep cone of depression with limited areal extent, which will have little effect in increasing groundwater velocities (and the associated flushing of contaminants) on a site-wide basis.
- The timeframe for remediation will be determined by how fast the lower-permeability zones flush. In localized areas of extremely slow groundwater velocities, cleanup time will be limited by the rate of contaminant diffusion from the low-permeability zones, which is an extremely slow process.
- The cleanup time will be limited by the desorption of contaminants from the aquifer matrix.

8.2 Rationale for Application of an ERD Zone

Based on the anticipated limitations of pump-and-treat in restoring groundwater quality to MCLs, the application of an ERD zone was identified as a technology that could enhance the overall remedial effort by augmenting the existing anaerobic and reducing groundwater environment. An ERD zone upgradient of the pumping wells would not interfere with groundwater extraction and would address the factors responsible for limiting the effectiveness of pump-and-treat. An ERD enhancement of the pump-and-treat remedy would augment the overall groundwater remediation in the following manner:

- An ERD zone would treat a large volume of aquifer and overcome the fact that the groundwater extraction wells influence only a small aquifer volume.
- An ERD zone would provide in-situ treatment of VOCs associated with extremely low permeability zones, and overcome the fact that a pump-and-treat system may be limited by the rate at which VOCs can diffuse from these zones.
- The injection of reagent acts as a surfactant that results in the desorption of VOCs from the aquifer matrix, making the VOC mass more available for reductive dechlorination. This process overcomes the fact that pump-and-treat can only address the dissolved component of VOC contamination.

Therefore, an ERD zone located close to the landfill boundary would complement and enhance the pump-and-treat remedy and provide the most feasible approach to expediting the timeframe for restoring groundwater quality.

8.3 Full-Scale Groundwater Remediation system

This section provides a description of the physical layout for an enhanced pump-and-treat groundwater remedy. The recommended configuration of remedial pumping wells and the approximate location for the ERD zone injection wells are shown on Figure 4.

8.3.1 Pump-and-Treat Configuration

The groundwater extraction component of the enhanced remedy would utilize existing wells PW-2, PW-3, PW-4, and PW-5. These well locations were part of the ROD Remedy for the extraction of impacted groundwater downgradient of the landfill. The wells are incorporated into the enhanced pump-and-treat design because they will intercept impacted groundwater within the limiting flowpaths of the highest concentrations of VOCs.

The extracted water will be treated and discharged to the North Stream. The 6 NYCRR Chapter X, Section 930.4 – Table 1, entitled, "Classifications and Standards of Quality and Purity which are Assigned to the Waters of the Susquehanna River

Bordering or Flowing Through the Counties of Tioga, Broome, Chenango, Delaware and Otsego", was used in the determination of the North Stream classification. The North Stream, which is referenced by the NYSDEC as Tributary 120, has a Fresh Surface Water Classification of C and a Water Quality Standard of C(T). Based on this classification and documented effluent limitations, an application will be submitted to the NYSDEC for the establishment of effluent limitations for the site.

A portion of the treated effluent will be used as the source of water for mixing the molasses and water solution for the ERD zone injections.

8.3.2 ERD System Configuration

The ERD zone component of the enhanced pump-and-treat groundwater remedy will use a series of injection wells along the southwest boundary of the landfill. The recommended location of the planned ERD injection wells is represented with gray shading (approximately 825 ft long) on Figure 4. The number of injection wells, the spacing between wells, and the precise location of the wells within this zone is presently under evaluation.

The location of the ERD zone is based on enhancing biogeochemical conditions along the section of the landfill boundary where the highest concentrations of VOC-impacted groundwater are migrating downgradient. Based on the southwesterly direction of groundwater flow inferred from water level contours on Figure 1, the ERD zone will enhance the removal of VOC mass throughout a large volume of aquifer material. The beneficial effects of the ERD zone will reduce VOC concentrations throughout the area approximately bounded by the North Stream (downgradient of PW-6) to the southwest and W-16S to the south.

The ERD zone is expected to reduce VOC concentrations throughout the reactive zone and also facilitate the desorption of VOCs from the aquifer matrix. This desorption effect will expedite the overall timeframe for remediation by making the sorbed VOCs available for remediation via reductive dechlorination or groundwater extraction. Once the ERD zone is well established and effectively reducing VOC concentrations, the VOCs in groundwater extracted by PW-2, PW-3, PW-4, and PW-5 are expected to decline to low asymptotic concentrations. After consistently low asymptotic concentrations of VOCs are observed in the extracted groundwater, the pumping and treatment of groundwater can be pulsed at rates consistent with the water needs for mixing with molasses for the ERD zone injections.

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It is estimated that asymptotic concentrations will be achieved in a relatively short timeframe (1 to 2 years) based on previous experience in similar environments. At the appropriate time we will recommend to the USEPA and NYSDEC that the extraction/treatment system be shut down (except for meeting the ERD zone water needs), and the wells be used either for monitoring purposes or as additional ERD injection points.

9. Summary

In summary, data collected over the past six months indicate that the pilot test was effective in establishing an ERD zone with elevated organic carbon in the aquifer at the site. The trends in the field parameter and biogeochemical measurements indicate that the ERD zone has continued to strengthen and expand throughout the pilot test. The VOC data collected throughout the test demonstrated that the ERD technique has been effective in transforming or degrading VOCs at rates that significantly exceed those observed historically for the site.

In areas located adjacent to the injection wells, desorption of VOCs from the aquifer matrix (which is expected to be a relatively short-term phenomena) is observed. This mass would be difficult to remediate through traditional remedial techniques (e.g., pump and treat). As evidenced from data collected at a sufficient distance downgradient of the pilot area, the mass that is introduced to the groundwater environment through desorption can be effectively degraded within the reactive zone.

The key observations that demonstrate the effectiveness of the ERD zone at the Colesville Landfill site are as follows:

- A steep decline in VOC concentrations was evident at the downgradient edge of the ERD zone (approximately 180 ft downgradient of the injection wells).

- Degradation of VOCs to more lightly chlorinated compounds is evident in the pilot test monitoring wells.

- A redox zone has been strongly established and significant concentrations of total organic carbon have been introduced to the groundwater system.

- An overall reduction in VOC concentrations has occurred as the result of the ERD zone.

The results obtained from this pilot test also identified the proper molasses reagent strengths and frequency of delivery, which could be employed in a full-scale system. Injections have continued in the pilot test area in order to maintain the reactive zone and collect data on the longer-term effects of the ERD approach. Additional data will be collected from other wells located downgradient of the pilot test (such as at GMMW-2, PW-4, and PW-5). The data will be used to evaluate the areal extent of the ERD treatment zone and provide engineering design information for a full-scale system.

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10. References

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Appendix A

Molasses Injection Logs, Enhanced Reductive Dechlorination Pilot Test, Colesville Landfill, Broome County, New York.

MOLASSES INJECTION LOG

In Situ Reactive Zone Technology Field Test
Colesville Landfill Site
Colesville, New York

Injection Well # IW-1

Date	Injection No.	Raw Molasses Volume (gallons)	Water Volume (gallons)	Solution Strength (Ratio)	Volume Injected (gallons)	Notes/ Observations
12/8/98	1	0.216	21.6	100:1	23	Initial Injection
12/22/98	2	0.216	21.6	100:1	23	DTW: 47.57 (GMPW-1 DTW: 49.81)
1/6/99	3	0.216	21.6	100:1	23	DTW: 47.31 (GMPW-1: 49.73); 25 minutes
1/21/99	4	0.216	21.6	100:1	23	DTW: 47.03 (GMPW-1: 49.86); 11 minutes
2/3/99	5	0.216	21.6	100:1	23	DTW: 46.77 (GMPW-1: 49.51); 25 minutes
2/16/99	6	0.216	21.6	100:1	23	DTW: 46.62 (GMPW-1: 49.53); 10 minutes
3/1/99	7	5.0	27.0	5.5:1	32	DTW: 46.93 (GMPW-1: 49.60); 10 minutes
3/9/99	8	5.0	27.0	5.5:1	32	DTW: 46.72 (GMPW-1: 49.63); 20 minutes
3/16/99	9	10.0	27.0	2.7:1	37	DTW: 44.76 (GMPW-1: 49.60); 25 minutes
3/29/99	10	5.0	27.0	5.5:1	32	
4/6/99	11	10.0	27.0	2.7:1	37	DTW: 43.13 (GMPW-1: 49.34): Pressure Injection
4/19/99	12	10.0	27.0	2.7:1	37	
5/3/99	13	10.0	27.0	2.7:1	37	DTW: 41.80 (GMPW-1: 49.11); Pressure 23 min.
5/17/99	14	10.0	27.0	2.7:1	37	DTW: 38.69 (GMPW-1: 49.17); Pressure 45 minutes
6/3/99	15	10.0	27.0	2.7:1	37	DTW: 42.84 (GMPW-1: 48.92)
6/16/99	16	10.0	27.0	2.7:1	37	DTW: 43.88 (GMPW-1: 49.08); Pressure 15 min.
6/30/99	17	10.0	27.0	2.7:1	37	DTW: 43.98 (GMPW-1: 49.23); Pressure 10 min.
7/14/99	18	10.0	27.0	2.7:1	37	DTW: 31.99 (GMPW-1: 49.16);

MOLASSES INJECTION LOG

In Situ Reactive Zone Technology Field Test
Colesville Landfill Site
Colesville, New York

Injection Well # IW-2

Date	Injection No.	Raw Molasses Volume (gallons)	Water Volume (gallons)	Solution Strength (Ratio)	Volume Injected (gallons)	Notes/ Observations
12/8/98	1	0.216	21.6	100:1	23	Initial Injection
12/22/98	2	0.216	21.6	100:1	23	DTW: 49.61 (GMMW-4 DTW: 49.04)
1/6/99	3	0.216	21.6	100:1	23	DTW: 49.54 (GMMW-4: 49.21); 15 minutes
1/21/99	4	0.216	21.6	100:1	23	DTW: 49.33 (GMMW-4: 49.17); 23 minutes
2/3/99	5	0.216	21.6	100:1	23	DTW: 48.95 (GMMW-4: 48.95); 10 minutes
2/16/99	6	0.216	21.6	100:1	23	DTW: 48.98 (GMMW-4: 48.95); 30 minutes
3/1/99	7	5.0	27.0	5.5:1	32	DTW: 48.98 (GMMW-4: 49.01); 40 minutes
3/9/99	8	5.0	27.0	5.5:1	32	DTW: 46.08 (GMMW-4: 48.97); 35 minutes
3/16/99	9	10.0	27.0	2.7:1	37	DTW: 44.75 (GMMW-4: 48.99); 100 minutes
3/29/99	10	5.0	27.0	5.5:1	32	
4/6/99	11	10.0	27.0	2.7:1	37	DTW: 44.35 (GMMW-4: 48.90); Pressure Injection
4/19/99	12	10.0	27.0	2.7:1	37	
5/3/99	13	0.0	0.0	--	0	DTW: 45.09 (GMMW-4: 48.71); Pressure 10 min.
5/17/99	14	10.0	27.0	2.7:1	37	DTW: 44.82 (GMMW-4: 47.57); Pressure 10 min.
6/3/99	15	0	27.0	water only	27	DTW: 44.28 (GMMW-4: 48.78)
6/16/99	16	10.0	27.0	2.7:1	37	DTW: 44.01 (GMMW-4: 47.88); Pressure 15 min.
6/30/99	17	0	27.0	water only	27	DTW: 43.80 (GMMW-4: 47.91); Gravity 3 hrs.
7/14/99	18	10.0	27.0	2.7:1	37	DTW: 43.63 (GMMW-4: 48.47)

MOLASSES INJECTION LOG

In Situ Reactive Zone Technology Field Test
Colesville Landfill Site
Colesville, New York

Injection Well # GMMW-1

Date	Injection No.	Raw Molasses Volume (gallons)	Water Volume (gallons)	Solution Strength (Ratio)	Volume Injected (gallons)	Notes/ Observations
12/8/98	1	0.216	21.6	100:1	23	Initial Injection
12/22/98	2	0.216	21.6	100:1	23	DTW: 47.77 (GMMW-5 DTW: 50.44)
1/6/99	3	0.216	21.6	100:1	23	DTW: 47.50 (GMMW-5: 50.43); 10 minutes
1/21/99	4	0.216	21.6	100:1	23	DTW: 47.60 (GMMW-5: 50.23); 7 minutes
2/3/99	5	0.216	21.6	100:1	23	DTW: 47.68 (GMMW-5: 50.05); 15 minutes
2/16/99	6	0.216	21.6	100:1	23	DTW: 47.64 (GMMW-5: 50.03); 15 minutes
3/1/99	7	5.0	27.0	5.5:1	32	DTW: 48.03 (GMMW-5: 49.90); 20 minutes
3/9/99	8	5.0	27.0	5.5:1	32	DTW: 48.21 (GMMW-5: 49.85); 10 minutes
3/16/99	9	10.0	27.0	2.7:1	37	DTW: 47.74 (GMMW-5: 49.83); 20 minutes
3/29/99	10	5.0	27.0	5.5:1	32	
4/6/99	11	10.0	27.0	2.7:1	37	DTW: 46.90 (GMMW-5: 49.77)
4/19/99	12	10.0	27.0	2.7:1	37	
5/3/99	13	10.0	27.0	2.7:1	37	DTW: 46.23 (GMMW-5: 49.37); Pressure 6 min.
5/17/99	14	10.0	27.0	2.7:1	37	DTW: 46.63 (GMMW-5: 49.50); Pressure 5 min
6/3/99	15	10.0	27.0	2.7:1	37	DTW: 45.83 (GMMW-5: 49.47)
6/16/99	16	10.0	27.0	2.7:1	37	DTW: 47.29 (GMMW-5: 45.44); Pressure 10 min.
6/30/99	17	10.0	27.0	2.7:1	37	DTW: 47.48 (GMMW-5: 49.52); Gravity 30 min.
7/14/99	18	10.0	27.0	2.7:1	37	DTW: 47.76 (GMMW-5: 49.64)

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Appendix B

VOC Mass Histograms for Selected Monitoring Well Sampling Results, Enhanced Reductive Dechlorination Pilot Test, Colesville Landfill, Broome County, New York.

able 1. Summary of Field Parameters Measured in Groundwater, Enhanced Reductive Dechlorination Pilot Test, Colesville Landfill, Broome County, New York.

ONSTITUENT:	WELL: DATE:	GMPW-1 12/7/98	GMPW-1 1/6/99	GMPW-1 2/3/99	GMPW-1 3/16/99	GMPW-1 4/6/99	GMPW-1 5/3/99	GMPW-1 6/3/99	GMPW-1 7/14/99	GMPW-2 12/10/98
eld Flow through Cell Parameters	Units									
H	pH units	6.85	6.72	6.90	6.9	6.9	6.64	5.93	6.08	6.22
edox	mv	-139.3	-10.5	-1.5	-51.7	--	-120.5	-159.1	-156.9	-49.7
onductivity	umhos/cm	430	245	200	432	400	559	859	877	495
emperature	celcius	13	7.0	19	11.5	12.0	13.2	13.1	12.4	12
urbidity	NTU	9.8	--	--	3.19	8.7	--	24.6	6.57	3.68
issolved oxygen	mg/L	1.0	1.3	1.1	0.74	1.2	0.93	6.80	2.02	1.1

ONSTITUENT:	WELL: DATE:	GMPW-2 7/14/98	GMMW-4 12/7/98	GMMW-4 1/6/99	GMMW-4 2/3/99	GMMW-4 3/16/99	GMMW-4 5/3/99	GMMW-4 6/2/99	GMMW-4* 7/14/99	GMMW-5 12/7/98
ield Flow through Cell Parameters	Units									
H	pH units	6.23	6.85	6.61	7.03	6.90	6.60	6.59	6.68	6.88
edox	mv	-54.4	-84.5	-10.5	-1.7	-85.6	-188.2	-126.2	-105.1	-6.5
onductivity	umhos/cm	792	600	360	285	799	1095	1060	1223	420
emperature	celcius	14.5	13	10	20	10.8	12.9	13.2	15.9	13
urbidity	NTU	8.05	2	--	--	13.70	--	20.7	9.14	0.95
issolved oxygen	mg/L	0.22	0.9	1.4	1.3	0.48	0.51	675	2.57	2

Footnotes:

--	Not analyzed.
ug/L	Micrograms per liter.
mg/L	Milligrams per liter.
ng/L	Nanograms per liter.
mv	Millivolts.
umhos/cm	Microohms per centimeter
NTU	Nephlometric turbidity units.

Baseline sampling event on 12/7/98.

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ject\Broome\NY0949.0012\reports\ERD_report_tables-Field Parameters able 1. Summary of Field Parameters Measured in Groundwater, Enhanced Reductive Dechlorination Pilot Test, Colesville Landfill, Broome County, New York.

ONSTITUENT:	WELL: DATE:	GMMW-5 1/6/99	GMMW-5 2/3/99	GMMW-5 3/16/99	GMMW-5 4/6/99	GMMW-5 5/3/99	GMMW-5 6/2/99	GMMW-5 7/14/99	GMMW-1 2/16/99	GMMW-1 3/9/99
ield Flow through Cell Parameters	Units									
H	pH units	6.63	7.11	6.9	6.9	6.46	5.97	5.88	6.9	6.2
edox	mv	-6.5	-1.3	-121.1	--	-156.7	-187.1	-98.9	-1.3	-426.4
onductivity	umhos/cm	220	220	609	280	1114	1925	3270	200	446
emperature	celcius	10	20	13.2	15.0	14.0	--	15.5	20	9.9
urbidity	NTU	--	--	9.1	10.5	--	11.19	11.9	4.4	23.1
issolved oxygen	mg/L	2.4	1.6	1.03	0.9	0.14	0.02	2.14	0.5	0.45

ONSTITUENT:	WELL: DATE:	IW-1 2/16/99	IW-1 3/9/99	IW-1 3/16/99	IW-2 2/16/99	IW-2 3/9/99	IW-2 3/16/99	IW-2 6/3/99
ield Flow through Cell Parameters	Units							
H	pH units	6.7	6.6	5.8	6.6	5.5	4.5	5.73
ledox	mv	-0.7	-139.3	-376.3	-2.7	-513.1	-78.7	75.7
Conductivity	umhos/cm	175	317	634	130	899	2790	4.85
emperature	celcius	20	5.4	13.7	20.5	8.1	10.4	13.7
Turbidity	NTU	14.6	20.4	73.0	21.8	87.4	177.6	<200
Dissolved oxygen	mg/L	1.3	1.07	0.20	1.0	0.37	1.24	7.09

Footnotes:

--	Not analyzed.
ug/L	Micrograms per liter.
mg/L	Milligrams per liter.
ng/L	Nanograms per liter.
mv	Millivolts.
umhos/cm	Microohms per centimeter
NTU	Nephlometric turbidity units.

Baseline sampling event on 12/7/98.

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Table 2. Summary of Biogeochemical Parameters Measured in Groundwater, Enhanced Reductive Dechlorination Pilot Test, Colesville Landfill, Broome County, New York.

CONSTITUENT:	WELL:	GMPW-1	GMPW-1	GMPW-1	GMPW-1	GMPW-1	GMPW-1	GMPW-2	GMPW-2
	DATE:	12/7/98	3/16/99	4/6/99	5/3/99	6/3/99	7/14/99	12/10/98	7/14/98
Dissolved Gases	Units								
Carbon dioxide	mg/L	90.56	--	51.51	--	--	273.95	326.10	--
Oxygen	mg/L	1.50	--	1.79	--	--	0.54	0.64	--
Nitrogen	mg/L	20.76	--	14.07	--	--	13.84	13.37	--
Methane	mg/L	1.02	--	0.32	--	--	0.36	1.45	--
Carbon monoxide	mg/L	<0.40	--	<0.40	--	--	<0.40	<0.40	--
Ethane	ng/L	4360	--	835	--	--	897	810	--
Ethene	ng/L	9140	--	2814	--	--	3232	5692	--
Inorganic Parameters in mg/L									
Alkalinity		337	--	251	--	--	170	364	370
Ammonia		<0.02	--	<0.02	--	--	0.15	<0.02	<0.02
Biological Oxygen Demand		<3	--	<3	--	--	748	--	<6
Chloride		<1	--	5.3	--	--	42.2	24	31.8
Chemical Oxygen Demand		8.2	--	<2	--	--	1480	--	12.6
Dissolved Organic Carbon		5.6	<0.5	<0.5	--	--	559	5	14.7
Flouride		0.16	--	--	--	--	--	0.16	--
Iron, Dissolved		5.33	--	6.71	--	--	95.9	2.39	14.4
Iron, Total		5.84	--	4.04	--	--	81.3	3.29	12.8
Iron, Ferrous		2.66	6.7	0.60	5.40	7.75	> 75	2.72	16.3
Manganese, Dissolved		1.91	--	1.77	--	--	14.5	0.047	0.188
Manganese, Total		1.96	--	1.5	--	--	13.7	0.06	0.134
Nitrate		<0.05	--	0.22	--	--	1.54	<0.2	0.41
Nitrite		0.016	--	<0.01	--	--	0.017	<0.01	0.02
Sulfate		2.15	--	6.75	--	--	33.8	6.04	5.2
Sulfide, Lab		<2	--	<2	--	--	0.385	<2	<2
Sulfide, field		0.022	0.014	0.027	0.086	0.170	--	0.07	0.170
Hardness		412	--	--	--	--	--	268	--
Total Organic Carbon		5	<0.5	4.3	--	--	337	<0.5	6.1

Footnotes:

--	Not analyzed.
ug/L	Micrograms per liter.
mg/L	Milligrams per liter.
ng/L	Nanograms per liter.
mv	Millivolts.
umhos/cm	Microohms per centimeter
NTU	Nephlometric turbidity units.

Baseline sampling event on 12/7/98.

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Table 2. Summary of Biogeochemical Parameters Measured in Groundwater, Enhanced Reductive Dechlorination Pilot Test, Colesville Landfill, Broome County, New York.

CONSTITUENT:	WELL: DATE:	GMMW-4 12/7/98	GMMW-4 3/16/99	GMMW-4 4/6/99	GMMW-4 5/3/99	GMMW-4 6/2/99	GMMW-4 7/14/99	GMMW-4* 7/14/99	GMMW-5 12/7/98
Dissolved Gases	Units								
Carbon dioxide	mg/L	167.95	--	136.43		--	176.86	175.14	84.67
Oxygen	mg/L	0.88	--	0.54		--	0.68	0.64	2.86
Nitrogen	mg/L	18.88	--	12.83		--	15.54	15.74	17.84
Methane	mg/L	0.92	--	0.41		--	0.62	0.6	0.45
Carbon monoxide	mg/L	<0.40	--	<0.4		--	<0.40	<0.40	<0.40
Ethane	ng/L	5843	--	1295		--	1897	1901	2590
Ethene	ng/L	23556	--	10799		--	16029	15993	7700
Inorganic Parameters in mg/L									
Alkalinity		518	--	465		--	585	590	316
Ammonia		0.05	--	0.13		--	0.05	<0.02	<0.02
Biological Oxygen Demand		<3	--	<3		--	57.7	33.7	<3
Chloride		48.4	--	6.4		--	47	45.1	25.2
Chemical Oxygen Demand		20.8	--	17.7		--	251	244	14.2
Dissolved Organic Carbon		8.5	8.8	7.7		--	84.9	81.5	5.5
Flouride		0.33	--	--		--	--	--	0.33
Iron, Dissolved		14.5	--	21.8		--	36.3	36.4	0.455
Iron, Total		14.8	--	24.9		--	36.3	34.1	0.493
Iron, Ferrous		2.32	23.4	20.2	39.0	>76	>75	>75	0.27
Manganese, Dissolved		3.73	--	4.92		--	12.5	13	1.79
Manganese, Total		3.94	--	4.37		--	13	11.9	2.15
Nitrate		0.28	--	0.34		--	<0.2	0.18	0.632
Nitrite		0.028	--	0.036		--	<0.01	0.051	0.026
Sulfate		3.08	--	6.61		--	2.21	2.24	4.38
Sulfide, Lab		<2	--	<2		--	<2	<2	<2
Sulfide, field		0.015	--	0.013	0.028	0.121	0.024	0.024	0.006
Hardness		680	--	--		--	--	--	486
Total Organic Carbon		7.4	6.5	7.4		--	64.8	75.7	6.6

Footnotes:

--	Not analyzed.
ug/L	Micrograms per liter.
mg/L	Milligrams per liter.
ng/L	Nanograms per liter.
mv	Millivolts.
umhos/cm	Microohms per centimeter
NTU	Nephlometric turbidity units.

Baseline sampling event on 12/7/98.

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Table 2. Summary of Biogeochemical Parameters Measured in Groundwater, Enhanced Reductive Dechlorination Pilot Test, Colesville Landfill, Broome County, New York.

CONSTITUENT:	WELL: / DATE:	GMMW-5 3/16/99	GMMW-5 4/6/99	GMMW-5 5/3/99	GMMW-5 6/2/99	GMMW-5 7/14/99	GMMW-1 2/16/99	GMMW-1 3/9/99	IW-1 2/16/99
Dissolved Gases	Units								
Carbon dioxide	mg/L	--	70.97	--	--	825.28	--	--	--
Oxygen	mg/L	--	0.57	--	--	0.17	--	--	--
Nitrogen	mg/L	--	12.05	--	--	1.64	--	--	--
Methane	mg/L	--	0.21	--	--	21.45	--	--	--
Carbon monoxide	mg/L	--	<0.4	--	--	<0.40	--	--	--
Ethane	ng/L	--	861	--	--	150	--	--	--
Ethene	ng/L	--	4329	--	--	1416	--	--	--
Inorganic Parameters in mg/L									
Alkalinity		--	341	--	--	656	--	--	--
Ammonia		--	0.03	--	--	0.49	--	--	--
Biological Oxygen Demand		--	6	--	--	1700	--	--	--
Chloride		--	7.2	--	--	73.1	--	--	--
Chemical Oxygen Demand		--	14	--	--	5380	--	--	--
Dissolved Organic Carbon		11.7	12.1	--	--	1950	5.8	445	27.9
Flouride		--	--	--	--	--	--	--	--
Iron, Dissolved		--	15.4	--	--	271	--	--	--
Iron, Total		--	15.7	--	--	263	--	--	--
Iron, Ferrous		23.7	1.89	22.0	>75	>75	19.2	2.78	1.14
Manganese, Dissolved		--	2.14	--	--	107	--	--	--
Manganese, Total		--	2.11	--	--	104	--	--	--
Nitrate		--	<2	--	--	2.53	--	--	--
Nitrite		--	<0.01	--	--	0.112	--	--	--
Sulfate		--	4.5	--	--	46.8	--	--	--
Sulfide, Lab		--	<2	--	--	<2	--	--	--
Sulfide, field		0.018	0.042	0.153	0.250	0.086	ND	0.176	0.005
Hardness		--	--	--	--	--	--	--	--
Total Organic Carbon		10.4	11.3	--	--	1980	5.8	804	24.4

Footnotes:

--	Not analyzed.
ug/L	Micrograms per liter.
mg/L	Milligrams per liter.
ng/L	Nanograms per liter.
mv	Millivolts.
umhos/cm	Microohms per centimeter
NTU	Nephlometric turbidity units.

Baseline sampling event on 12/7/98.

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Table 2. Summary of Biogeochemical Parameters Measured in Groundwater, Enhanced Reductive Dechlorination Pilot Test, Colesville Landfill, Broome County, New York.

CONSTITUENT:	WELL: DATE:	IW-1 3/9/99	IW-1 3/16/99	IW-2 2/16/99	IW-2 3/9/99	IW-2 3/16/99	FB-1 4/6/99	FB-1 7/14/99
Dissolved Gases	Units							
Carbon dioxide	mg/L	--	--	--	--	--	0.46	--
Oxygen	mg/L	--	--	--	--	--	5.26	--
Nitrogen	mg/L	--	--	--	--	--	9.58	--
Methane	mg/L	--	--	--	--	--	0.00236	--
Carbon monoxide	mg/L	--	--	--	--	--	<0.4	--
Ethane	ng/L	--	--	--	--	--	17	--
Ethene	ng/L	--	--	--	--	--	35	--
Inorganic Parameters in mg/L								
Alkalinity		--	--	--	--	--	<2	<2
Ammonia		--	--	--	--	--	<0.02	<0.02
Biological Oxygen Demand		--	--	--	--	--	<3	<2
Chloride		--	--	--	--	--	<0.1	<0.05
Chemical Oxygen Demand		--	--	--	--	--	<2	<2
Dissolved Organic Carbon		395	986	26.1	1230	39,900	--	--
Flouride		--	--	--	--	--	--	--
Iron, Dissolved		--	--	--	--	--	--	--
Iron, Total		--	--	--	--	--	0.2	0.173
Iron, Ferrous		2.60	32	16.70	27.3	25.1	--	--
Manganese, Dissolved		--	--	--	--	--	--	--
Manganese, Total		--	--	--	--	--	0.023	0.018
Nitrate		--	--	--	--	--	<0.2	0.107
Nitrite		--	--	--	--	--	<0.01	<0.01
Sulfate		--	--	--	--	--	<2	<1
Sulfide, Lab		--	--	--	--	--	<2	<2
Sulfide, field		0.033	0.169	0.182	0.222	1.6	--	--
Hardness		--	--	--	--	--	--	--
Total Organic Carbon		804	973	24.4	1540	36,400	<0.5	<0.5

Footnotes:

--	Not analyzed.
ug/L	Micrograms per liter.
mg/L	Milligrams per liter.
ng/L	Nanograms per liter.
mv	Millivolts.
umhos/cm	Microohms per centimeter
NTU	Nephlometric turbidity units.

Baseline sampling event on 12/7/98.

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Table 3. Summary of VOCs Detected in Groundwater, Enhanced Reductive Dechlorination Pilot Test, Colesville Landfill, Broome County, New York.

CONSTITUENT:	WELL: / DATE:	GMPW-1 12/7/98	GMPW-1 4/6/99	GMPW-1 7/14/99	GMPW-2 12/10/98	GMPW-2 7/14/98	GMMW-4 12/7/98
Volatile Organic Compounds in ug/L							
Benzene		37.8	21	19	24.7	<1.0	46.1
Bromobenzene		<1	<10	<1.0	<1	<1.0	<1
Chlorobromomethane		<1	<10	<1.0	<1	<1.0	<1
Bromodichloromethane		88.6	<10	<1.0	<1	<1.0	<1
Bromoform		<1	<10	<1.0	<1	<1.0	<1
Bromomethane		<1	<10	<1.0	<1	<1.0	<1
n-Butylbenzene		<1	<10	<1.0	<1	<1.0	1.4
sec-Butylbenzene		<1	<10	<1.0	<1	<1.0	<1
tert-Butylbenzene		<1	<10	<1.0	<1	<1.0	<1
Carbon tetrachloride		<1	<10	<1.0	<1	<1.0	151
Chlorobenzene		111	57	62	16.5	<1.0	<1
Dibromochloromethane		<1	<10	<1.0	<1	<1.0	270
Chloroethane		83.1	150	18	41.3	<1.0	17.7
Chloroform		7.5	<10	4.0	9	<1.0	<1
Chloromethane		<1	<10	<1.0	<1	<1.0	<1
2-Chlorotoluene		<1	<10	<1.0	<1	<1.0	<1
4-Chlorotoluene		<1	<10	<1.0	<1	<1.0	<1
1,2-Dibromo-3-chloropropane		<1	<10	<1.0	<1	<1.0	<1
1,2-Dibromoethane		<1	<10	<1.0	<1	<1.0	<1
Dibromomethane		<1	<10	<1.0	<1	<1.0	<1
1,2-Dichlorobenzene		<1	<10	<1.0	<1	<1.0	<1
1,3-Dichlorobenzene		<1	<10	<1.0	<1	<1.0	<1
1,4-Dichlorobenzene		<1	<10	<1.0	<1	<1.0	<1
Dichlorodifluoromethane		<1	<10	<1.0	<1	<1.0	<1
1,1-Dichloroethane		147	490	190	110	2.2	25.1
1,2-Dichloroethane		6.3	<10	<1.0	<1	<1.0	12.9
1,1-Dichloroethene		8.8	33	8.3	15	<1.0	654
cis-1,2-Dichloroethene		573	440	360	254	2.7	2.8
trans-1,2-Dichloroethene		1.2	27	<1.0	1.1	<1.0	<1
1,2-Dichloropropane		<1	<10	<1.0	2	<1.0	31.2
1,3-Dichloropropane		<1	<10	<1.0	<1	<1.0	<1
2,2-Dichloropropane		<1	<10	<1.0	<1	<1.0	<1
1,1-Dichloropropene		<1	<10	<1.0	<1	<1.0	<1
cis-1,3-Dichloropropene		<1	<10	<1.0	<1	<1.0	<1
trans-1,3-Dichloropropene		<1	<10	<1.0	<1	<1.0	13.1
Ethylbenzene		<1	<10	<1.0	<1	<1.0	<1
Hexachlorobutadiene		<1	<10	<1.0	<1	<1.0	<1
Isopropylbenzene		8.2	<10	<1.0	<1	<1.0	<1
p-Isopropyltoluene		<1	<10	<1.0	<1	<1.0	<1
Methylene chloride		150	350	75	58.2	<1.0	<1
Naphthalene		<1	<10	<1.0	<1	<1.0	<1
n-Propylbenzene		<1	<10	<1.0	1.1	<1.0	<1
Styrene		<1	<10	<1.0	<1	<1.0	<1
1,1,1,2-Tetrachloroethane		<1	<10	<1.0	<1	<1.0	<1
1,1,2,2-Tetrachloroethane		<1	<10	<1.0	<1	<1.0	<1
Tetrachloroethene		7	<10	<1.0	13.2	<1.0	15.1

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Table 3. Summary of VOCs Detected in Groundwater, Enhanced Reductive Dechlorination Pilot Test, Colesville Landfill, Broome County, New York.

CONSTITUENT:	SITE: DATE:	GMPW-1 12/7/98	GMPW-1 4/6/99	GMPW-1 7/14/99	GMPW-2 12/10/98	GMPW-2 7/14/98	GMMW-4 12/7/98
Volatile Organic Compounds in ug/L continued							
Toluene		2.4	<10	<1.0	2.2	--	27.6
1,2,3-Trichlorobenzene		<1	<10	<1.0	<1	<1.0	<1
1,2,4-Trichlorobenzene		<1	<10	<1.0	<1	<1.0	<1
1,1,1-Trichloroethane		98.8	140	73	505	2.6	13.1
1,1,2-Trichloroethane		2.7	<10	<1.0	<1	<1.0	12.1
Trichloroethene		219	91	4.7	96.2	1.3	<1
Trichlorofluoromethane		<1	<10	<1.0	<1	<1.0	<1
1,2,3-Trichloropropane		<1	<10	<1.0	<1	<1.0	<1
1,2,4-Trimethylbenzene		<1	<10	<1.0	<1	<1.0	3.2
1,3,5-Trimethylbenzene		<1	<10	<1.0	<1	<1.0	<1
Vinyl chloride		<1	270	26	<1	<1.0	<1
o-Xylene		<1	12	<1.0	<1	<1.0	28.2
M/P-xylenes		<1	<20	<1.0	<1	<1.0	16.4
Total VOCs		1552.4	2081				1341

Footnotes:

--	Not analyzed.
ug/L	Micrograms per liter.
mg/L	Milligrams per liter.
ng/L	Nanograms per liter.
mv	Millivolts.
umhos/cm	Microohms per centimeter
NTU	Nephlometric turbidity units.

Baseline sampling event on 12/7/98.

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Table 3. Summary of VOCs Detected in Groundwater, Enhanced Reductive Dechlorination Pilot Test, Colesville Landfill, Broome County, New York.

CONSTITUENT:	WELL: DATE:	GMMW-4 4/6/99	GMMW-4 7/14/99	GMMW-4* 7/14/99	GMMW-5 12/7/98	GMMW-5 4/6/99	GMMW-5 7/14/99
<u>Volatile Organic Compounds in ug/L</u>							
Benzene		<1	52	46	26.9	15	13
Bromobenzene		<1	<10	<10	<1	<10	<1.0
Chlorobromomethane		<1	<10	<10	<1	<10	<1.0
Bromodichloromethane		<1	<10	<10	<1	<10	<1.0
Bromoform		<1	<10	<10	<1	<10	<1.0
Bromomethane		<1	<10	<10	<1	<10	<1.0
n-Butylbenzene		<1	<10	<10	<1	<10	<1.0
sec-Butylbenzene		<1	<10	<10	<1	<10	<1.0
tert-Butylbenzene		<1	<10	<10	<1	<10	<1.0
Carbon tetrachloride		<1	<10	<10	<1	<10	<1.0
Chlorobenzene		<1	<10	320	99.5	66	52
Dibromochloromethane		<1	<10	<10	<1	<10	<1.0
Chloroethane		27	720	690	130	350	40
Chloroform		<1	35	34	11	<10	<1.0
Chloromethane		<1	<10	<10	<1	<10	<1.0
2-Chlorotoluene		<1	<10	<10	<1	<10	<1.0
4-Chlorotoluene		<1	<10	<10	<1	<10	<1.0
1,2-Dibromo-3-chloropropane		<1	<10	<10	<1	<10	<1.0
1,2-Dibromoethane		<1	<10	<10	<1	<10	<1.0
Dibromomethane		<1	<10	<10	<1	<10	<1.0
1,2-Dichlorobenzene		<1	<10	<10	<1	<10	<1.0
1,3-Dichlorobenzene		<1	<10	<10	<1	<10	<1.0
1,4-Dichlorobenzene		<1	<10	<10	<1	<10	<1.0
Dichlorodifluoromethane		<1	<10	<10	<1	<10	<1.0
1,1-Dichloroethane		31	930	890	227	580	450
1,2-Dichloroethane		<1	36	34	10	<10	2.9
1,1-Dichloroethene		<1	42	39	9	<10	2.8
cis-1,2-Dichloroethene		35	2000	1900	462	860	1200
trans-1,2-Dichloroethene		<1	<10	<10	2.3	<10	<1.0
1,2-Dichloropropane		<1	<10	<10	<1	<10	<1.0
1,3-Dichloropropane		<1	<10	<10	33.6	<10	<1.0
2,2-Dichloropropane		<1	<10	<10	<1	<10	<1.0
1,1-Dichloropropene		<1	<10	<10	<1	<10	<1.0
cis-1,3-Dichloropropene		<1	<10	<10	<1	<10	<1.0
trans-1,3-Dichloropropene		<1	<10	<10	<1	<10	<1.0
Ethylbenzene		<1	14	13	4.1	<10	1.4
Hexachlorobutadiene		<1	<10	<10	<1	<10	<1.0
Isopropylbenzene		<1	<10	<10	<1	<10	<1.0
p-Isopropyltoluene		<1	<10	<10	<1	<10	<1.0
Methylene chloride		15	210	200	88.6	240	32
Naphthalene		<1	<10	<10	<1	<10	<1.0
n-Propylbenzene		<1	<10	<10	<1	<10	<1.0
Styrene		<1	<10	<10	<1	<10	<1.0
1,1,1,2-Tetrachloroethane		<1	<10	<10	<1	<10	<1.0
1,1,2,2-Tetrachloroethane		<1	<10	<10	<1	<10	<1.0
Tetrachloroethene		<1	11	10	8.7	<10	1.3

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Table 3. Summary of VOCs Detected in Groundwater, Enhanced Reductive Dechlorination Pilot Test, Colesville Landfill, Broome County, New York.

CONSTITUENT:	SITE: DATE:	GMMW-4 4/6/99	GMMW-4 7/14/99	GMMW-4* 7/14/99	GMMW-5 12/7/98	GMMW-5 4/6/99	GMMW-5 7/14/99
Volatile Organic Compounds in ug/L continued							
Toluene		<1	110	100	29.7	23	22
1,2,3-Trichlorobenzene		<1	<10	<10	<1	<10	<1.0
1,2,4-Trichlorobenzene		<1	<10	<10	<1	<10	<1.0
1,1,1-Trichloroethane		<1	40	38	10.5	39	11
1,1,2-Trichloroethane		<1	14	13	5	<10	1.0
Trichloroethene		64	950	930	588	240	11
Trichlorofluoromethane		<1	<10	<10	<1	<10	<1.0
1,2,3-Trichloropropane		<1	<10	<10	<1	<10	<1.0
1,2,4-Trimethylbenzene		<1	33	15	1.3	<10	<1.0
1,3,5-Trimethylbenzene		<1	<10	<10	<1	<10	3.3
Vinyl chloride		34	420	400	143	360	21
o-Xylene		<1	57	44	13.2	<10	4.0
M/P-xylenes		<2	32	24	9.2	<20	3.4
Total VOCs		206			1912.6	2773	

Footnotes:

–	Not analyzed.
ug/L	Micrograms per liter.
mg/L	Milligrams per liter.
ng/L	Nanograms per liter.
mv	Millivolts.
umhos/cm	Microohms per centimeter
NTU	Nephlometric turbidity units.
*	Duplicate sample.

Baseline sampling event on 12/7/98.

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Table 3. Summary of VOCs Detected in Groundwater, Enhanced Reductive Dechlorination Pilot Test, Colesville Landfill, Broome County, New York.

CONSTITUENT:	WELL: DATE:	FB-1 4/6/99	FB-1 7/14/99	TB-1 4/6/99	TB-1 7/14/99
Volatile Organic Compounds in ug/L					
Benzene		<1	<1.0	<1	<1.0
Bromobenzene		<1	<1.0	<1	<1.0
Chlorobromomethane		<1	<1.0	<1	<1.0
Bromodichloromethane		<1	<1.0	<1	<1.0
Bromoform		<1	<1.0	<1	<1.0
Bromomethane		<1	<1.0	<1	<1.0
n-Butylbenzene		<1	<1.0	<1	<1.0
sec-Butylbenzene		<1	<1.0	<1	<1.0
tert-Butylbenzene		<1	<1.0	<1	<1.0
Carbon tetrachloride		<1	<1.0	<1	<1.0
Chlorobenzene		<1	<1.0	<1	<1.0
Dibromochloromethane		<1	<1.0	<1	<1.0
Chloroethane		<1	<1.0	<1	<1.0
Chloroform		<1	<1.0	<1	<1.0
Chloromethane		<1	<1.0	<1	<1.0
2-Chlorotoluene		<1	<1.0	<1	<1.0
4-Chlorotoluene		<1	<1.0	<1	<1.0
1,2-Dibromo-3-chloropropane		<1	<1.0	<1	<1.0
1,2-Dibromoethane		<1	<1.0	<1	<1.0
Dibromomethane		<1	<1.0	<1	<1.0
1,2-Dichlorobenzene		<1	<1.0	<1	<1.0
1,3-Dichlorobenzene		<1	<1.0	<1	<1.0
1,4-Dichlorobenzene		<1	<1.0	<1	<1.0
Dichlorodifluoromethane		<1	<1.0	<1	<1.0
1,1-Dichloroethane		<1	<1.0	<1	<1.0
1,2-Dichloroethane		<1	<1.0	<1	<1.0
1,1-Dichloroethene		<1	<1.0	<1	<1.0
cis-1,2-Dichloroethene		<1	<1.0	<1	<1.0
trans-1,2-Dichloroethene		<1	<1.0	<1	<1.0
1,2-Dichloropropane		<1	<1.0	<1	<1.0
1,3-Dichloropropane		<1	<1.0	<1	<1.0
2,2-Dichloropropane		<1	<1.0	<1	<1.0
1,1-Dichloropropene		<1	<1.0	<1	<1.0
cis-1,3-Dichloropropene		<1	<1.0	<1	<1.0
trans-1,3-Dichloropropene		<1	<1.0	<1	<1.0
Ethylbenzene		<1	<1.0	<1	<1.0
Hexachlorobutadiene		<1	<1.0	<1	<1.0
Isopropylbenzene		<1	<1.0	<1	<1.0
p-Isopropyltoluene		<1	3.2	<1	<1.0
Methylene chloride		<1	<1.0	<1	<1.0
Naphthalene		<1	<1.0	<1	<1.0
n-Propylbenzene		<1	<1.0	<1	<1.0
Styrene		<1	<1.0	<1	<1.0
1,1,1,2-Tetrachloroethane		<1	<1.0	<1	<1.0
1,1,2,2-Tetrachloroethane		<1	<1.0	<1	<1.0
Tetrachloroethene		<1	<1.0	<1	<1.0

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Table 3. Summary of VOCs Detected in Groundwater, Enhanced Reductive Dechlorination Pilot Test, Colesville Landfill, Broome County, New York.

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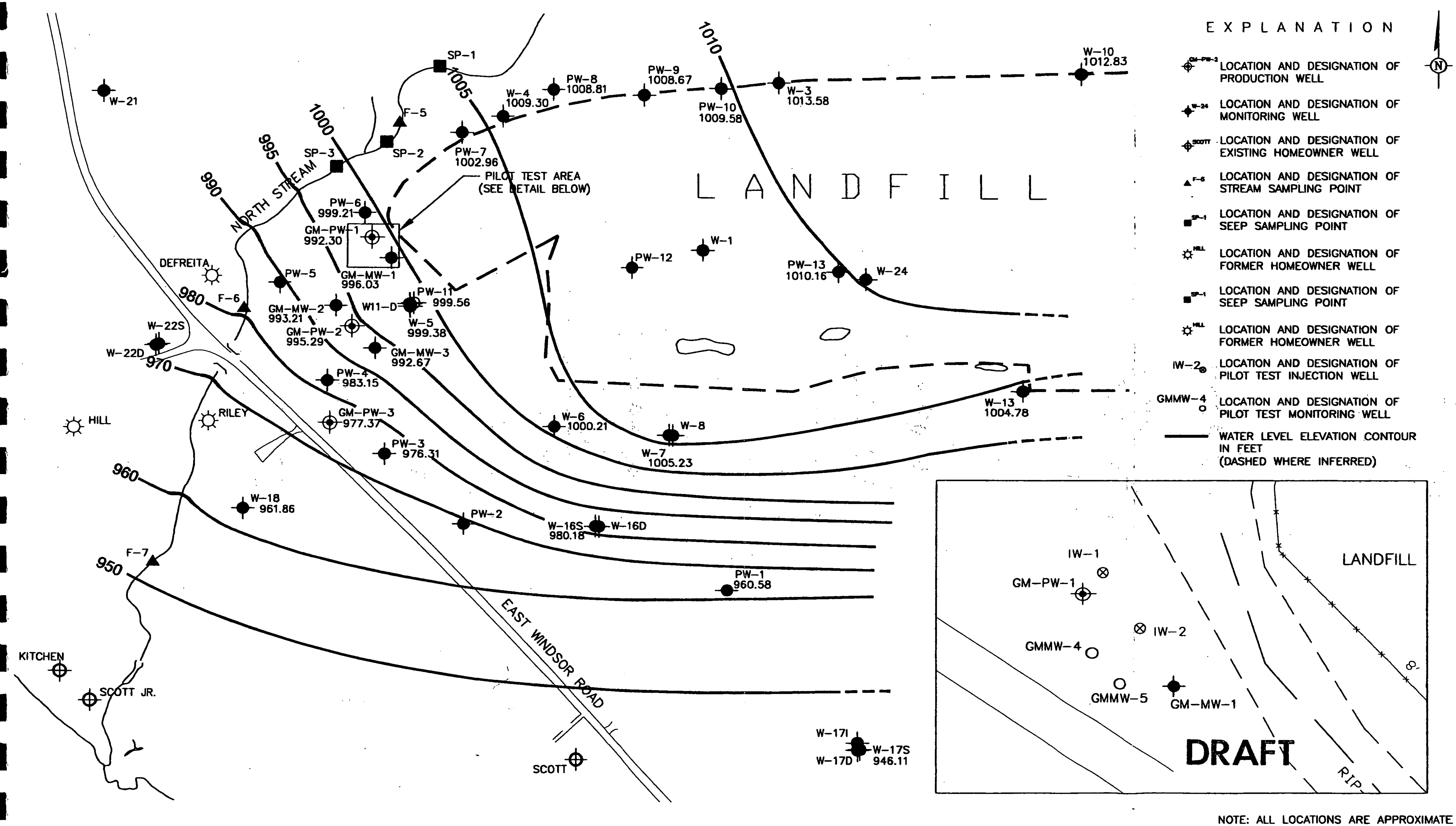
CONSTITUENT:	SITE: DATE:	FB-1 4/6/99	FB-1 7/14/99	TB-1 4/6/99	TB-1 7/14/99
Volatile Organic Compounds in ug/L continued					
Toluene		<1	<1.0	<1	<1.0
1,2,3-Trichlorobenzene		<1	<1.0	<1	<1.0
1,2,4-Trichlorobenzene		<1	<1.0	<1	<1.0
1,1,1-Trichloroethane		<1	<1.0	<1	<1.0
1,1,2-Trichloroethane		<1	<1.0	<1	<1.0
Trichloroethene		<1	<1.0	<1	<1.0
Trichlorofluoromethane		<1	<1.0	<1	<1.0
1,2,3-Trichloropropane		<1	<1.0	<1	<1.0
1,2,4-Trimethylbenzene		<1	<1.0	<1	<1.0
1,3,5-Trimethylbenzene		<1	<1.0	<1	<1.0
Vinyl chloride		<1	<1.0	<1	<1.0
o-Xylene		<1	<1.0	<1	<1.0
M/P-xylenes		<2	<2.0	<2	<2.0
Total VOCs		0		0	

Footnotes:

--	Not analyzed.
ug/L	Micrograms per liter.
mg/L	Milligrams per liter.
ng/L	Nanograms per liter.
mv	Millivolts.
umhos/cm	Microohms per centimeter
NTU	Nephlometric turbidity units.
*	Duplicate sample.

Baseline sampling event on 12/7/98.



0 200 SCALE IN FEET

NO.	DATE	REVISION DESCRIPTION	BY CKD

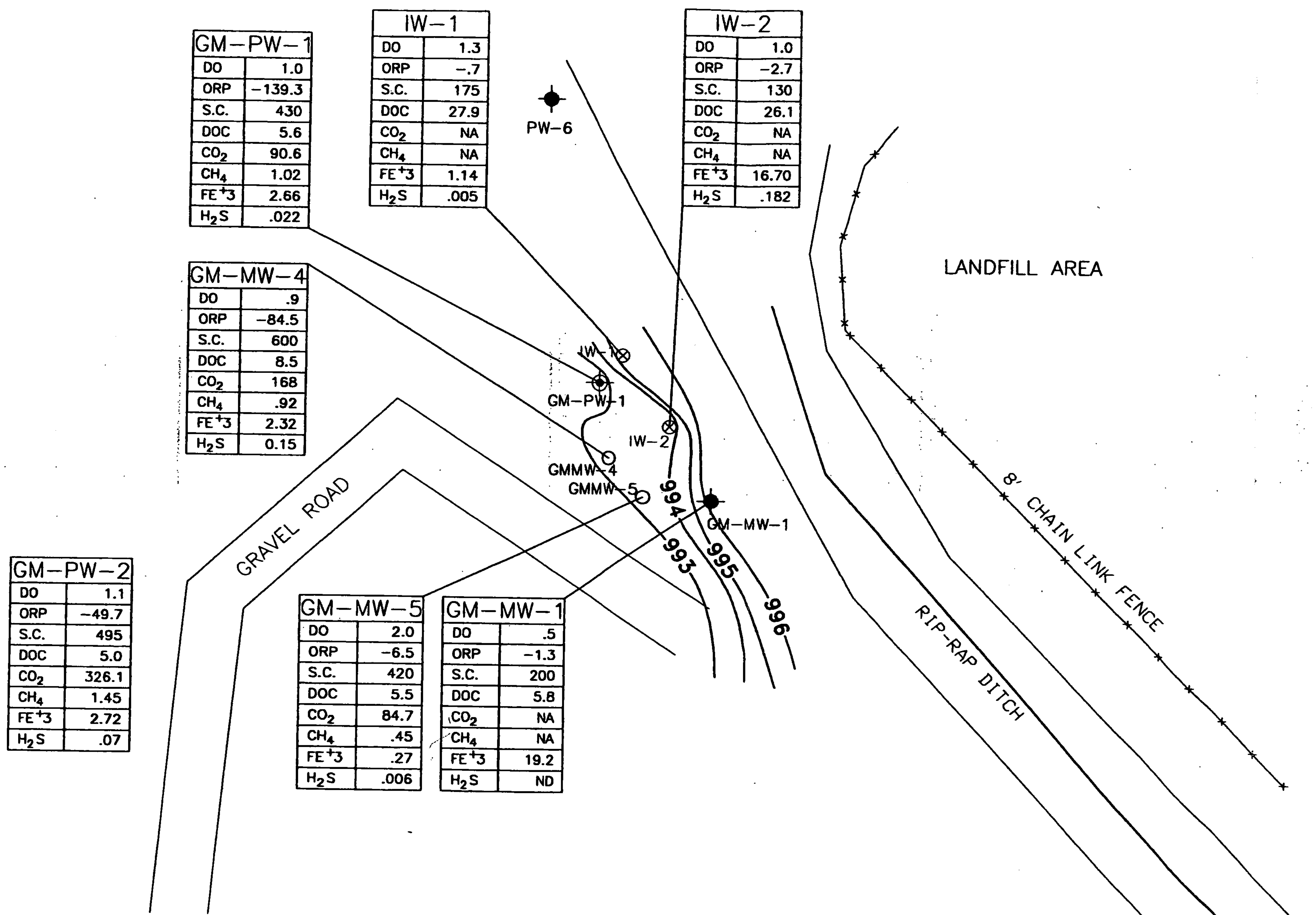
ARCADIS GERAGHTY&MILLER

COLESVILLE LANDFILL
COLESVILLE, NEW YORK

DRAWN A.G. | DATE 9/21/99 | PROJECT MANAGER S. FELDMAN | DEPARTMENT MANAGER
LEAD DESIGN PROF. | CHECKED D. STERN

WATER LEVEL CONTOURS
DECEMBER 8, 1998
COLESVILLE LANDFILL
BROOME COUNTY, NEW YORK

PROJECT NUMBER NY0949001275 | DRAWING NUMBER 1



GM-PW-1

DO	1.0
ORP	−139.3
S.C.	430
DOC	5.6
CO_2	90.6
CH_4	1.02
FE^{+3}	2.66
H_2S	.022

IW-1

DO	1.3
ORP	−.7
S.C.	175
DOC	27.9
CO_2	NA
CH_4	NA
FE^{+3}	1.14
H_2S	.005

IW-2

DO	1.0
ORP	−2.7
S.C.	130
DOC	26.1
CO_2	NA
CH_4	NA
FE^{+3}	16.70
H_2S	.182

GM-MW-4

DO	.9
ORP	−84.5
S.C.	600
DOC	8.5
CO_2	168
CH_4	.92
FE^{+3}	2.32
H_2S	0.15

GM-PW-2

DO	1.1
ORP	−49.7
S.C.	495
DOC	5.0
CO_2	326.1
CH_4	1.45
FE^{+3}	2.72
H_2S	.07

GM-MW-5

DO	2.0
ORP	−6.5
S.C.	420
DOC	5.5
CO_2	84.7
CH_4	.45
FE^{+3}	.27
H_2S	.006

GM-MW-1

DO	.5
ORP	−1.3
S.C.	200
DOC	5.8
CO_2	NA
CH_4	NA
FE^{+3}	19.2
H_2S	ND

GM-PW-2 LOCATION AND DESIGNATION OF PRODUCTION WELL

W-24 LOCATION AND DESIGNATION OF MONITORING WELL

IW-2 LOCATION AND DESIGNATION OF PROPOSED INJECTION WELL

GMMW-4 LOCATION AND DESIGNATION OF PROPOSED MONITORING WELL

DO DISSOLVED OXYGEN (mg/L)

ORP OXIDATION REDUCTION POTENTIAL (mV)

S.C. SPECIFIC CONDUCTANCE (u℧/cm)

DOC DISSOLVED ORGANIC CARBON (mg/L)

CO_2 CARBON DIOXIDE (mg/L) (mg/L)

CH_4 METHANE (mg/L)

FE^{+3} FERROUS IRON (mg/L)

H_2S HYDROGEN SULFIDE (mg/L)

NA NOT ANALYZED

DRAFT

0 20 SCALE IN FEET

NO.	DATE	REVISION DESCRIPTION	BY / CKD

ARCADIS GERAGHTY&MILLER

COLESVILLE LANDFILL
COLESVILLE, NEW YORK

DRAWN: M. WASILEWSKI | DATE: 9/27/99 | PROJECT MANAGER: S. FELDMAN | DEPARTMENT MANAGER
LEAD DESIGN PROF. | CHECKED: D. STERN

SUMMARY OF GEOCHEMICAL INDICATOR PARAMETERS – BASELINE SAMPLING EVENT DECEMBER 1998

PROJECT NUMBER: NY0949001T4 | DRAWING NUMBER: 2

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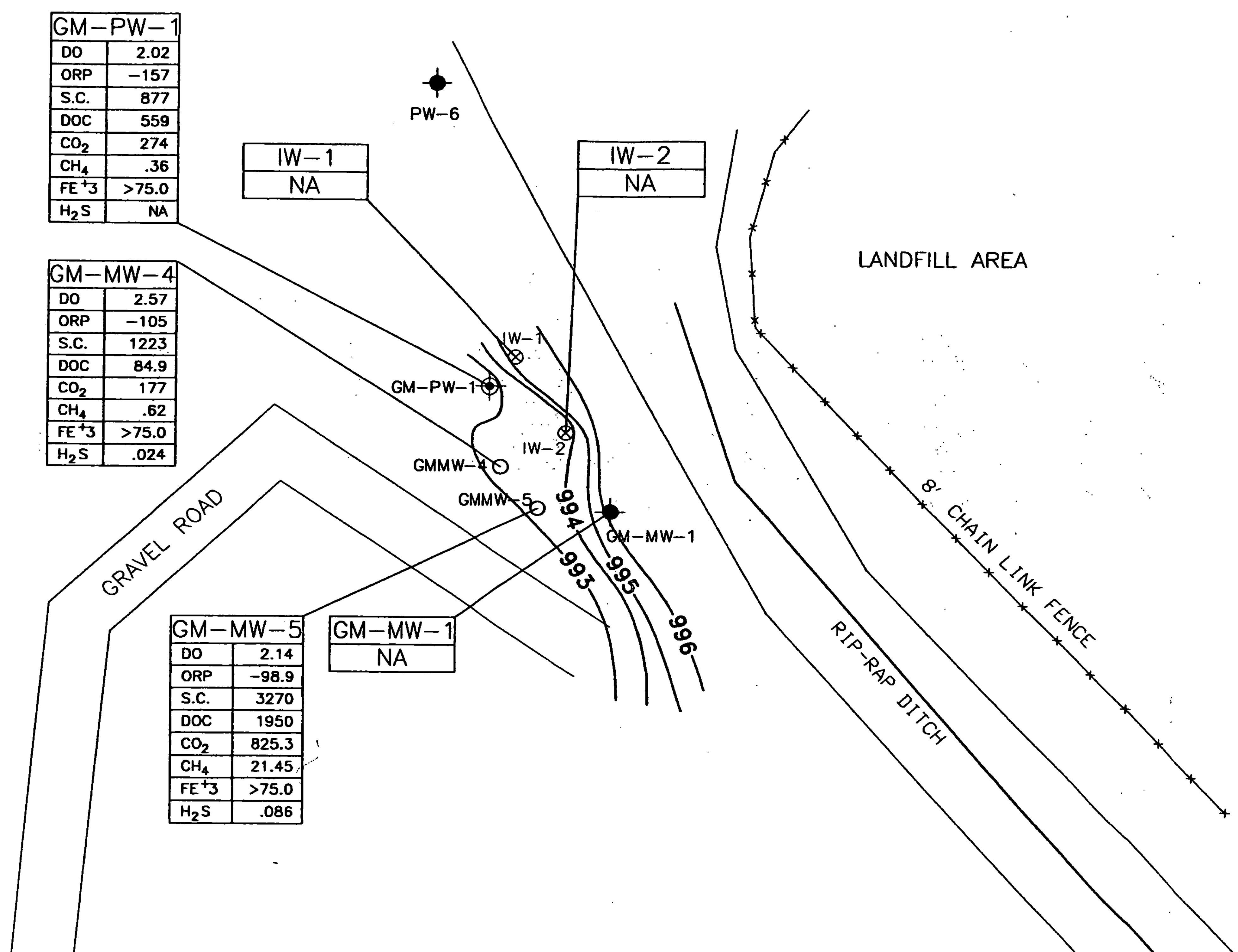

GM-PW-1	
DO	2.02
ORP	-157
S.C.	877
DOC	559
CO_2	274
CH_4	.36
FE^{+3}	>75.0
H_2S	NA

GM-MW-4	
DO	2.57
ORP	-105
S.C.	1223
DOC	84.9
CO_2	177
CH_4	.62
FE^{+3}	>75.0
H_2S	.024

GM-PW-2	
DO	.22
ORP	-.54.4
S.C.	792
DOC	14.7
CO_2	NA
CH_4	NA
FE^{+3}	16.3
H_2S	.170

GM-MW-5	
DO	2.14
ORP	-98.9
S.C.	3270
DOC	1950
CO_2	825.3
CH_4	21.45
FE^{+3}	>75.0
H_2S	.086

GM-MW-1
NA

GM-PW-2 LOCATION AND DESIGNATION OF PRODUCTION WELL

W-24 LOCATION AND DESIGNATION OF MONITORING WELL

IW-2 LOCATION AND DESIGNATION OF PROPOSED INJECTION WELL

GMMW-4 LOCATION AND DESIGNATION OF PROPOSED MONITORING WELL

DO DISSOLVED OXYGEN (mg/L)

ORP OXIDATION REDUCTION POTENTIAL (mV)

S.C. SPECIFIC CONDUCTANCE (uΩ/cm)

DOC DISSOLVED ORGANIC CARBON (mg/L)

CO_2 CARBON DIOXIDE (mg/L) (mg/L)

CH_4 METHANE (mg/L)

FE^{+3} FERROUS IRON (mg/L)

H_2S HYDROGEN SULFIDE (mg/L)

NA NOT ANALYZED

DRAFT

0 20 SCALE IN FEET

NO.	DATE	REVISION DESCRIPTION	BY / CKD

ARCADIS GERAGHTY&MILLER

COLESVILLE LANDFILL
COLESVILLE, NEW YORK

DRAWN M. WASILEWSKI | DATE 9/27/99 | PROJECT MANAGER S. FELDMAN | DEPARTMENT MANAGER | LEAD DESIGN PROF. | CHECKED D. STERN

SUMMARY OF GEOCHEMICAL INDICATOR PARAMETERS - JULY 1999

PROJECT NUMBER NY0949001T4 | DRAWING NUMBER 3

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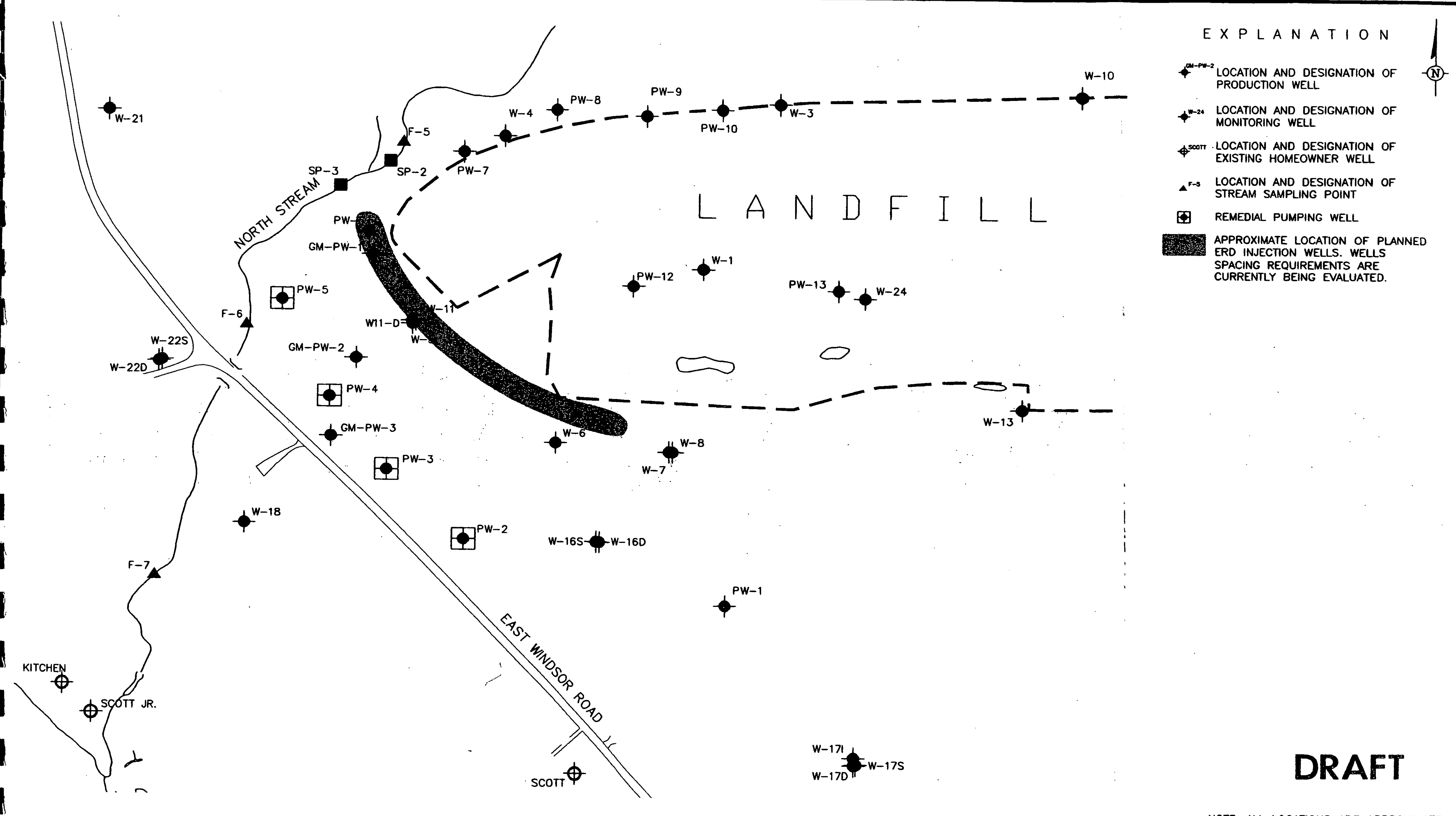
G:\APROJECT\BROOME\NY0949.001\CADD\GEOCHEM-2.DWG



NOTE: ALL LOCATIONS ARE APPROXIMATE

0 200
SCALE IN FEET

NO.	DATE	REVISION DESCRIPTION	BY / CKD

ARCADIS GERAGHTY & MILLER

COLESVILLE LANDFILL
COLESVILLE, NEW YORK

DRAWN A.G.	DATE 9/25/99	PROJECT MANAGER S. FELDMAN	DEPARTMENT MANAGER
RECOMMENDED CONFIGURATION OF ENHANCED PUMP-AND-TREAT GROUNDWATER REMEDIATION SYSTEM		LEAD DESIGN PROF.	CHECKED D. STERN
		PROJECT NUMBER NY09490012T5	DRAWING NUMBER 4

APPENDIX C

ARCADIS GERAGHTY & MILLER

Appendix C

Memorandum – Groundwater Remedial Design, Colesville Landfill, Broome County, New York

ARCADIS GERAGHTY & MILLER

ARCADIS Geraghty & Miller, Inc.
88 Duryea Road
Melville
New York 11747
Tel 631 249 7600
Fax 631 249 7610

ENVIRONMENTAL

MEMO

To:
George Jacob, USEPA - Region II

Copies:
Brian Davidson, NYSDEC
Ray Standish, Broome County
Nelson Johnson, GAF Corp.

From:
Steven Feldman SMF
Tom Lobasso

Date:
17 December 1999

Subject:
Groundwater Remedial Design, Colesville Landfill

ARCADIS Geraghty & Miller Project No.:
NY000949.0013

ARCADIS Geraghty & Miller has been moving forward with the groundwater remedial design based on the conceptual layout shown on Figure 4 of the October 29, 1999 report entitled, "Results of the Enhanced Reductive Dechlorination Pilot Study, Colesville Landfill, Broome County, New York. We have made two revisions to the conceptual layout shown on Figure 4 based on groundwater quality data received during November.

Based on these data, VOCs were not detected in Well PW-2, nor were they detected in this well during the 1992 sampling event. Therefore, Well PW-2 would not be used as an extraction well. Historic groundwater quality data are provided in the attached Table 1. The second modification is the termination of the line of enhanced reductive dechlorination (ERD) injection wells as shown on the attached Figure 1.

The rationale for terminating the line of injection wells in this area is that natural attenuation (as evidenced by groundwater quality in PW-2, PW-1, W-16S, W-17S and MW-20S) will effectively reduce concentrations of VOCs to below MCLs. The spacing between injection wells will be 30 ft based on data collected during the pilot test.

As discussed during our conversation on December 15, 1999, we have tentatively scheduled a conference call for Wednesday, December 22[st] to discuss the status of the design, provide an opportunity to get EPA and NYSDEC input during the design process, and discuss the overall project schedule.

A proposed schedule is provided below.

Milestone	Completion Date
Submittal of 95% design Late Report on Enhancement	January 21, 2000
EPA and DEC review	February 18, 2000
Submittal of Final Design	March 10, 2000
EPA and DEC Design Approval	March 31, 2000
EPA Issuance of ESD	April 20, 2000
Pre-Construction Meeting	May 4, 2000
Remedial Construction	May 22, 2000
Completion of Construction	
Start-up	

ARCADIS GERAGHTY & MILLER

Table 1. Historic Groundwater Quality Data, Colesville Landfill, Broome County, New York.

Constituent (ug/L)	Site ID: Date:	COL-PW1 02/05/92	COL-PW2 02/05/92	PW-2 9/23/99	COL-PW3 02/05/92	PW-3 9/24/99
Benzene		< 1	< 1	< 1.0	4.0	< 1.0
Bromobenzene		–	–	< 1.0	–	< 1.0
Bromochloromethane		–	–	< 1.0	–	< 1.0
Bromodichloromethane		< 1	< 1	< 1.0	< 1	< 1.0
Bromoform		< 1	< 1	< 1.0	< 1	< 1.0
Bromomethane		< 1	< 1	< 1.0	< 1	< 1.0
n-Butylbenzene		–	–	< 1.0	–	< 1.0
sec-Butylbenzene		–	–	< 1.0	–	< 1.0
tert-Butylbenzene		–	–	< 1.0	–	< 1.0
Carbon tetrachloride		< 1	< 1	< 1.0	< 1	< 1.0
Chlorobenzene		< 1	< 1	< 1.0	< 1	< 1.0
Dibromochloromethane		< 1	< 1	< 1.0	< 1	< 1.0
Chloroethane		< 1	< 1	< 1.0	4.0	< 1.0
Chloroform		< 1	< 1	< 1.0	11.0	2.2
Chloromethane		< 1	< 1	< 1.0	< 1	< 1.0
2-Chlorotoluene		–	–	< 1.0	–	< 1.0
4-Chlorotoluene		–	–	< 1.0	–	< 1.0
1,2-Dibromo-3-chloropropane		–	–	< 1.0	–	< 1.0
1,2-Dibromoethane		–	–	< 1.0	–	< 1.0
Dibromomethane		–	–	< 1.0	–	< 1.0
1,2-Dichlorobenzene		< 1	< 1	< 1.0	< 1	< 1.0
1,3-Dichlorobenzene		< 1	< 1	< 1.0	< 1	< 1.0
1,4-Dichlorobenzene		< 1	< 1	< 1.0	< 1	< 1.0
Dichlorodifluoromethane		< 1	< 1	< 1.0	42.0	< 1.0
1,1-Dichloroethane		< 1	< 1	< 1.0	70.0	18
1,2-Dichloroethane		< 1	< 1	< 1.0	1.0	< 1.0
1,1-Dichloroethene		< 1	< 1	< 1.0	< 1	< 1.0
cis-1,2-Dichloroethene		–	–	< 1.0	–	4.1
trans-1,2-Dichloroethene		< 1	< 1	< 1.0	< 1	< 1.0
1,2-Dichloropropane		< 1	< 1	< 1.0	< 1	< 1.0
1,3-Dichloropropane		–	–	< 1.0	–	< 1.0
2,2-Dichloropropane		–	–	< 1.0	–	< 1.0
1,1-Dichloropropene		–	–	< 1.0	–	< 1.0
cis-1,3-Dichloropropene		< 1	< 1	< 1.0	< 1	< 1.0
trans-1,3-Dichloropropene		< 1	< 1	< 1.0	< 1	< 1.0
Ethylbenzene		< 1	< 1	< 1.0	< 1	< 1.0
Hexachlorobutadiene		–	–	< 1.0	–	< 1.0
Isopropylbenzene		–	–	< 1.0	–	< 1.0
p-Isopropyltoluene		–	–	< 1.0	–	< 1.0
Methylene chloride		4.0 B	4.0 B	< 1.0	10.0 B	< 1.0
Naphthalene		–	–	< 1.0	–	< 1.0
n-Propylbenzene		–	–	< 1.0	–	< 1.0
Styrene		–	–	< 1.0	–	< 1.0
1,1,1,2-Tetrachloroethane		–	–	< 1.0	–	< 1.0
1,1,2,2-Tetrachloroethane		< 1	< 1	< 1.0	< 1	< 1.0
Tetrachloroethene		< 1	< 1	< 1.0	2.0	3.7
Toluene		< 1	< 1	< 1.0	< 1	< 1.0
1,2,3-Trichlorobenzene		–	–	< 1.0	–	< 1.0
1,2,4-Trichlorobenzene		–	–	< 1.0	–	< 1.0
1,1,1-Trichloroethane		< 1	< 1	< 1.0	21.0	27
1,1,2-Trichloroethane		< 1	< 1	< 1.0	< 1	< 1.0
Trichloroethene		< 1	< 1	< 1.0	49.0	17
Trichlorofluoromethane		< 1	< 1	< 1.0	9.0	< 1.0
1,2,3-Trichloropropane		–	–	< 1.0	–	< 1.0
1,2,4-Trimethylbenzene		–	–	< 1.0	–	< 1.0
1,3,5-Trimethylbenzene		–	–	< 1.0	–	< 1.0
Vinyl chloride		< 1	< 1	< 1.0	10.0	< 1.0
o-Xylene		< 1	< 1	< 1.0	< 1	< 1.0
m/p-xylenes		< 1	< 1	< 2.0	< 1	< 2.0

ARCADIS GERAGHTY&MILLER

Table 1. Historic Groundwater Quality Data, Colesville Landfill, Broome County, New York.

Site ID:	COL-PW04	PW-4	PW-04	PW-4	PW-4
Date:	02/05/92	09/13/95	12/12/95	03/12/96	06/26/96
Constituent (ug/L)					
Benzene	< 1	0.6 J	< 1	< 1	< 1
Bromobenzene	–	< 1	< 1	< 1	< 1
Bromochloromethane	–	< 1	< 1	< 1	< 1
Bromodichloromethane	< 1	< 1	< 1	< 1	< 1
Bromoform	< 1	< 1	< 1	< 1	< 1
Bromomethane	< 1	< 1	< 1	< 1	< 1
n-Butylbenzene	–	< 1	< 1	< 1	< 1
sec-Butylbenzene	–	< 1	< 1	< 1	< 1
tert-Butylbenzene	–	< 1	< 1	< 1	< 1
Carbon tetrachloride	< 1	< 1	< 1	< 1	< 1
Chlorobenzene	< 1	0.1 J	< 1	< 1	< 1
Dibromochloromethane	< 1	< 1	< 1	< 1	< 1
Chloroethane	2.0	4.6	5.9	< 1	8.1
Chloroform	5.0	3.6	3.6	2.1	4.1
Chloromethane	< 1	< 1	< 1	< 1	1.2
2-Chlorotoluene	–	< 1	< 1	< 1	< 1
4-Chlorotoluene	–	< 1	< 1	< 1	< 1
1,2-Dibromo-3-chloropropane	–	< 1	< 1	< 1	< 1
1,2-Dibromoethane	–	< 1	< 1	< 1	< 1
Dibromomethane	–	< 1	< 1	< 1	< 1
1,2-Dichlorobenzene	< 1	< 1	< 1	< 1	< 1
1,3-Dichlorobenzene	< 1	< 1	< 1	< 1	< 1
1,4-Dichlorobenzene	< 1	< 1	< 1	< 1	< 1
Dichlorodifluoromethane	42.0	3.7	24.9	< 1	4.9
1,1-Dichloroethane	37.0	40.9	22.5	23.5	49.5
1,2-Dichloroethane	< 1	< 1	< 1	< 1	< 1
1,1-Dichloroethene	< 1	0.8 J	2.6	< 1	< 1
cis-1,2-Dichloroethene	–	14.9	13.4	6.4	18
trans-1,2-Dichloroethene	< 1	< 1	< 1	< 1	< 1
1,2-Dichloropropane	< 1	< 1	< 1	< 1	< 1
1,3-Dichloropropane	–	< 1	< 1	< 1	< 1
2,2-Dichloropropane	–	< 1	< 1	< 1	< 1
1,1-Dichloropropene	–	< 1	< 1	< 1	< 1
cis-1,3-Dichloropropene	< 1	< 1	< 1	< 1	< 1
trans-1,3-Dichloropropene	< 1	< 1	< 1	< 1	< 1
Ethylbenzene	< 1	< 1	< 1	< 1	< 1
Hexachlorobutadiene	–	< 1	< 1	< 1	< 1
Isopropylbenzene	–	< 1	< 1	< 1	< 1
p-Isopropyltoluene	–	< 1	< 1	< 1	< 1
Methylene chloride	12.0 B	5.9	4.9	5.4	6.5
Naphthalene	–	0.2 J	< 1	< 1	< 1
n-Propylbenzene	–	< 1	< 1	< 1	< 1
Styrene	–	< 1	< 1	< 1	< 1
1,1,1,2-Tetrachloroethane	–	< 1	< 1	< 1	< 1
1,1,2,2-Tetrachloroethane	< 1	< 1	< 1	< 1	< 1
Tetrachloroethene	< 1	< 1	< 1	< 1	< 1
Toluene	< 1	0.2 J	< 1	< 1	< 1
1,2,3-Trichlorobenzene	--	< 1	< 1	< 1	< 1
1,2,4-Trichlorobenzene	--	< 1	< 1	< 1	< 1
1,1,1-Trichloroethane	40.0	32.7	23.8	20.6	28.5
1,1,2-Trichloroethane	< 1	< 1	< 1	< 1	< 1
Trichloroethene	17.0	17.2	18.7	18.4	20.6
Trichlorofluoromethane	6.0	0.3 J	1.5	< 1	< 1
1,2,3-Trichloropropane	--	< 1	< 1	< 1	< 1
1,2,4-Trimethylbenzene	--	< 1	< 1	< 1	< 1
1,3,5-Trimethylbenzene	--	< 1	< 1	< 1	< 1
Vinyl chloride	3.0	1.7 J	1.6	< 1	1.6
o-Xylene	< 1	< 1	< 1	< 1	< 1
m/p-xylenes	< 1	< 1	< 1	< 1	< 1

ARCADIS GERAGHTY&MILLER

Table 1. Historic Groundwater Quality Data, Colesville Landfill, Broome County, New York.

Constituent (ug/L)	Site ID: Date:	PW-4 03/19/97	PW-4 07/17/97	PW-4 9/24/99	COL-PW05 02/05/92	PW-5 09/13/95
Benzene		< 1	< 1	1.6	< 1	< 1
Bromobenzene		< 1	< 1	< 1.0	—	< 1
Bromochloromethane		< 1	< 1	< 1.0	—	< 1
Bromodichloromethane		< 1	< 1	< 1.0	< 1	< 1
Bromoform		< 1	< 1	< 1.0	< 1	< 1
Bromomethane		< 1	< 1	< 1.0	< 1	< 1
n-Butylbenzene		< 1	< 1	< 1.0	—	< 1
sec-Butylbenzene		< 1	< 1	< 1.0	—	< 1
tert-Butylbenzene		< 1	< 1	< 1.0	—	< 1
Carbon tetrachloride		< 1	< 1	< 1.0	< 1	< 1
Chlorobenzene		< 1	< 1	< 1.0	< 1	< 1
Dibromochloromethane		< 1	< 1	< 1.0	< 1	< 1
Chloroethane		4.7	< 1	8.5	< 1	< 1
Chloroform		3.1	5.1	4.2	< 1	< 1
Chloromethane		< 1	< 1	< 1.0	< 1	< 1
2-Chlorotoluene		< 1	< 1	< 1.0	—	< 1
4-Chlorotoluene		< 1	< 1	< 1.0	—	< 1
1,2-Dibromo-3-chloropropane		< 1	< 1	< 1.0	—	< 1
1,2-Dibromoethane		< 1	< 1	< 1.0	—	< 1
Dibromomethane		< 1	< 1	< 1.0	—	< 1
1,2-Dichlorobenzene		< 1	< 1	< 1.0	< 1	< 1
1,3-Dichlorobenzene		< 1	< 1	< 1.0	< 1	< 1
1,4-Dichlorobenzene		< 1	< 1	< 1.0	< 1	< 1
Dichlorodifluoromethane		< 1	< 1	< 1.0	< 1	< 1
1,1-Dichloroethane		20.4	37.1	56	< 1	9.8
1,2-Dichloroethane		< 1	< 1	< 1.0	< 1	< 1
1,1-Dichloroethene		0.7 J	< 1	< 1.0	< 1	< 1
cis-1,2-Dichloroethene		8.2	14.1	22	—	17.2
trans-1,2-Dichloroethene		< 1	< 1	< 1.0	< 1	< 1
1,2-Dichloropropane		< 1	< 1	< 1.0	< 1	< 1
1,3-Dichloropropane		< 1	< 1	< 1.0	—	< 1
2,2-Dichloropropane		< 1	< 1	< 1.0	—	< 1
1,1-Dichloropropene		< 1	< 1	< 1.0	—	< 1
cis-1,3-Dichloropropene		< 1	< 1	< 1.0	< 1	< 1
trans-1,3-Dichloropropene		< 1	< 1	< 1.0	< 1	< 1
Ethylbenzene		< 1	< 1	< 1.0	< 1	< 1
Hexachlorobutadiene		< 1	< 1	< 1.0	—	< 1
Isopropylbenzene		< 1	< 1	< 1.0	—	< 1
p-Isopropyltoluene		< 1	< 1	< 1.0	—	< 1
Methylene chloride		1.4	< 1	50	4.0 B	< 1
Naphthalene		< 1	< 1	< 1.0	—	< 1
n-Propylbenzene		< 1	< 1	< 1.0	—	< 1
Styrene		< 1	< 1	< 1.0	—	< 1
1,1,1,2-Tetrachloroethane		< 1	< 1	< 1.0	—	< 1
1,1,2,2-Tetrachloroethane		< 1	< 1	< 1.0	< 1	< 1
Tetrachloroethene		< 1	< 1	< 1.0	< 1	< 1
Toluene		< 1	< 1	< 1.0	< 1	0.2 J
1,2,3-Trichlorobenzene		< 1	< 1	< 1.0	—	< 1
1,2,4-Trichlorobenzene		< 1	< 1	< 1.0	—	< 1
1,1,1-Trichloroethane		25.2	31.9	110	< 1	6.5
1,1,2-Trichloroethane		< 1	< 1	< 1.0	< 1	< 1
Trichloroethene		35	35	39	< 1	14.4
Trichlorofluoromethane		1.1	< 1	< 1.0	< 1	< 1
1,2,3-Trichloropropane		< 1	< 1	< 1.0	—	< 1
1,2,4-Trimethylbenzene		< 1	< 1	< 1.0	—	< 1
1,3,5-Trimethylbenzene		< 1	< 1	< 1.0	—	< 1
Vinyl chloride		< 1	< 1	< 1.0	< 1	< 1
o-Xylene		< 1	< 1	< 1.0	< 1	< 1
m/p-xylenes		< 1	< 1	< 2.0	< 1	< 1

Table 1. Historic Groundwater Quality Data, Colesville Landfill, Broome County, New York.

Constituent (ug/L)	Site ID: Date:	PW-5 12/12/95		PW-5 03/12/96		PW-5 03/19/97		PW-5 9/24/99		COL-PW06 02/05/92		
Benzene		<	1	<	1	<	1	<	1.0	<	1	
Bromobenzene		<	1	<	1	<	1	<	1.0		—	
Bromochloromethane		<	1	<	1	<	1	<	1.0		—	
Bromodichloromethane		<	1	<	1	<	1	<	1.0	<	1	
Bromoform		<	1	<	1	<	1	<	1.0	<	1	
Bromomethane		<	1	<	1	<	1	<	1.0	<	1	
n-Butylbenzene		<	1	<	1	<	1	<	1.0		--	
sec-Butylbenzene		<	1	<	1	<	1	<	1.0		—	
tert-Butylbenzene		<	1	<	1	<	1	<	1.0		—	
Carbon tetrachloride		<	1	<	1	<	1	<	1.0	<	1	
Chlorobenzene		<	1	<	1	<	1	<	1.0		24.0	J
Dibromochloromethane		<	1	<	1	<	1	<	1.0	<	1	
Chloroethane		<	1	<	1	<	1	<	1.0		61.0	
Chloroform		<	1	<	1	<	1	<	1.0		7.0	
Chloromethane		<	1	<	1	<	1	<	1.0	<	1	
2-Chlorotoluene		<	1	<	1	<	1	<	1.0		—	
4-Chlorotoluene		<	1	<	1	<	1	<	1.0		—	
1,2-Dibromo-3-chloropropane		<	1	<	1	<	1	<	1.0		—	
1,2-Dibromoethane		<	1	<	1	<	1	<	1.0		—	
Dibromomethane		<	1	<	1	<	1	<	1.0		—	
1,2-Dichlorobenzene		<	1	<	1	<	1	<	1.0	<	1	
1,3-Dichlorobenzene		<	1	<	1	<	1	<	1.0	<	1	
1,4-Dichlorobenzene		<	1	<	1	<	1	<	1.0	<	1	
Dichlorodifluoromethane		<	1	<	1	<	1	<	1.0		R	
1,1-Dichloroethane		<	1	<	1	<	1		24		R	
1,2-Dichloroethane		<	1	<	1	<	1	<	1.0		8.0	
1,1-Dichloroethene		<	1	<	1	<	1	<	1.0		4.0	
cis-1,2-Dichloroethene		<	1	<	1	<	1		88		—	
trans-1,2-Dichloroethene		<	1	<	1	<	1	<	1.0	<	1	
1,2-Dichloropropane		<	1	<	1	<	1	<	1.0	<	1	
1,3-Dichloropropane		<	1	<	1	<	1	<	1.0		—	
2,2-Dichloropropane		<	1	<	1	<	1	<	1.0		—	
1,1-Dichloropropene		<	1	<	1	<	1	<	1.0		—	
cis-1,3-Dichloropropene		<	1	<	1	<	1	<	1.0	<	1	
trans-1,3-Dichloropropene		<	1	<	1	<	1	<	1.0	<	1	
Ethylbenzene		<	1	<	1	<	1	<	1.0	<	1	
Hexachlorobutadiene		<	1	<	1	<	1	<	1.0		—	
Isopropylbenzene		<	1	<	1	<	1	<	1.0		—	
p-Isopropyltoluene		<	1	<	1	<	1	<	1.0		—	
Methylene chloride		<	1	<	1	<	1	<	1.0		14.0	B
Naphthalene		<	1	<	1	<	1	<	1.0		—	
n-Propylbenzene		<	1	<	1	<	1	<	1.0		--	
Styrene		<	1	<	1	<	1	<	1.0		—	
1,1,1,2-Tetrachloroethane		<	1	<	1	<	1	<	1.0		--	
1,1,2,2-Tetrachloroethane		<	1	<	1	<	1	<	1.0	<	1	
Tetrachloroethene		<	1	<	1	<	1	<	1.0		3.0	
Toluene		<	1	<	1	<	1	<	1.0	<	1	
1,2,3-Trichlorobenzene		<	1	<	1	<	1	<	1.0		—	
1,2,4-Trichlorobenzene		<	1	<	1	<	1	<	1.0		--	
1,1,1-Trichloroethane		<	1	<	1	<	1		4.3		R	
1,1,2-Trichloroethane		<	1	<	1	<	1	<	1.0		9.0	
Trichloroethene		<	1	<	1	<	1		66		96.0	J
Trichlorofluoromethane		<	1	<	1	<	1	<	1.0		6.0	
1,2,3-Trichloropropane		<	1	<	1	<	1	<	1.0		—	
1,2,4-Trimethylbenzene		<	1	<	1	<	1	<	1.0		—	
1,3,5-Trimethylbenzene		<	1	<	1	<	1	<	1.0		--	
Vinyl chloride		<	1	<	1	<	1	<	1.0		R	
o-Xylene		<	1	<	1	<	1	<	1.0	<	1	
m/p-xylenes		<	1	<	1	<	1	<	2.0	<	1	

ARCADIS GERAGHTY&MILLER

Table 1. Historic Groundwater Quality Data, Colesville Landfill, Broome County, New York.

Site ID: / Constituent (ug/L)	PW-6DL	PW-6	PW-6	PW-6	PW-6
Date:	02/05/92	09/13/95	12/12/95	03/11/96	03/19/97
Benzene	8.0	20.3	23.5	12.2	11.1
Bromobenzene	–	< 1	< 1	< 1	< 1
Bromochloromethane	–	< 1	< 1	< 1	< 1
Bromodichloromethane	< 5	< 1	< 1	< 1	< 1
Bromoform	< 5	< 1	< 1	< 1	< 1
Bromomethane	< 5	< 1	< 1	< 1	< 1
n-Butylbenzene	–	< 1	< 1	< 1	< 1
sec-Butylbenzene	–	0.1 J	< 1	< 1	< 1
tert-Butylbenzene	–	< 1	< 1	< 1	< 1
Carbon tetrachloride	< 5	< 1	< 1	< 1	< 1
Chlorobenzene	36.0 J	23.3	47.1	25.6	84.1
Dibromochloromethane	< 5	< 1	< 1	< 1	< 1
Chloroethane	72.0	43.7	39.9	10.7	36.6
Chloroform	11.0	< 1	1.9	< 1	0.9 J
Chloromethane	< 5	< 1	< 1	< 1	< 1
2-Chlorotoluene	–	< 1	< 1	< 1	< 1
4-Chlorotoluene	–	< 1	< 1	< 1	< 1
1,2-Dibromo-3-chloropropane	–	< 1	< 1	< 1	< 1
1,2-Dibromoethane	–	< 1	< 1	< 1	< 1
Dibromomethane	–	< 1	< 1	< 1	< 1
1,2-Dichlorobenzene	< 5	< 1	< 1	< 1	< 1
1,3-Dichlorobenzene	< 5	< 1	< 1	< 1	< 1
1,4-Dichlorobenzene	< 5	< 1	< 1	< 1	< 1
Dichlorodifluoromethane	R	6.4	33.2	< 1	< 1
1,1-Dichloroethane	R	182	141	63.7	122 D
1,2-Dichloroethane	15.0	3.0	5.6	17.1	1.7
1,1-Dichloroethene	17.0	2.9	2.2	0.2 J	1.3
cis-1,2-Dichloroethene	–	446	98.1	19.9	81.2
trans-1,2-Dichloroethene	< 5	0.7 J	1.2	< 1	0.8 J
1,2-Dichloropropane	< 5	< 1	< 1	< 1	< 1
1,3-Dichloropropane	–	< 1	< 1	< 1	< 1
2,2-Dichloropropane	–	< 1	< 1	< 1	< 1
1,1-Dichloropropene	–	< 1	< 1	< 1	< 1
cis-1,3-Dichloropropene	< 5	< 1	< 1	< 1	< 1
trans-1,3-Dichloropropene	< 5	< 1	< 1	< 1	< 1
Ethylbenzene	< 5	2.4	1.9	1.4	0.7 J
Hexachlorobutadiene	–	< 1	< 1	< 1	< 1
Isopropylbenzene	–	< 1	< 1	< 1	< 1
p-Isopropyltoluene	–	< 1	0.1 J	< 1	< 1
Methylene chloride	36.0 B	4.1	13.4	2.5	7.3
Naphthalene	–	0.2 J	< 1	< 1	< 1
n-Propylbenzene	–	< 1	< 1	0.6 J	< 1
Styrene	–	< 1	< 1	< 1	< 1
1,1,1,2-Tetrachloroethane	–	< 1	< 1	< 1	< 1
1,1,2,2-Tetrachloroethane	< 5	< 1	< 1	< 1	< 1
Tetrachloroethene	< 5	5.1	4.8	< 1	1.7
Toluene	< 5	105	58.8	130	37.3
1,2,3-Trichlorobenzene	–	< 1	< 1	< 1	< 1
1,2,4-Trichlorobenzene	–	< 1	< 1	< 1	< 1
1,1,1-Trichloroethane	R	67.1	11.8	< 1	16.0
1,1,2-Trichloroethane	23.0	4.8	3.8	1.2	2.5
Trichloroethene	257.0 J	440	201	62.4	297 D
Trichlorofluoromethane	10.0	< 1	< 1	< 1	< 1
1,2,3-Trichloropropane	–	< 1	< 1	< 1	< 1
1,2,4-Trimethylbenzene	–	< 1	< 1	< 1	< 1
1,3,5-Trimethylbenzene	–	< 1	< 1	< 1	< 1
Vinyl chloride	R	60.1	35.6	11.3	51.8
o-Xylene	< 5	7.8	3.9	2.5	1.8
m/p-xylenes	< 5	4.9	3.7	2.6	1.5

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Table 1. Historic Groundwater Quality Data, Colesville Landfill, Broome County, New York.

Constituent (ug/L) / Site ID: / Date:	PW-6 9/22/99	COL-PW07 02/05/92	PW-7 09/13/95	PW-7 12/12/95	PW-7 03/11/96
Benzene	14	7.0	15.4	5.5	3.2
Bromobenzene	< 1.0	–	< 1	< 1	< 1
Bromochloromethane	< 1.0	–	< 1	< 1	< 1
Bromodichloromethane	< 1.0	< 1	4.4	< 1	< 1
Bromoform	< 1.0	< 1	< 1	< 1	< 1
Bromomethane	< 1.0	< 1	< 1	< 1	< 1
n-Butylbenzene	< 1.0	–	21.9	0.3 J	< 1
sec-Butylbenzene	< 1.0	–	3.7	< 1	< 1
tert-Butylbenzene	< 1.0	–	< 1	< 1	< 1
Carbon tetrachloride	< 1.0	< 1	< 1	< 1	< 1
Chlorobenzene	< 1.0	26.0	52.3	16.7	5.6
Dibromochloromethane	< 1.0	< 1	< 1	< 1	< 1
Chloroethane	77	24.0	25.7	14.5	4.0
Chloroform	9.0	< 1	< 1	< 1	< 1
Chloromethane	< 1.0	< 1	< 1	< 1	< 1
2-Chlorotoluene	< 1.0	–	< 1	< 1	< 1
4-Chlorotoluene	< 1.0	–	< 1	< 1	< 1
1,2-Dibromo-3-chloropropane	< 1.0	–	< 1	< 1	< 1
1,2-Dibromoethane	< 1.0	–	< 1	< 1	< 1
Dibromomethane	< 1.0	–	< 1	< 1	< 1
1,2-Dichlorobenzene	< 1.0	< 1	0.9 J	< 1	< 1
1,3-Dichlorobenzene	< 1.0	< 1	< 1	< 1	< 1
1,4-Dichlorobenzene	< 1.0	< 1	0.5 J	< 1	< 1
Dichlorodifluoromethane	< 1.0	36.0	3.0	14.2	< 1
1,1-Dichloroethane	540	68.0	92.3	24.0	30.9
1,2-Dichloroethane	4.0	1.0	< 1	< 1	< 1
1,1-Dichloroethene	21	< 1	< 1	< 1	< 1
cis-1,2-Dichloroethene	290	–	2.7	1.2	0.8 J
trans-1,2-Dichloroethene	< 1.0	< 1	< 1	< 1	< 1
1,2-Dichloropropane	< 1.0	< 1	< 1	< 1	< 1
1,3-Dichloropropane	< 1.0	–	< 1	< 1	< 1
2,2-Dichloropropane	< 1.0	–	< 1	< 1	< 1
1,1-Dichloropropene	< 1.0	–	< 1	< 1	< 1
cis-1,3-Dichloropropene	< 1.0	< 1	< 1	< 1	< 1
trans-1,3-Dichloropropene	< 1.0	< 1	< 1	< 1	< 1
Ethylbenzene	< 1.0	100.0	918	16.8	2.4
Hexachlorobutadiene	< 1.0	–	< 1	< 1	< 1
Isopropylbenzene	< 1.0	–	29.1	0.5 J	< 1
p-Isopropyltoluene	< 1.0	–	2.6	0.2 J	< 1
Methylene chloride	33	5.0 B	1.1	0.8 J	< 1
Naphthalene	< 1.0	–	241	6.4	< 1
n-Propylbenzene	< 1.0	–	20.6	0.3 J	< 1
Styrene	< 1.0	–	< 1	< 1	< 1
1,1,1,2-Tetrachloroethane	< 1.0	–	< 1	< 1	< 1
1,1,2,2-Tetrachloroethane	< 1.0	< 1	< 1	< 1	< 1
Tetrachloroethene	< 1.0	< 1	0.2 J	< 1	< 1
Toluene	32	6.0	25.7	0.6 J	< 1
1,2,3-Trichlorobenzene	< 1.0	–	< 1	< 1	< 1
1,2,4-Trichlorobenzene	< 1.0	–	< 1	< 1	< 1
1,1,1-Trichloroethane	38	< 1	< 1	0.6 J	< 1
1,1,2-Trichloroethane	< 1.0	< 1	1.5	1.0 J	< 1
Trichloroethene	410	6.0	6.0	3.6	1.9
Trichlorofluoromethane	< 1.0	2.0	< 1	2.6	< 1
1,2,3-Trichloropropane	< 1.0	–	< 1	< 1	< 1
1,2,4-Trimethylbenzene	< 1.0	–	38.7	0.6 J	< 1
1,3,5-Trimethylbenzene	< 1.0	–	13.6	0.4 J	< 1
Vinyl chloride	120	13.0	2.4	2.9	< 1
o-Xylene	3.0	210	2830	41.3	1.0
m/p-xylenes	< 2.0	210	3520	64.6	5.9

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Table 1. Historic Groundwater Quality Data, Colesville Landfill, Broome County, New York.

Constituent (ug/L) — Site ID: / Date:	PW-7 03/19/97	PW-7 9/23/99	COL-PW08 02/05/92	COL-PW09 02/05/92	COL-PW10 02/05/92
Benzene	4.1	< 1.0	< 1	< 1	20.0
Bromobenzene	< 1	< 1.0	–	–	–
Bromochloromethane	< 1	< 1.0	–	–	–
Bromodichloromethane	< 1	< 1.0	< 1	< 1	< 1
Bromoform	< 1	< 1.0	< 1	< 1	< 1
Bromomethane	< 1	< 1.0	< 1	< 1	< 1
n-Butylbenzene	29.4	< 1.0	–	–	–
sec-Butylbenzene	1.4	< 1.0	–	–	–
tert-Butylbenzene	< 1	< 1.0	–	–	–
Carbon tetrachloride	< 1	< 1.0	< 1	< 1	< 1
Chlorobenzene	144 D	26	< 1	2.0	96.0
Dibromochloromethane	< 1	< 1.0	< 1	< 1	< 1
Chloroethane	46.4	4.0	< 1	< 1	< 1
Chloroform	0.7 J	< 1.0	< 1	< 1	< 1
Chloromethane	< 1	< 1.0	< 1	< 1	< 1
2-Chlorotoluene	< 1	< 1.0	–	–	–
4-Chlorotoluene	< 1	< 1.0	–	–	–
1,2-Dibromo-3-chloropropane	< 1	< 1.0	–	–	–
1,2-Dibromoethane	< 1	< 1.0	–	–	–
Dibromomethane	< 1	< 1.0	–	–	–
1,2-Dichlorobenzene	< 1	< 1.0	< 1	< 1	< 1
1,3-Dichlorobenzene	< 1	< 1.0	< 1	< 1	< 1
1,4-Dichlorobenzene	< 1	< 1.0	< 1	< 1	< 1
Dichlorodifluoromethane	< 1	< 1.0	< 1	< 1	< 1
1,1-Dichloroethane	158 D	89	< 1	3.0	14.0
1,2-Dichloroethane	< 1	< 1.0	< 1	< 1	< 1
1,1-Dichloroethene	< 1	< 1.0	< 1	< 1	< 1
cis-1,2-Dichloroethene	18.8	9.8	–	--	–
trans-1,2-Dichloroethene	0.7 J	< 1.0	< 1	< 1	< 1
1,2-Dichloropropane	< 1	< 1.0	< 1	< 1	< 1
1,3-Dichloropropane	< 1	< 1.0	–	–	–
2,2-Dichloropropane	< 1	< 1.0	–	–	–
1,1-Dichloropropene	< 1	< 1.0	–	--	–
cis-1,3-Dichloropropene	< 1	< 1.0	< 1	< 1	< 1
trans-1,3-Dichloropropene	< 1	< 1.0	< 1	< 1	< 1
Ethylbenzene	26.7	3.3	< 1	< 1	< 1
Hexachlorobutadiene	< 1	< 1.0	–	--	–
Isopropylbenzene	2.7	< 1.0	–	--	–
p-Isopropyltoluene	0.9 J	< 1.0	–	–	–
Methylene chloride	0.9 J	< 1.0	3.0 B	3.0 B	3.0 B
Naphthalene	100 D	< 1.0	--	–	–
n-Propylbenzene	1.2	< 1.0	–	–	–
Styrene	< 1	< 1.0	–	--	--
1,1,1,2-Tetrachloroethane	< 1	< 1.0	–	–	–
1,1,2,2-Tetrachloroethane	< 1	< 1.0	< 1	< 1	< 1
Tetrachloroethene	1.1	< 1.0	< 1	< 1	< 1
Toluene	0.7 J	< 1.0	< 1	< 1	< 1
1,2,3-Trichlorobenzene	< 1	< 1.0	–	--	–
1,2,4-Trichlorobenzene	3.1	< 1.0	–	–	–
1,1,1-Trichloroethane	15.6	56	< 1	< 1	< 1
1,1,2-Trichloroethane	1.8	< 1.0	< 1	< 1	< 1
Trichloroethene	12.7	8.0	3.0	34.0	2.0
Trichlorofluoromethane	< 1	< 1.0	< 1	< 1	< 1
1,2,3-Trichloropropane	< 1	< 1.0	–	–	–
1,2,4-Trimethylbenzene	4.2	< 1.0	–	--	--
1,3,5-Trimethylbenzene	1.7	< 1.0	–	--	--
Vinyl chloride	22.8	< 1.0	< 1	< 1	7.0
o-Xylene	1.1	< 1.0	< 1	< 1	< 1
m/p-xylenes	40.2	< 2.0	< 1	< 1	< 1

Table 1. Historic Groundwater Quality Data, Colesville Landfill, Broome County, New York.

Constituent (ug/L)	Site ID: Date:	COL-PW11 02/05/92	PW-11DL 02/05/92	COL-PW12 02/05/92	COL-PW13 02/05/92	PW-13 07/15/97
Benzene		13.0	20.0	19.0	6.0	2.2
Bromobenzene		--	--	--	--	< 1
Bromochloromethane		--	--	--	--	< 1
Bromodichloromethane		< 1	< 5	< 1	< 1	< 1
Bromoform		< 1	< 5	< 1	< 1	< 1
Bromomethane		< 1	< 5	< 1	< 1	< 1
n-Butylbenzene		--	--	--	--	< 1
sec-Butylbenzene		--	--	--	--	< 1
tert-Butylbenzene		--	--	--	--	< 1
Carbon tetrachloride		< 1	< 5	< 1	< 1	< 1
Chlorobenzene		10.0	11.0	77.0	64.0	73.2
Dibromochloromethane		< 1	< 5	< 1	< 1	< 1
Chloroethane		29.0	48.0	< 1	5.0	< 1
Chloroform		< 1	< 5	< 1	< 1	< 1
Chloromethane		< 1	< 5	< 1	< 1	< 1
2-Chlorotoluene		--	--	--	--	< 1
4-Chlorotoluene		--	--	--	--	< 1
1,2-Dibromo-3-chloropropane		--	--	--	--	< 1
1,2-Dibromoethane		--	--	--	--	< 1
Dibromomethane		--	--	--	--	< 1
1,2-Dichlorobenzene		< 1	< 5	< 1	< 1	< 1
1,3-Dichlorobenzene		< 1	< 5	< 1	< 1	< 1
1,4-Dichlorobenzene		< 1	< 5	< 1	< 1	< 1
Dichlorodifluoromethane		81.0	< 5	< 1	< 1	< 1
1,1-Dichloroethane		97.0	280.0	13.0	40.0	68.3
1,2-Dichloroethane		2.0	4.0 J	< 1	43.0	< 1
1,1-Dichloroethene		1	< 5	< 1	< 1	< 1
cis-1,2-Dichloroethene		--	--	--	--	33.1
trans-1,2-Dichloroethene		2.0	< 5	< 1	< 1	< 1
1,2-Dichloropropane		< 1	< 5	< 1	< 1	< 1
1,3-Dichloropropane		--	--	--	--	< 1
2,2-Dichloropropane		--	--	--	--	< 1
1,1-Dichloropropene		--	--	--	--	< 1
cis-1,3-Dichloropropene		< 1	< 5	< 1	< 1	< 1
trans-1,3-Dichloropropene		< 1	< 5	< 1	< 1	< 1
Ethylbenzene		< 1	< 5	< 1	< 1	< 1
Hexachlorobutadiene		--	--	--	--	< 1
Isopropylbenzene		--	--	--	--	< 1
p-Isopropyltoluene		--	--	--	--	< 1
Methylene chloride		11.0 B	26.0 B	3.0 B	5.0 B	< 1
Naphthalene		--	--	--	--	< 1
n-Propylbenzene		--	--	--	--	< 1
Styrene		--	--	--	--	< 1
1,1,1,2-Tetrachloroethane		--	--	--	--	< 1
1,1,2,2-Tetrachloroethane		< 1	< 5	< 1	< 1	< 1
Tetrachloroethene		3.0	2.0 J	< 1	< 1	< 1
Toluene		5.0	6.0	< 1	< 1	< 1
1,2,3-Trichlorobenzene		--	--	--	--	< 1
1,2,4-Trichlorobenzene		--	--	--	--	< 1
1,1,1-Trichloroethane		8.0	9.0	< 1	6.0	13.8
1,1,2-Trichloroethane		< 1	< 5	< 1	< 1	< 1
Trichloroethene		15.0	24.0	4.0	17.0	5.9
Trichlorofluoromethane		15.0	< 5	< 1	6.0	< 1
1,2,3-Trichloropropane		--	--	--	--	< 1
1,2,4-Trimethylbenzene		--	--	--	--	< 1
1,3,5-Trimethylbenzene		--	--	--	--	< 1
Vinyl chloride		40.0	34.0	< 1	17.0	8.1
o-Xylene		< 1	< 1	< 1	< 1	< 1
m/p-xylenes		< 1	< 1	< 1	< 1	< 1

ARCADIS GERAGHTY&MILLER

Table 1. Historic Groundwater Quality Data, Colesville Landfill, Broome County, New York.

Site ID: / Date:	RILEY-WELL 06/13/95	RILEY WELL 09/13/95	W-03 06/13/95	W-3 09/13/95	W-3 12/12/95
Constituent (ug/L)					
Benzene	< 1	0.5 J	< 1	< 1	< 1
Bromobenzene	< 1	< 1	< 1	< 1	< 1
Bromochloromethane	< 1	< 1	< 1	< 1	< 1
Bromodichloromethane	< 1	< 1	< 1	< 1	< 1
Bromoform	< 1	< 1	< 1	< 1	< 1
Bromomethane	< 1	< 1	< 1	< 1	< 1
n-Butylbenzene	< 1	< 1	< 1	< 1	< 1
sec-Butylbenzene	< 1	< 1	< 1	< 1	< 1
tert-Butylbenzene	< 1	< 1	< 1	< 1	< 1
Carbon tetrachloride	< 1	< 1	< 1	< 1	< 1
Chlorobenzene	< 1	< 1	< 1	< 1	< 1
Dibromochloromethane	< 1	< 1	< 1	< 1	< 1
Chloroethane	0.4 J	< 1	< 1	< 1	0.1 J
Chloroform	0.3 J	< 1	< 1	< 1	< 1
Chloromethane	< 1	< 1	< 1	< 1	< 1
2-Chlorotoluene	< 1	< 1	< 1	< 1	< 1
4-Chlorotoluene	< 1	< 1	< 1	< 1	< 1
1,2-Dibromo-3-chloropropane	< 1	< 1	< 1	< 1	< 1
1,2-Dibromoethane	< 1	< 1	< 1	< 1	< 1
Dibromomethane	< 1	< 1	< 1	< 1	< 1
1,2-Dichlorobenzene	< 1	< 1	< 1	< 1	< 1
1,3-Dichlorobenzene	< 1	< 1	< 1	< 1	< 1
1,4-Dichlorobenzene	< 1	< 1	< 1	< 1	< 1
Dichlorodifluoromethane	2.0	< 1	< 1	< 1	3.1
1,1-Dichloroethane	50.5	61.6	0.3 J	< 1	1.0
1,2-Dichloroethane	< 1	< 1	< 1	< 1	< 1
1,1-Dichloroethene	0.5 J	< 1	< 1	< 1	< 1
cis-1,2-Dichloroethene	45.3	50.2	< 1	< 1	< 1
trans-1,2-Dichloroethene	< 1	< 1	< 1	< 1	< 1
1,2-Dichloropropane	< 1	< 1	< 1	< 1	< 1
1,3-Dichloropropane	< 1	< 1	< 1	< 1	< 1
2,2-Dichloropropane	< 1	< 1	< 1	< 1	< 1
1,1-Dichloropropene	< 1	< 1	< 1	< 1	< 1
cis-1,3-Dichloropropene	< 1	< 1	< 1	< 1	< 1
trans-1,3-Dichloropropene	< 1	< 1	< 1	< 1	< 1
Ethylbenzene	< 1	< 1	< 1	< 1	< 1
Hexachlorobutadiene	< 1	< 1	< 1	< 1	< 1
Isopropylbenzene	< 1	< 1	< 1	< 1	< 1
p-Isopropyltoluene	< 1	< 1	< 1	< 1	< 1
Methylene chloride	< 1	< 1	< 1	< 1	1.8
Naphthalene	< 1	< 1	< 1	< 1	< 1
n-Propylbenzene	< 1	< 1	< 1	< 1	< 1
Styrene	< 1	< 1	< 1	< 1	< 1
1,1,1,2-Tetrachloroethane	< 1	< 1	< 1	< 1	< 1
1,1,2,2-Tetrachloroethane	< 1	< 1	< 1	< 1	< 1
Tetrachloroethene	< 1	< 1	< 1	< 1	< 1
Toluene	< 1	< 1	< 1	< 1	< 1
1,2,3-Trichlorobenzene	< 1	< 1	< 1	< 1	< 1
1,2,4-Trichlorobenzene	< 1	< 1	< 1	< 1	< 1
1,1,1-Trichloroethane	16.8	< 1	1.4	< 1	2.0
1,1,2-Trichloroethane	< 1	< 1	< 1	< 1	< 1
Trichloroethene	32.2	46.6	< 1	< 1	< 1
Trichlorofluoromethane	< 1	< 1	< 1	< 1	< 1
1,2,3-Trichloropropane	< 1	< 1	< 1	< 1	< 1
1,2,4-Trimethylbenzene	< 1	< 1	< 1	< 1	< 1
1,3,5-Trimethylbenzene	< 1	< 1	< 1	< 1	< 1
Vinyl chloride	1.2	< 1	< 1	< 1	< 1
o-Xylene	< 1	< 1	< 1	< 1	< 1
m/p-xylenes	< 1	< 1	< 1	< 1	< 1

ARCADIS GERAGHTY&MILLER

Table 1. Historic Groundwater Quality Data, Colesville Landfill, Broome County, New York.

Constituent (ug/L)	Site ID: W-3 Date: 03/11/96	W-3 03/19/97	W-3 9/24/99	W-04 06/13/95	W-05 06/13/95
Benzene	< 1	< 1	< 1.0	0.8 J	14.4
Bromobenzene	< 1	< 1	< 1.0	< 1	< 1
Bromochloromethane	< 1	< 1	< 1.0	< 1	< 1
Bromodichloromethane	< 1	< 1	< 1.0	< 1	< 1
Bromoform	< 1	< 1	< 1.0	< 1	< 1
Bromomethane	< 1	< 1	< 1.0	< 1	< 1
n-Butylbenzene	< 1	< 1	< 1.0	< 1	< 1
sec-Butylbenzene	< 1	< 1	< 1.0	< 1	0.8 J
tert-Butylbenzene	< 1	< 1	< 1.0	< 1	< 1
Carbon tetrachloride	< 1	< 1	< 1.0	< 1	< 1
Chlorobenzene	< 1	< 1	< 1.0	9.3	24.3
Dibromochloromethane	< 1	< 1	< 1.0	< 1	< 1
Chloroethane	< 1	< 1	< 1.0	0.6 J	53.6
Chloroform	< 1	< 1	< 1.0	0.4 J	0.4 J
Chloromethane	< 1	< 1	< 1.0	< 1	< 1
2-Chlorotoluene	< 1	< 1	< 1.0	< 1	< 1
4-Chlorotoluene	< 1	< 1	< 1.0	< 1	< 1
1,2-Dibromo-3-chloropropane	< 1	< 1	< 1.0	< 1	< 1
1,2-Dibromoethane	< 1	< 1	< 1.0	< 1	< 1
Dibromomethane	< 1	< 1	< 1.0	< 1	< 1
1,2-Dichlorobenzene	< 1	< 1	< 1.0	< 1	< 1
1,3-Dichlorobenzene	< 1	< 1	< 1.0	< 1	< 1
1,4-Dichlorobenzene	< 1	< 1	< 1.0	< 1	< 1
Dichlorodifluoromethane	< 1	< 1	< 1.0	< 1	15.0
1,1-Dichloroethane	< 1	1.0	4.3	36	87.1
1,2-Dichloroethane	3.5	< 1	< 1.0	< 1	< 1
1,1-Dichloroethene	< 1	< 1	< 1.0	< 1	< 1
cis-1,2-Dichloroethene	< 1	< 1	< 1.0	5.1	10.0
trans-1,2-Dichloroethene	< 1	< 1	< 1.0	< 1	0.7 J
1,2-Dichloropropane	< 1	< 1	< 1.0	< 1	< 1
1,3-Dichloropropane	< 1	< 1	< 1.0	< 1	< 1
2,2-Dichloropropane	< 1	< 1	< 1.0	< 1	< 1
1,1-Dichloropropene	< 1	< 1	< 1.0	< 1	< 1
cis-1,3-Dichloropropene	< 1	< 1	< 1.0	< 1	< 1
trans-1,3-Dichloropropene	< 1	< 1	< 1.0	< 1	< 1
Ethylbenzene	< 1	< 1	< 1.0	< 1	0.5 J
Hexachlorobutadiene	< 1	< 1	< 1.0	< 1	< 1
Isopropylbenzene	< 1	< 1	< 1.0	< 1	0.2 J
p-Isopropyltoluene	< 1	< 1	< 1.0	< 1	< 1
Methylene chloride	0.6 J	< 1	< 1.0	0.1 J	2.4
Naphthalene	< 1	< 1	< 1.0	< 1	< 1
n-Propylbenzene	0.7 J	< 1	< 1.0	< 1	< 1
Styrene	< 1	< 1	< 1.0	< 1	< 1
1,1,1,2-Tetrachloroethane	< 1	< 1	< 1.0	< 1	< 1
1,1,2,2-Tetrachloroethane	< 1	< 1	< 1.0	< 1	< 1
Tetrachloroethene	< 1	< 1	< 1.0	0.3 J	0.2 J
Toluene	< 1	< 1	< 1.0	< 1	161
1,2,3-Trichlorobenzene	< 1	< 1	< 1.0	< 1	< 1
1,2,4-Trichlorobenzene	< 1	< 1	< 1.0	< 1	< 1
1,1,1-Trichloroethane	< 1	2.0	5.6	3.4	4.3
1,1,2-Trichloroethane	< 1	< 1	< 1.0	< 1	< 1
Trichloroethene	< 1	< 1	< 1.0	16.8	7.5
Trichlorofluoromethane	< 1	< 1	< 1.0	< 1	< 1
1,2,3-Trichloropropane	< 1	< 1	< 1.0	< 1	< 1
1,2,4-Trimethylbenzene	< 1	< 1	< 1.0	< 1	< 1
1,3,5-Trimethylbenzene	< 1	< 1	< 1.0	< 1	0.2 J
Vinyl chloride	< 1	< 1	< 1.0	1.4	4.4
o-Xylene	< 1	< 1	< 1.0	< 1	2.8
m/p-xylenes	< 1	< 1	< 2.0	< 1	1.2

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Table 1. Historic Groundwater Quality Data, Colesville Landfill, Broome County, New York.

Constituent (ug/L)	Site ID: Date:	W-5 09/13/95	W-5 12/12/95	W-5 03/11/96	W-5 06/25/96	W-5 03/19/97
Benzene		14.0	12.6	16.1	9.9	15
Bromobenzene		< 1	< 1	< 1	< 1	< 1
Bromochloromethane		< 1	< 1	< 1	< 1	< 1
Bromodichloromethane		< 1	< 1	< 1	< 1	< 1
Bromoform		< 1	< 1	< 1	< 1	< 1
Bromomethane		< 1	< 1	< 1	< 1	< 1
n-Butylbenzene		< 1	< 1	< 1	< 1	< 1
sec-Butylbenzene		1.4	0.2 J	< 1	< 1	< 1
tert-Butylbenzene		< 1	< 1	< 1	< 1	< 1
Carbon tetrachloride		< 1	< 1	< 1	< 1	< 1
Chlorobenzene		2.9	11.8	22.6	8.8	17.9
Dibromochloromethane		< 1	< 1	< 1	< 1	< 1
Chloroethane		< 1	72.4	77.1	64.1	70.8
Chloroform		< 1	0.5 J	< 1	< 1	< 1
Chloromethane		< 1	6.8	< 1	< 1	< 1
2-Chlorotoluene		< 1	< 1	< 1	< 1	< 1
4-Chlorotoluene		< 1	< 1	< 1	< 1	< 1
1,2-Dibromo-3-chloropropane		< 1	< 1	< 1	< 1	< 1
1,2-Dibromoethane		< 1	< 1	< 1	< 1	< 1
Dibromomethane		< 1	< 1	< 1	< 1	< 1
1,2-Dichlorobenzene		< 1	< 1	< 1	< 1	< 1
1,3-Dichlorobenzene		< 1	< 1	< 1	< 1	< 1
1,4-Dichlorobenzene		< 1	< 1	< 1	< 1	< 1
Dichlorodifluoromethane		< 1	33.9	5.0	< 1	< 1
1,1-Dichloroethane		53.6	32.0	23.5	28.1	40.3
1,2-Dichloroethane		< 1	1.2	< 1	< 1	< 1
1,1-Dichloroethene		< 1	1.2	< 1	< 1	0.8 J
cis-1,2-Dichloroethene		10.5	10.6	8.4	4.7	7.5
trans-1,2-Dichloroethene		< 1	0.5 J	< 1	< 1	0.6 J
1,2-Dichloropropane		< 1	< 1	< 1	< 1	< 1
1,3-Dichloropropane		< 1	< 1	< 1	< 1	< 1
2,2-Dichloropropane		< 1	< 1	< 1	< 1	< 1
1,1-Dichloropropene		< 1	< 1	< 1	< 1	< 1
cis-1,3-Dichloropropene		< 1	< 1	< 1	< 1	< 1
trans-1,3-Dichloropropene		< 1	< 1	< 1	< 1	< 1
Ethylbenzene		1.1	1.2	0.6 J	< 1	1.0
Hexachlorobutadiene		< 1	< 1	< 1	< 1	< 1
Isopropylbenzene		< 1	0.6 J	0.1 J	< 1	< 1
p-Isopropyltoluene		< 1	0.1 J	< 1	< 1	< 1
Methylene chloride		4.4	4.5	< 1	2.8	1.1
Naphthalene		< 1	< 0.2	< 1	< 1	< 1
n-Propylbenzene		< 1	< 1	< 1	< 1	< 1
Styrene		< 1	< 1	< 1	< 1	< 1
1,1,1,2-Tetrachloroethane		< 1	12.8	< 1	< 1	< 1
1,1,2,2-Tetrachloroethane		< 1	< 1	< 1	< 1	< 1
Tetrachloroethene		< 1	0.1 J	< 1	< 1	< 1
Toluene		101	63.7	68.2	60.8	30.9
1,2,3-Trichlorobenzene		< 1	< 1	< 1	< 1	< 1
1,2,4-Trichlorobenzene		< 1	< 1	< 1	< 1	< 1
1,1,1-Trichloroethane		2.4	5.6	1.0	2	9.4
1,1,2-Trichloroethane		< 1	< 1	< 1	< 1	< 1
Trichloroethene		7.9	9.6	3.6	< 1	15.2
Trichlorofluoromethane		< 1	< 1	< 1	< 1	< 1
1,2,3-Trichloropropane		< 1	< 1	< 1	< 1	< 1
1,2,4-Trimethylbenzene		< 1	0.1 J	< 1	< 1	< 1
1,3,5-Trimethylbenzene		< 1	0.1 J	0.1 J	< 1	< 1
Vinyl chloride		< 1	7.1	3.1	2.5	9.0
o-Xylene		4.6	4.4	2.3	2.1	2.9
m/p-xylenes		2.9	2.6	2.2	2.4	2.6

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Table 1. Historic Groundwater Quality Data, Colesville Landfill, Broome County, New York.

Constituent (ug/L)	Site ID: W-5 Date: 07/16/97	W-5 9/22/99	W-06 06/13/95	W-6 09/13/95	W-6 12/12/95
Benzene	52.1	20	30.6	24.1	22.1
Bromobenzene	< 1	< 1.0	< 1	< 1	< 1
Bromochloromethane	< 1	< 1.0	< 1	< 1	< 1
Bromodichloromethane	< 1	< 1.0	< 1	< 1	< 1
Bromoform	< 1	< 1.0	< 1	< 1	< 1
Bromomethane	< 1	< 1.0	< 1	< 1	< 1
n-Butylbenzene	< 1	< 1.0	< 1	< 1	< 1
sec-Butylbenzene	< 1	< 1.0	0.5 J	0.3 J	0.2 J
tert-Butylbenzene	< 1	< 1.0	< 1	< 1	0.2 J
Carbon tetrachloride	< 1	< 1.0	< 1	< 1	< 1
Chlorobenzene	< 1	48	46.2	37.5	50.2
Dibromochloromethane	< 1	< 1.0	< 1	< 1	< 1
Chloroethane	152	260	9.3	1.7	18.1
Chloroform	< 1	< 1.0	0.3 J	< 1	< 1
Chloromethane	< 1	11	23.2	3.7	21.4
2-Chlorotoluene	< 1	< 1.0	< 1	< 1	< 1
4-Chlorotoluene	< 1	< 1.0	< 1	< 1	< 1
1,2-Dibromo-3-chloropropane	< 1	< 1.0	< 1	< 1	< 1
1,2-Dibromoethane	< 1	< 1.0	< 1	< 1	< 1
Dibromomethane	< 1	< 1.0	< 1	< 1	< 1
1,2-Dichlorobenzene	< 1	< 1.0	< 1	< 1	< 1
1,3-Dichlorobenzene	< 1	< 1.0	< 1	< 1	< 1
1,4-Dichlorobenzene	< 1	< 1.0	< 1	< 1	< 1
Dichlorodifluoromethane	< 1	< 1.0	11.4	5.3	55.0
1,1-Dichloroethane	< 1	58	25.0	10.4	6.9
1,2-Dichloroethane	< 1	< 1.0	1.1	< 1	1.3
1,1-Dichloroethene	< 1	< 1.0	< 1	< 1	< 1
cis-1,2-Dichloroethene	< 1	< 1.0	3.5	1.8	2.2
trans-1,2-Dichloroethene	< 1	< 1.0	< 1	< 1	< 1
1,2-Dichloropropane	< 1	< 1.0	1.1	< 1	< 1
1,3-Dichloropropane	< 1	< 1.0	< 1	< 1	< 1
2,2-Dichloropropane	< 1	< 1.0	< 1	< 1	< 1
1,1-Dichloropropene	< 1	< 1.0	< 1	< 1	< 1
cis-1,3-Dichloropropene	< 1	< 1.0	< 1	< 1	< 1
trans-1,3-Dichloropropene	< 1	< 1.0	< 1	< 1	< 1
Ethylbenzene	< 1	5.7	23.2	27.2	40.2
Hexachlorobutadiene	< 1	< 1.0	< 1	< 1	< 1
Isopropylbenzene	< 1	< 1.0	0.6 J	0.6 J	0.9 J
p-Isopropyltoluene	< 1	< 1.0	0.1 J	0.1 J	0.4 J
Methylene chloride	< 1	8.3	0.8 J	< 1	0.9 J
Naphthalene	< 1	< 1.0	< 1	0.2 J	0.4 J
n-Propylbenzene	< 1	< 1.0	< 1	0.2 J	0.3 J
Styrene	< 1	< 1.0	< 1	< 1	< 1
1,1,1,2-Tetrachloroethane	< 1	< 1.0	< 1	< 1	< 1
1,1,2,2-Tetrachloroethane	< 1	< 1.0	< 1	< 1	< 1
Tetrachloroethene	< 1	< 1.0	< 1	0.2 J	0.1 J
Toluene	76.3	30	154	282	273
1,2,3-Trichlorobenzene	< 1	< 1.0	< 1	< 1	< 1
1,2,4-Trichlorobenzene	99	< 1.0	< 1	< 1	< 1
1,1,1-Trichloroethane	< 1	1.7	0.4 J	< 1	< 1
1,1,2-Trichloroethane	< 1	76	< 1	< 1	< 1
Trichloroethene	< 1	1.9	4.6	1.4	1.6
Trichlorofluoromethane	< 1	< 1.0	< 1	< 1	< 1
1,2,3-Trichloropropane	< 1	< 1.0	< 1	< 1	< 1
1,2,4-Trimethylbenzene	< 1	< 1.0	1.5	0.9 J	2.8
1,3,5-Trimethylbenzene	< 1	< 1.0	0.6 J	0.7 J	1.5
Vinyl chloride	< 1	3.1	2.5	0.7 J	4.0
o-Xylene	< 1	4.2	26.2	30.9	38.6
m/p-xylenes	< 1	7.4	70.0	82.7	132

Table 1. Historic Groundwater Quality Data, Colesville Landfill, Broome County, New York.

Constituent (ug/L)	Site ID: W-6 Date: 03/11/96	W-6 03/19/97	W-6 9/23/99	W-07 06/13/95	W-7 09/13/95
Benzene	19.9	9.7	21	10.0	11.3
Bromobenzene	< 1	< 1	< 1.0	< 1	< 1
Bromochloromethane	< 1	< 1	< 1.0	< 1	< 1
Bromodichloromethane	< 1	< 1	< 1.0	< 1	< 1
Bromoform	< 1	< 1	< 1.0	< 1	< 1
Bromomethane	< 1	< 1	< 1.0	< 1	< 1
n-Butylbenzene	0.2 J	< 1	< 1.0	< 1	< 1
sec-Butylbenzene	0.9 J	< 1	< 1.0	< 1	< 1
tert-Butylbenzene	0.2 J	< 1	< 1.0	< 1	< 1
Carbon tetrachloride	< 1	< 1	< 1.0	< 1	< 1
Chlorobenzene	38.7	12.7	< 1.0	10.0	8.8
Dibromochloromethane	< 1	< 1	< 1.0	< 1	< 1
Chloroethane	4.4	19.0	< 1.0	14.4	7.1
Chloroform	< 1	< 1	< 1.0	< 1	< 1
Chloromethane	12.4	< 1	< 1.0	< 1	1.3
2-Chlorotoluene	< 1	< 1	< 1.0	< 1	< 1
4-Chlorotoluene	< 1	< 1	< 1.0	< 1	< 1
1,2-Dibromo-3-chloropropane	< 1	< 1	< 1.0	< 1	< 1
1,2-Dibromoethane	< 1	< 1	< 1.0	< 1	< 1
Dibromomethane	< 1	< 1	< 1.0	< 1	< 1
1,2-Dichlorobenzene	< 1	< 1	< 1.0	< 1	< 1
1,3-Dichlorobenzene	< 1	< 1	< 1.0	< 1	< 1
1,4-Dichlorobenzene	< 1	< 1	< 1.0	< 1	< 1
Dichlorodifluoromethane	17.9	< 1	< 1.0	< 1	4.3
1,1-Dichloroethane	19.7	33.2	70	7.8	6.4
1,2-Dichloroethane	< 1	< 1	< 1.0	< 1	< 1
1,1-Dichloroethene	< 1	< 1	< 1.0	< 1	< 1
cis-1,2-Dichloroethene	1.3	7.4	< 1.0	1.5	0.9 J
trans-1,2-Dichloroethene	< 1	< 1	< 1.0	< 1	< 1
1,2-Dichloropropane	< 1	< 1	< 1.0	0.2 J	< 1
1,3-Dichloropropane	< 1	< 1	< 1.0	< 1	< 1
2,2-Dichloropropane	< 1	< 1	< 1.0	< 1	< 1
1,1-Dichloropropene	< 1	< 1	< 1.0	< 1	< 1
cis-1,3-Dichloropropene	< 1	< 1	< 1.0	< 1	< 1
trans-1,3-Dichloropropene	< 1	< 1	< 1.0	< 1	< 1
Ethylbenzene	35.8	1.9	9.9	< 1	< 1
Hexachlorobutadiene	< 1	< 1	< 1.0	< 1	< 1
Isopropylbenzene	0.7 J	< 1	< 1.0	< 1	< 1
p-Isopropyltoluene	0.2 J	< 1	< 1.0	< 1	< 1
Methylene chloride	0.4 J	< 1	< 1.0	0.7 J	0.3 J
Naphthalene	0.3 J	< 1	< 1.0	< 1	< 1
n-Propylbenzene	< 1	< 1	< 1.0	< 1	< 1
Styrene	< 1	< 1	< 1.0	< 1	< 1
1,1,1,2-Tetrachloroethane	< 1	< 1	< 1.0	< 1	< 1
1,1,2,2-Tetrachloroethane	< 1	< 1	< 1.0	< 1	< 1
Tetrachloroethene	< 1	< 1	< 1.0	< 1	< 1
Toluene	82.7	0.8 J	< 1.0	0.5 J	< 1
1,2,3-Trichlorobenzene	< 1	< 1	< 1.0	< 1	< 1
1,2,4-Trichlorobenzene	< 1	< 1	< 1.0	< 1	< 1
1,1,1-Trichloroethane	< 1	< 1	< 1.0	0.3 J	< 1
1,1,2-Trichloroethane	< 1	< 1	< 1.0	< 1	< 1
Trichloroethene	1.4	3.9	6.4	3.3 J	2.5
Trichlorofluoromethane	< 1	< 1	< 1.0	< 1	< 1
1,2,3-Trichloropropane	< 1	< 1	< 1.0	< 1	< 1
1,2,4-Trimethylbenzene	3.2	< 1	< 1.0	< 1	< 1
1,3,5-Trimethylbenzene	1.0	< 1	< 1.0	< 1	< 1
Vinyl chloride	0.3 J	6.2	< 1.0	< 1	0.4 J
o-Xylene	24.8	1.5	< 1.0	< 1	< 1
m/p-xylenes	117	4.1	18	0.3 J	< 1

Table 1. Historic Groundwater Quality Data, Colesville Landfill, Broome County, New York.

Site ID: / Date:	W-7 12/12/95	W-7 03/11/96	W-7 06/26/96	W-7 03/19/97	W-7 07/16/97
Constituent (ug/L)					
Benzene	8.8	4.6	< 1	3.6	3.5
Bromobenzene	< 1	< 1	< 1	< 1	< 1
Bromochloromethane	< 1	< 1	< 1	< 1	< 1
Bromodichloromethane	< 1	< 1	< 1	< 1	< 1
Bromoform	< 1	< 1	< 1	< 1	< 1
Bromomethane	< 1	< 1	< 1	< 1	< 1
n-Butylbenzene	< 1	< 1	< 1	< 1	< 1
sec-Butylbenzene	< 1	< 1	< 1	< 1	< 1
tert-Butylbenzene	< 1	< 1	< 1	< 1	< 1
Carbon tetrachloride	< 1	< 1	< 1	< 1	< 1
Chlorobenzene	10.6	7.0	8.7	29.1	26.9
Dibromochloromethane	< 1	< 1	6.2	< 1	< 1
Chloroethane	13.5	3.2	< 1	15.6	6
Chloroform	< 1	< 1	< 1	< 1	< 1
Chloromethane	3.1	< 1	< 1	< 1	9.6
2-Chlorotoluene	< 1	< 1	< 1	< 1	< 1
4-Chlorotoluene	< 1	< 1	< 1	< 1	< 1
1,2-Dibromo-3-chloropropane	< 1	< 1	< 1	< 1	< 1
1,2-Dibromoethane	< 1	< 1	< 1	< 1	< 1
Dibromomethane	< 1	< 1	< 1	< 1	< 1
1,2-Dichlorobenzene	< 1	< 1	< 1	< 1	< 1
1,3-Dichlorobenzene	< 1	< 1	< 1	< 1	< 1
1,4-Dichlorobenzene	< 1	< 1	< 1	< 1	< 1
Dichlorodifluoromethane	26.1	< 1	< 1	< 1	9.7
1,1-Dichloroethane	4.8	3.6	8.3	8.9	9.3
1,2-Dichloroethane	< 1	< 1	< 1	< 1	< 1
1,1-Dichloroethene	< 1	< 1	< 1	< 1	< 1
cis-1,2-Dichloroethene	1.1	< 1	< 1	2.7	3.1
trans-1,2-Dichloroethene	< 1	< 1	< 1	< 1	< 1
1,2-Dichloropropane	< 1	< 1	< 1	< 1	< 1
1,3-Dichloropropane	< 1	< 1	< 1	< 1	< 1
2,2-Dichloropropane	< 1	< 1	< 1	< 1	< 1
1,1-Dichloropropene	< 1	< 1	< 1	< 1	< 1
cis-1,3-Dichloropropene	< 1	< 1	< 1	< 1	< 1
trans-1,3-Dichloropropene	< 1	< 1	< 1	< 1	< 1
Ethylbenzene	0.3 J	< 1	< 1	< 1	< 1
Hexachlorobutadiene	< 1	< 1	< 1	< 1	< 1
Isopropylbenzene	0.1 J	< 1	< 1	< 1	< 1
p-Isopropyltoluene	< 1	< 1	< 1	< 1	< 1
Methylene chloride	0.4 J	< 1	< 1	< 1	< 1
Naphthalene	0.2 J	< 1	< 1	< 1	< 1
n-Propylbenzene	< 1	< 1	< 1	< 1	< 1
Styrene	< 1	< 1	< 1	< 1	< 1
1,1,1,2-Tetrachloroethane	< 1	< 1	< 1	< 1	< 1
1,1,2,2-Tetrachloroethane	< 1	< 1	< 1	< 1	< 1
Tetrachloroethene	0.1 J	< 1	< 1	< 1	< 1
Toluene	0.9 J	< 1	< 1	< 1	< 1
1,2,3-Trichlorobenzene	< 1	< 1	< 1	< 1	< 1
1,2,4-Trichlorobenzene	< 1	< 1	< 1	< 1	< 1
1,1,1-Trichloroethane	0.4 J	< 1	< 1	< 1	< 1
1,1,2-Trichloroethane	< 1	< 1	< 1	< 1	< 1
Trichloroethene	3.3	1.6	< 1	2.1	2
Trichlorofluoromethane	1.4	< 1	< 1	0.9 J	3.1
1,2,3-Trichloropropane	< 1	< 1	< 1	< 1	< 1
1,2,4-Trimethylbenzene	< 1	< 1	< 1	< 1	< 1
1,3,5-Trimethylbenzene	< 1	< 1	< 1	< 1	< 1
Vinyl chloride	2.9	< 1	< 1	4.6	3.5
o-Xylene	0.3 J	< 1	< 1	< 1	< 1
m/p-xylenes	0.7 J	< 1	< 1	< 1	< 1

Table 1. Historic Groundwater Quality Data, Colesville Landfill, Broome County, New York.

Constituent (ug/L)	Site ID: / Date:	W-7 9/23/99	W-10 06/13/95	W-10 06/25/96	W-10 07/16/97	W-13 06/13/95
Benzene		2.5	< 1	< 1	< 1	< 1
Bromobenzene		< 1.0	< 1	< 1	< 1	< 1
Bromochloromethane		< 1.0	< 1	< 1	< 1	< 1
Bromodichloromethane		< 1.0	< 1	< 1	< 1	< 1
Bromoform		< 1.0	< 1	< 1	< 1	< 1
Bromomethane		< 1.0	< 1	< 1	< 1	< 1
n-Butylbenzene		< 1.0	< 1	< 1	< 1	< 1
sec-Butylbenzene		< 1.0	< 1	< 1	< 1	< 1
tert-Butylbenzene		< 1.0	< 1	< 1	< 1	< 1
Carbon tetrachloride		< 1.0	< 1	< 1	< 1	< 1
Chlorobenzene		26	< 1	< 1	< 1	< 1
Dibromochloromethane		< 1.0	< 1	< 1	< 1	< 1
Chloroethane		< 1.0	1.0	< 1	< 1	< 1
Chloroform		< 1.0	0.2 J	< 1	< 1	< 1
Chloromethane		< 1.0	11.3	< 1	7.6	< 1
2-Chlorotoluene		< 1.0	< 1	< 1	< 1	< 1
4-Chlorotoluene		< 1.0	< 1	< 1	< 1	< 1
1,2-Dibromo-3-chloropropane		< 1.0	< 1	< 1	< 1	< 1
1,2-Dibromoethane		< 1.0	< 1	< 1	< 1	< 1
Dibromomethane		< 1.0	< 1	< 1	< 1	< 1
1,2-Dichlorobenzene		< 1.0	< 1	< 1	< 1	< 1
1,3-Dichlorobenzene		< 1.0	< 1	< 1	< 1	< 1
1,4-Dichlorobenzene		< 1.0	< 1	< 1	< 1	< 1
Dichlorodifluoromethane		< 1.0	25.9	< 1	9.1	< 1
1,1-Dichloroethane		8.7	17.2	12.8	9.8	< 1
1,2-Dichloroethane		< 1.0	< 1	< 1	< 1	< 1
1,1-Dichloroethene		< 1.0	1.5 J	< 1	< 1	< 1
cis-1,2-Dichloroethene		< 1.0	< 1	< 1	< 1	< 1
trans-1,2-Dichloroethene		< 1.0	< 1	< 1	< 1	< 1
1,2-Dichloropropane		< 1.0	< 1	< 1	< 1	< 1
1,3-Dichloropropane		< 1.0	< 1	< 1	< 1	< 1
2,2-Dichloropropane		< 1.0	< 1	< 1	< 1	< 1
1,1-Dichloropropene		< 1.0	< 1	< 1	< 1	< 1
cis-1,3-Dichloropropene		< 1.0	< 1	< 1	< 1	< 1
trans-1,3-Dichloropropene		< 1.0	< 1	< 1	< 1	< 1
Ethylbenzene		3.0	< 1	< 1	< 1	< 1
Hexachlorobutadiene		< 1.0	< 1	< 1	< 1	< 1
Isopropylbenzene		< 1.0	< 1	< 1	< 1	< 1
p-Isopropyltoluene		< 1.0	< 1	< 1	< 1	< 1
Methylene chloride		< 1.0	3.9	< 1	< 1	< 1
Naphthalene		< 1.0	< 1	< 1	< 1	< 1
n-Propylbenzene		< 1.0	< 1	< 1	< 1	< 1
Styrene		< 1.0	< 1	< 1	< 1	< 1
1,1,1,2-Tetrachloroethane		< 1.0	< 1	< 1	< 1	< 1
1,1,2,2-Tetrachloroethane		< 1.0	< 1	< 1	< 1	< 1
Tetrachloroethene		< 1.0	< 1	< 1	< 1	< 1
Toluene		< 1.0	< 1	< 1	3.2	< 1
1,2,3-Trichlorobenzene		< 1.0	< 1	< 1	< 1	< 1
1,2,4-Trichlorobenzene		< 1.0	< 1	< 1	< 1	< 1
1,1,1-Trichloroethane		< 1.0	61.4	30.9	17	< 1
1,1,2-Trichloroethane		< 1.0	< 1	< 1	< 1	< 1
Trichloroethene		< 1.0	< 1	< 1	< 1	< 1
Trichlorofluoromethane		< 1.0	1.7	< 1	< 1	< 1
1,2,3-Trichloropropane		< 1.0	< 1	< 1	< 1	< 1
1,2,4-Trimethylbenzene		< 1.0	< 1	< 1	< 1	< 1
1,3,5-Trimethylbenzene		< 1.0	< 1	< 1	< 1	< 1
Vinyl chloride		< 1.0	9.2	< 1	3.7	< 1
o-Xylene		< 1.0	< 1	< 1	< 1	< 1
m/p-xylenes		< 2.0	< 1	< 1	< 1	< 1

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Table 1. Historic Groundwater Quality Data, Colesville Landfill, Broome County, New York.

Constituent (ug/L)	Site ID: Date:	W-13 06/25/96	W-14S 06/27/96	W-14S 07/17/97	W-16S 06/13/95	W-16S 09/13/95
Benzene		< 1	< 1	< 1	16.7	20.9
Bromobenzene		< 1	< 1	< 1	< 1	< 1
Bromochloromethane		< 1	< 1	< 1	< 1	< 1
Bromodichloromethane		< 1	< 1	< 1	< 1	< 1
Bromoform		< 1	< 1	< 1	< 1	< 1
Bromomethane		< 1	< 1	< 1	< 1	< 1
n-Butylbenzene		< 1	< 1	< 1	< 1	< 1
sec-Butylbenzene		< 1	< 1	< 1	< 1	< 1
tert-Butylbenzene		< 1	< 1	< 1	< 1	< 1
Carbon tetrachloride		< 1	< 1	< 1	< 1	< 1
Chlorobenzene		15.7	< 1	< 1	58.9	69.1
Dibromochloromethane		< 1	< 1	< 1	< 1	< 1
Chloroethane		11.5	< 1	< 1	6.1	< 1
Chloroform		1.1	< 1	< 1	0.2 J	< 1
Chloromethane		4.7	< 1	< 1	18.8	7.0
2-Chlorotoluene		< 1	< 1	< 1	< 1	< 1
4-Chlorotoluene		< 1	< 1	< 1	< 1	< 1
1,2-Dibromo-3-chloropropane		< 1	< 1	< 1	< 1	< 1
1,2-Dibromoethane		< 1	< 1	< 1	< 1	< 1
Dibromomethane		< 1	< 1	< 1	< 1	< 1
1,2-Dichlorobenzene		< 1	< 1	< 1	< 1	< 1
1,3-Dichlorobenzene		< 1	< 1	< 1	< 1	< 1
1,4-Dichlorobenzene		< 1	< 1	< 1	< 1	< 1
Dichlorodifluoromethane		5.8	< 1	< 1	11.1	13.1
1,1-Dichloroethane		83.4	< 1	< 1	27.4	34.5
1,2-Dichloroethane		7.5	< 1	< 1	0.6 J	0.6 J
1,1-Dichloroethene		< 1	< 1	< 1	< 1	< 1
cis-1,2-Dichloroethene		45.6	< 1	< 1	1.5	2.4
trans-1,2-Dichloroethene		< 1	< 1	< 1	< 1	< 1
1,2-Dichloropropane		< 1	< 1	< 1	< 1	< 1
1,3-Dichloropropane		< 1	< 1	< 1	< 1	< 1
2,2-Dichloropropane		< 1	< 1	< 1	< 1	< 1
1,1-Dichloropropene		< 1	< 1	< 1	< 1	< 1
cis-1,3-Dichloropropene		< 1	< 1	< 1	< 1	< 1
trans-1,3-Dichloropropene		< 1	< 1	< 1	< 1	< 1
Ethylbenzene		< 1	< 1	< 1	< 1	< 1
Hexachlorobutadiene		< 1	< 1	< 1	< 1	< 1
Isopropylbenzene		< 1	< 1	< 1	0.5 J	0.5 J
p-Isopropyltoluene		< 1	< 1	< 1	< 1	< 1
Methylene chloride		5.7	< 1	< 1	1.8	1.5
Naphthalene		< 1	< 1	< 1	< 1	0.2 J
n-Propylbenzene		< 1	< 1	< 1	< 1	< 1
Styrene		< 1	< 1	< 1	< 1	< 1
1,1,1,2-Tetrachloroethane		< 1	< 1	< 1	< 1	< 1
1,1,2,2-Tetrachloroethane		< 1	< 1	< 1	< 1	< 1
Tetrachloroethene		< 1	< 1	< 1	0.2 J	< 1
Toluene		< 1	< 1	< 1	0.1 J	1.0
1,2,3-Trichlorobenzene		< 1	< 1	< 1	< 1	< 1
1,2,4-Trichlorobenzene		< 1	< 1	< 1	< 1	< 1
1,1,1-Trichloroethane		30.4	< 1	< 1	0.4 J	0.5 J
1,1,2-Trichloroethane		< 1	< 1	< 1	< 1	< 1
Trichloroethene		< 1	< 1	< 1	4.4	7.7
Trichlorofluoromethane		1.2	< 1	< 1	< 1	< 1
1,2,3-Trichloropropane		< 1	< 1	< 1	< 1	< 1
1,2,4-Trimethylbenzene		< 1	< 1	< 1	< 1	< 1
1,3,5-Trimethylbenzene		< 1	< 1	< 1	< 1	0.4 J
Vinyl chloride		18.2	< 1	< 1	2.2	< 1
o-Xylene		< 1	< 1	< 1	< 1	< 1
m/p-xylenes		< 1	< 1	< 1	< 1	< 1

Table 1. Historic Groundwater Quality Data, Colesville Landfill, Broome County, New York.

Site ID: / Date: / Constituent (ug/L)	W-16S 12/12/95	W-16S 03/12/96	W-16S 06/26/96	W-16S 03/19/97	W-16S 07/16/97
Benzene	22.2	15.7	19.4	10.0	16.3
Bromobenzene	< 1	< 1	< 1	< 1	< 1
Bromochloromethane	< 1	< 1	< 1	< 1	< 1
Bromodichloromethane	< 1	< 1	< 1	< 1	< 1
Bromoform	< 1	< 1	< 1	< 1	< 1
Bromomethane	< 1	< 1	< 1	< 1	< 1
n-Butylbenzene	0.1 J	0.5 J	< 1	< 1	< 1
sec-Butylbenzene	< 1	< 1	< 1	< 1	< 1
tert-Butylbenzene	< 1	< 1	< 1	< 1	< 1
Carbon tetrachloride	< 1	< 1	< 1	< 1	< 1
Chlorobenzene	46.8	85.8	43.5	97.8	108
Dibromochloromethane	< 1	< 1	< 1	< 1	< 1
Chloroethane	16.7	< 1	3.8	6.3	9.8
Chloroform	< 1	< 1	< 1	< 1	< 1
Chloromethane	10.1	< 1	10.2	< 1	9.8
2-Chlorotoluene	< 1	< 1	< 1	< 1	< 1
4-Chlorotoluene	< 1	< 1	< 1	< 1	< 1
1,2-Dibromo-3-chloropropane	< 1	< 1	< 1	< 1	< 1
1,2-Dibromoethane	< 1	< 1	< 1	< 1	< 1
Dibromomethane	< 1	< 1	< 1	< 1	< 1
1,2-Dichlorobenzene	< 1	< 1	< 1	< 1	< 1
1,3-Dichlorobenzene	< 1	< 1	< 1	< 1	< 1
1,4-Dichlorobenzene	< 1	< 1	< 1	< 1	< 1
Dichlorodifluoromethane	53.1	< 1	6.1	< 1	11.5
1,1-Dichloroethane	22.1	19.7	33.9	12.9	< 1
1,2-Dichloroethane	0.8 J	< 1	< 1	< 1	1.1
1,1-Dichloroethene	< 1	< 1	< 1	< 1	18.8
cis-1,2-Dichloroethene	2.6	1.9	2.7	1.9	4.6
trans-1,2-Dichloroethene	< 1	< 1	< 1	< 1	1
1,2-Dichloropropane	< 1	< 1	< 1	< 1	< 1
1,3-Dichloropropane	< 1	< 1	< 1	< 1	< 1
2,2-Dichloropropane	< 1	< 1	< 1	< 1	< 1
1,1-Dichloropropene	< 1	< 1	< 1	< 1	< 1
cis-1,3-Dichloropropene	< 1	< 1	< 1	< 1	< 1
trans-1,3-Dichloropropene	< 1	< 1	< 1	< 1	< 1
Ethylbenzene	< 1	< 1	< 1	< 1	< 1
Hexachlorobutadiene	< 1	< 1	< 1	< 1	< 1
Isopropylbenzene	0.5 J	< 1	< 1	< 1	< 1
p-Isopropyltoluene	< 1	< 1	< 1	< 1	< 1
Methylene chloride	2.4	1.2	< 1	< 1	< 1
Naphthalene	0.1 J	< 1	< 1	< 1	< 1
n-Propylbenzene	< 1	< 1	< 1	< 1	< 1
Styrene	< 1	< 1	< 1	< 1	< 1
1,1,1,2-Tetrachloroethane	< 1	< 1	< 1	< 1	< 1
1,1,2,2-Tetrachloroethane	< 1	< 1	< 1	< 1	< 1
Tetrachloroethene	0.3 J	< 1	< 1	< 1	< 1
Toluene	0.4 J	0.1 J	< 1	1.8	< 1
1,2,3-Trichlorobenzene	< 1	< 1	< 1	< 1	< 1
1,2,4-Trichlorobenzene	< 1	< 1	< 1	< 1	< 1
1,1,1-Trichloroethane	0.8 J	< 1	< 1	< 1	< 1
1,1,2-Trichloroethane	< 1	< 1	< 1	< 1	< 1
Trichloroethene	5.4	5.5	6.5	2.7	6.8
Trichlorofluoromethane	3.5	1.0	1.5	< 1	7.4
1,2,3-Trichloropropane	< 1	< 1	< 1	< 1	< 1
1,2,4-Trimethylbenzene	< 1	< 1	< 1	< 1	< 1
1,3,5-Trimethylbenzene	< 1	< 1	< 1	< 1	< 1
Vinyl chloride	6.1	< 1	1.4	< 1	7.7
o-Xylene	0.1 J	< 1	< 1	< 1	< 1
m/p-xylenes	0.3 J	< 1	< 1	< 1	< 1

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Table 1. Historic Groundwater Quality Data, Colesville Landfill, Broome County, New York.

Site ID: / Date:	W-16S 9/23/99	W-17I 06/13/95	W-17I 09/13/95	W-17I 12/12/95	W-17I 03/12/96
Constituent (ug/L)					
Benzene	18	< 1	< 1	< 1	< 1
Bromobenzene	< 1.0	< 1	< 1	< 1	< 1
Bromochloromethane	< 1.0	< 1	< 1	< 1	< 1
Bromodichloromethane	< 1.0	< 1	< 1	< 1	< 1
Bromoform	< 1.0	< 1	< 1	< 1	< 1
Bromomethane	< 1.0	< 1	< 1	< 1	< 1
n-Butylbenzene	< 1.0	< 1	< 1	< 1	< 1
sec-Butylbenzene	< 1.0	< 1	< 1	< 1	< 1
tert-Butylbenzene	< 1.0	< 1	< 1	< 1	9.0
Carbon tetrachloride	< 1.0	< 1	< 1	< 1	< 1
Chlorobenzene	< 1.0	< 1	< 1	< 1	< 1
Dibromochloromethane	< 1.0	< 1	< 1	< 1	< 1
Chloroethane	3.3	< 1	< 1	< 1	< 1
Chloroform	< 1.0	0.1 J	< 1	< 1	< 1
Chloromethane	< 1.0	< 1	< 1	< 1	< 1
2-Chlorotoluene	< 1.0	< 1	< 1	< 1	< 1
4-Chlorotoluene	< 1.0	< 1	< 1	< 1	< 1
1,2-Dibromo-3-chloropropane	< 1.0	< 1	< 1	< 1	< 1
1,2-Dibromoethane	< 1.0	< 1	< 1	< 1	< 1
Dibromomethane	< 1.0	< 1	< 1	< 1	< 1
1,2-Dichlorobenzene	< 1.0	< 1	< 1	< 1	< 1
1,3-Dichlorobenzene	< 1.0	< 1	< 1	< 1	< 1
1,4-Dichlorobenzene	< 1.0	< 1	< 1	< 1	< 1
Dichlorodifluoromethane	< 1.0	< 1	< 1	< 1	< 1
1,1-Dichloroethane	32	3.6	2.8	< 1	< 1
1,2-Dichloroethane	< 1.0	< 1	< 1	< 1	< 1
1,1-Dichloroethene	< 1.0	< 1	< 1	< 1	< 1
cis-1,2-Dichloroethene	< 1.0	1.4	1.0	< 1	< 1
trans-1,2-Dichloroethene	< 1.0	< 1	< 1	< 1	< 1
1,2-Dichloropropane	< 1.0	< 1	< 1	< 1	< 1
1,3-Dichloropropane	< 1.0	< 1	< 1	< 1	< 1
2,2-Dichloropropane	< 1.0	< 1	< 1	< 1	< 1
1,1-Dichloropropene	< 1.0	< 1	< 1	< 1	< 1
cis-1,3-Dichloropropene	< 1.0	< 1	< 1	< 1	< 1
trans-1,3-Dichloropropene	< 1.0	< 1	< 1	< 1	< 1
Ethylbenzene	< 1.0	< 1	< 1	< 1	< 1
Hexachlorobutadiene	< 1.0	< 1	< 1	< 1	< 1
Isopropylbenzene	< 1.0	< 1	< 1	< 1	< 1
p-Isopropyltoluene	< 1.0	< 1	< 1	< 1	< 1
Methylene chloride	< 1.0	< 1	< 1	< 1	< 1
Naphthalene	< 1.0	< 1	< 1	< 1	< 1
n-Propylbenzene	< 1.0	< 1	< 1	< 1	< 1
Styrene	< 1.0	< 1	< 1	< 1	0.9 J
1,1,1,2-Tetrachloroethane	< 1.0	< 1	< 1	< 1	< 1
1,1,2,2-Tetrachloroethane	< 1.0	< 1	< 1	< 1	< 1
Tetrachloroethene	< 1.0	< 1	< 1	< 1	< 1
Toluene	< 1.0	< 1	< 1	< 1	< 1
1,2,3-Trichlorobenzene	< 1.0	< 1	< 1	< 1	< 1
1,2,4-Trichlorobenzene	< 1.0	< 1	< 1	< 1	4.0
1,1,1-Trichloroethane	< 1.0	2.4	1.4	< 1	< 1
1,1,2-Trichloroethane	< 1.0	< 1	< 1	< 1	< 1
Trichloroethene	< 1.0	2.3	1.7	< 1	< 1
Trichlorofluoromethane	< 1.0	< 1	< 1	< 1	< 1
1,2,3-Trichloropropane	< 1.0	< 1	< 1	< 1	< 1
1,2,4-Trimethylbenzene	< 1.0	< 1	< 1	< 1	< 1
1,3,5-Trimethylbenzene	< 1.0	< 1	< 1	< 1	< 1
Vinyl chloride	< 1.0	< 1	< 1	< 1	< 1
o-Xylene	< 1.0	< 1	< 1	< 1	0.7 J
m/p-xylenes	< 2.0	< 1	< 1	< 1	< 1

ARCADIS GERAGHTY & MILLER

Table 1. Historic Groundwater Quality Data, Colesville Landfill, Broome County, New York.

Constituent (ug/L)	Site ID: / Date:	W-17I 03/19/97		W-17S 06/13/95		W-17S 09/13/95		W-17S 12/12/95		W-17S 03/12/96
Benzene		< 1		< 1		< 1		< 1		< 1
Bromobenzene		< 1		< 1		< 1		< 1		< 1
Bromochloromethane		< 1		< 1		< 1		< 1		< 1
Bromodichloromethane		< 1		< 1		< 1		< 1		< 1
Bromoform		< 1		< 1		< 1		< 1		< 1
Bromomethane		< 1		< 1		< 1		< 1		< 1
n-Butylbenzene		< 1		< 1		< 1		< 1		< 1
sec-Butylbenzene		< 1		< 1		< 1		< 1		< 1
tert-Butylbenzene		< 1		< 1		< 1		< 1		< 1
Carbon tetrachloride		< 1		< 1		< 1		< 1		< 1
Chlorobenzene		< 1		< 1		0.1	J	0.8	J	< 1
Dibromochloromethane		< 1		< 1		< 1		< 1		< 1
Chloroethane		< 1		< 1		< 1		< 1		< 1
Chloroform		< 1		0.1	J	< 1		< 1		< 1
Chloromethane		< 1		< 1		< 1		< 1		< 1
2-Chlorotoluene		< 1		< 1		< 1		< 1		< 1
4-Chlorotoluene		< 1		< 1		< 1		< 1		< 1
1,2-Dibromo-3-chloropropane		< 1		< 1		< 1		< 1		< 1
1,2-Dibromoethane		< 1		< 1		< 1		< 1		< 1
Dibromomethane		< 1		< 1		0.1	J	< 1		< 1
1,2-Dichlorobenzene		< 1		< 1		< 1		< 1		< 1
1,3-Dichlorobenzene		< 1		< 1		< 1		< 1		< 1
1,4-Dichlorobenzene		< 1		< 1		< 1		< 1		< 1
Dichlorodifluoromethane		< 1		< 1		< 1		< 1		< 1
1,1-Dichloroethane		< 1		< 1		1.6		0.7	J	< 1
1,2-Dichloroethane		< 1		< 1		< 1		< 1		< 1
1,1-Dichloroethene		< 1		< 1		< 1		< 1		< 1
cis-1,2-Dichloroethene		< 1		< 1		< 1		0.2	J	< 1
trans-1,2-Dichloroethene		< 1		< 1		< 1		< 1		< 1
1,2-Dichloropropane		< 1		< 1		< 1		< 1		< 1
1,3-Dichloropropane		< 1		< 1		< 1		< 1		< 1
2,2-Dichloropropane		< 1		< 1		< 1		< 1		< 1
1,1-Dichloropropene		< 1		< 1		< 1		< 1		< 1
cis-1,3-Dichloropropene		< 1		< 1		< 1		< 1		< 1
trans-1,3-Dichloropropene		< 1		< 1		< 1		< 1		< 1
Ethylbenzene		< 1		< 1		< 1		< 1		< 1
Hexachlorobutadiene		< 1		< 1		< 1		< 1		< 1
Isopropylbenzene		< 1		< 1		< 1		< 1		< 1
p-Isopropyltoluene		< 1		< 1		< 1		< 1		< 1
Methylene chloride		< 1		< 1		< 1		< 1		< 1
Naphthalene		< 1		< 1		< 1		< 1		< 1
n-Propylbenzene		< 1		< 1		< 1		< 1		< 1
Styrene		< 1		< 1		< 1		< 1		< 1
1,1,1,2-Tetrachloroethane		< 1		< 1		< 1		< 1		< 1
1,1,2,2-Tetrachloroethane		< 1		< 1		< 1		< 1		< 1
Tetrachloroethene		< 1		< 1		0.1	J	< 1		< 1
Toluene		< 1		< 1		< 1		0.2	J	< 1
1,2,3-Trichlorobenzene		< 1		< 1		< 1		< 1		< 1
1,2,4-Trichlorobenzene		< 1		< 1		< 1		< 1		< 1
1,1,1-Trichloroethane		< 1		0.2	J	< 1		0.2	J	< 1
1,1,2-Trichloroethane		< 1		< 1		< 1		< 1		< 1
Trichloroethene		< 1		< 1		0.7	J	0.6	J	< 1
Trichlorofluoromethane		< 1		< 1		< 1		< 1		< 1
1,2,3-Trichloropropane		< 1		< 1		< 1		< 1		< 1
1,2,4-Trimethylbenzene		< 1		< 1		< 1		< 1		< 1
1,3,5-Trimethylbenzene		< 1		< 1		< 1		< 1		< 1
Vinyl chloride		< 1		< 1		< 1		< 1		< 1
o-Xylene		< 1		< 1		< 1		< 1		< 1
m/p-xylenes		< 1		< 1		< 1		0.2	J	< 1

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Table 1. Historic Groundwater Quality Data, Colesville Landfill, Broome County, New York.

Constituent (ug/L) Site ID: / Date:	W-17S 03/19/97	W-17S 9/23/99	W-18 06/13/95	W-18 09/13/95	W-18 12/12/95
Benzene	< 1	< 1.0	< 1	< 1	< 1
Bromobenzene	< 1	< 1.0	< 1	< 1	< 1
Bromochloromethane	< 1	< 1.0	< 1	< 1	< 1
Bromodichloromethane	< 1	< 1.0	< 1	< 1	< 1
Bromoform	< 1	< 1.0	< 1	< 1	< 1
Bromomethane	< 1	< 1.0	< 1	< 1	< 1
n-Butylbenzene	< 1	< 1.0	< 1	< 1	< 1
sec-Butylbenzene	< 1	< 1.0	< 1	< 1	< 1
tert-Butylbenzene	< 1	< 1.0	< 1	< 1	< 1
Carbon tetrachloride	< 1	< 1.0	< 1	< 1	< 1
Chlorobenzene	< 1	< 1.0	< 1	< 1	< 1
Dibromochloromethane	< 1	< 1.0	< 1	< 1	< 1
Chloroethane	< 1	< 1.0	< 1	< 1	< 1
Chloroform	< 1	< 1.0	2.9	2.4	2.9
Chloromethane	< 1	< 1.0	< 1	< 1	< 1
2-Chlorotoluene	< 1	< 1.0	< 1	< 1	< 1
4-Chlorotoluene	< 1	< 1.0	< 1	< 1	< 1
1,2-Dibromo-3-chloropropane	< 1	< 1.0	< 1	< 1	< 1
1,2-Dibromoethane	< 1	< 1.0	< 1	< 1	< 1
Dibromomethane	< 1	< 1.0	< 1	< 1	< 1
1,2-Dichlorobenzene	< 1	< 1.0	< 1	< 1	< 1
1,3-Dichlorobenzene	< 1	< 1.0	< 1	< 1	< 1
1,4-Dichlorobenzene	< 1	< 1.0	< 1	< 1	< 1
Dichlorodifluoromethane	< 1	< 1.0	< 1	2.6	< 1
1,1-Dichloroethane	1.0	11	41.0	53.4	45.8
1,2-Dichloroethane	< 1	< 1.0	< 1	< 1	< 1
1,1-Dichloroethene	< 1	< 1.0	0.3 J	< 1	< 1
cis-1,2-Dichloroethene	< 1	< 1.0	26.1	25.8	29.4
trans-1,2-Dichloroethene	< 1	< 1.0	< 1	< 1	< 1
1,2-Dichloropropane	< 1	< 1.0	< 1	< 1	< 1
1,3-Dichloropropane	< 1	< 1.0	< 1	< 1	< 1
2,2-Dichloropropane	< 1	< 1.0	< 1	< 1	< 1
1,1-Dichloropropene	< 1	< 1.0	< 1	< 1	< 1
cis-1,3-Dichloropropene	< 1	< 1.0	< 1	< 1	< 1
trans-1,3-Dichloropropene	< 1	< 1.0	< 1	< 1	< 1
Ethylbenzene	< 1	< 1.0	< 1	< 1	< 1
Hexachlorobutadiene	< 1	< 1.0	< 1	< 1	< 1
Isopropylbenzene	< 1	< 1.0	< 1	< 1	< 1
p-Isopropyltoluene	< 1	< 1.0	< 1	< 1	< 1
Methylene chloride	< 1	< 1.0	< 1	0.2 J	< 1
Naphthalene	< 1	< 1.0	< 1	< 1	< 1
n-Propylbenzene	< 1	< 1.0	< 1	< 1	< 1
Styrene	< 1	< 1.0	< 1	< 1	< 1
1,1,1,2-Tetrachloroethane	< 1	< 1.0	< 1	< 1	< 1
1,1,2,2-Tetrachloroethane	< 1	< 1.0	< 1	< 1	< 1
Tetrachloroethene	< 1	< 1.0	< 1	< 1	0.1 J
Toluene	< 1	< 1.0	< 1	< 1	< 1
1,2,3-Trichlorobenzene	< 1	< 1.0	< 1	< 1	< 1
1,2,4-Trichlorobenzene	< 1	< 1.0	< 1	< 1	< 1
1,1,1-Trichloroethane	< 1	< 3.4	17.3	25.5	19.3
1,1,2-Trichloroethane	< 1	< 1.0	< 1	< 1	< 1
Trichloroethene	< 1	< 1.0	32.9	43.8	29.3
Trichlorofluoromethane	< 1	< 1.0	< 1	0.2 J	< 1
1,2,3-Trichloropropane	< 1	< 1.0	< 1	< 1	< 1
1,2,4-Trimethylbenzene	< 1	< 1.0	< 1	< 1	< 1
1,3,5-Trimethylbenzene	< 1	< 1.0	< 1	< 1	< 1
Vinyl chloride	< 1	< 1.0	< 1	< 1	< 1
o-Xylene	< 1	< 1.0	< 1	< 1	< 1
m/p-xylenes	< 1	< 2.0	< 1	< 1	< 1

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Table 1. Historic Groundwater Quality Data, Colesville Landfill, Broome County, New York.

Constituent (ug/L)	Site ID: W-18 Date: 03/12/96	W-18 06/26/96	W-18* 06/26/96	W-18 03/19/97	W-18 07/16/97
Benzene	< 1	< 1	< 1	< 1	< 1
Bromobenzene	< 1	< 1	< 1	< 1	< 1
Bromochloromethane	< 1	< 1	< 1	< 1	< 1
Bromodichloromethane	< 1	< 1	< 1	< 1	< 1
Bromoform	< 1	< 1	< 1	< 1	< 1
Bromomethane	< 1	< 1	< 1	< 1	< 1
n-Butylbenzene	< 1	< 1	< 1	< 1	< 1
sec-Butylbenzene	0.3 J	< 1	< 1	< 1	< 1
tert-Butylbenzene	< 1	< 1	< 1	< 1	< 1
Carbon tetrachloride	< 1	< 1	< 1	< 1	< 1
Chlorobenzene	< 1	< 1	< 1	< 1	< 1
Dibromochloromethane	< 1	< 1	< 1	< 1	< 1
Chloroethane	< 1	< 1	2.8	< 1	< 1
Chloroform	0.9 J	1.9	1.8	0.8 J	2.9
Chloromethane	< 1	< 1	< 1	< 1	< 1
2-Chlorotoluene	< 1	< 1	< 1	< 1	< 1
4-Chlorotoluene	< 1	< 1	< 1	< 1	< 1
1,2-Dibromo-3-chloropropane	< 1	< 1	< 1	< 1	< 1
1,2-Dibromoethane	< 1	< 1	< 1	< 1	< 1
Dibromomethane	< 1	< 1	< 1	< 1	< 1
1,2-Dichlorobenzene	< 1	< 1	< 1	< 1	< 1
1,3-Dichlorobenzene	< 1	< 1	< 1	< 1	< 1
1,4-Dichlorobenzene	< 1	< 1	< 1	< 1	< 1
Dichlorodifluoromethane	< 1	< 1	2.9	< 1	3.2
1,1-Dichloroethane	23.2	45.2	43.8	20.1	35.1
1,2-Dichloroethane	< 1	< 1	< 1	< 1	< 1
1,1-Dichloroethene	< 1	< 1	< 1	< 1	< 1
cis-1,2-Dichloroethene	14.2	22.3	20.7	11.6	22.1
trans-1,2-Dichloroethene	< 1	< 1	< 1	< 1	< 1
1,2-Dichloropropane	< 1	< 1	< 1	< 1	< 1
1,3-Dichloropropane	< 1	< 1	< 1	< 1	< 1
2,2-Dichloropropane	< 1	< 1	< 1	< 1	< 1
1,1-Dichloropropene	< 1	< 1	< 1	< 1	< 1
cis-1,3-Dichloropropene	< 1	< 1	< 1	< 1	< 1
trans-1,3-Dichloropropene	< 1	< 1	< 1	< 1	< 1
Ethylbenzene	< 1	< 1	< 1	< 1	< 1
Hexachlorobutadiene	< 1	< 1	< 1	< 1	< 1
Isopropylbenzene	< 1	< 1	< 1	< 1	< 1
p-Isopropyltoluene	< 1	< 1	< 1	< 1	< 1
Methylene chloride	< 1	< 1	< 1	< 1	< 1
Naphthalene	< 1	< 1	< 1	< 1	< 1
n-Propylbenzene	< 1	< 1	< 1	< 1	< 1
Styrene	< 1	< 1	< 1	< 1	< 1
1,1,1,2-Tetrachloroethane	< 1	< 1	< 1	< 1	< 1
1,1,2,2-Tetrachloroethane	< 1	< 1	< 1	< 1	< 1
Tetrachloroethene	< 1	< 1	< 1	< 1	< 1
Toluene	< 1	< 1	< 1	< 1	< 1
1,2,3-Trichlorobenzene	< 1	< 1	< 1	< 1	< 1
1,2,4-Trichlorobenzene	< 1	< 1	< 1	< 1	< 1
1,1,1-Trichloroethane	11.3	21.1	20.1	9.1	13.7
1,1,2-Trichloroethane	< 1	< 1	< 1	< 1	< 1
Trichloroethene	27.9	26.7	27.4	19.6	35.4
Trichlorofluoromethane	< 1	< 1	< 1	< 1	< 1
1,2,3-Trichloropropane	< 1	< 1	< 1	< 1	< 1
1,2,4-Trimethylbenzene	< 1	< 1	< 1	< 1	< 1
1,3,5-Trimethylbenzene	< 1	< 1	< 1	< 1	< 1
Vinyl chloride	< 1	< 1	< 1	< 1	< 1
o-Xylene	< 1	< 1	< 1	< 1	< 1
m/p-xylenes	< 1	< 1	< 1	< 1	< 1

ARCADIS GERAGHTY & MILLER

Table 1. Historic Groundwater Quality Data, Colesville Landfill, Broome County, New York.

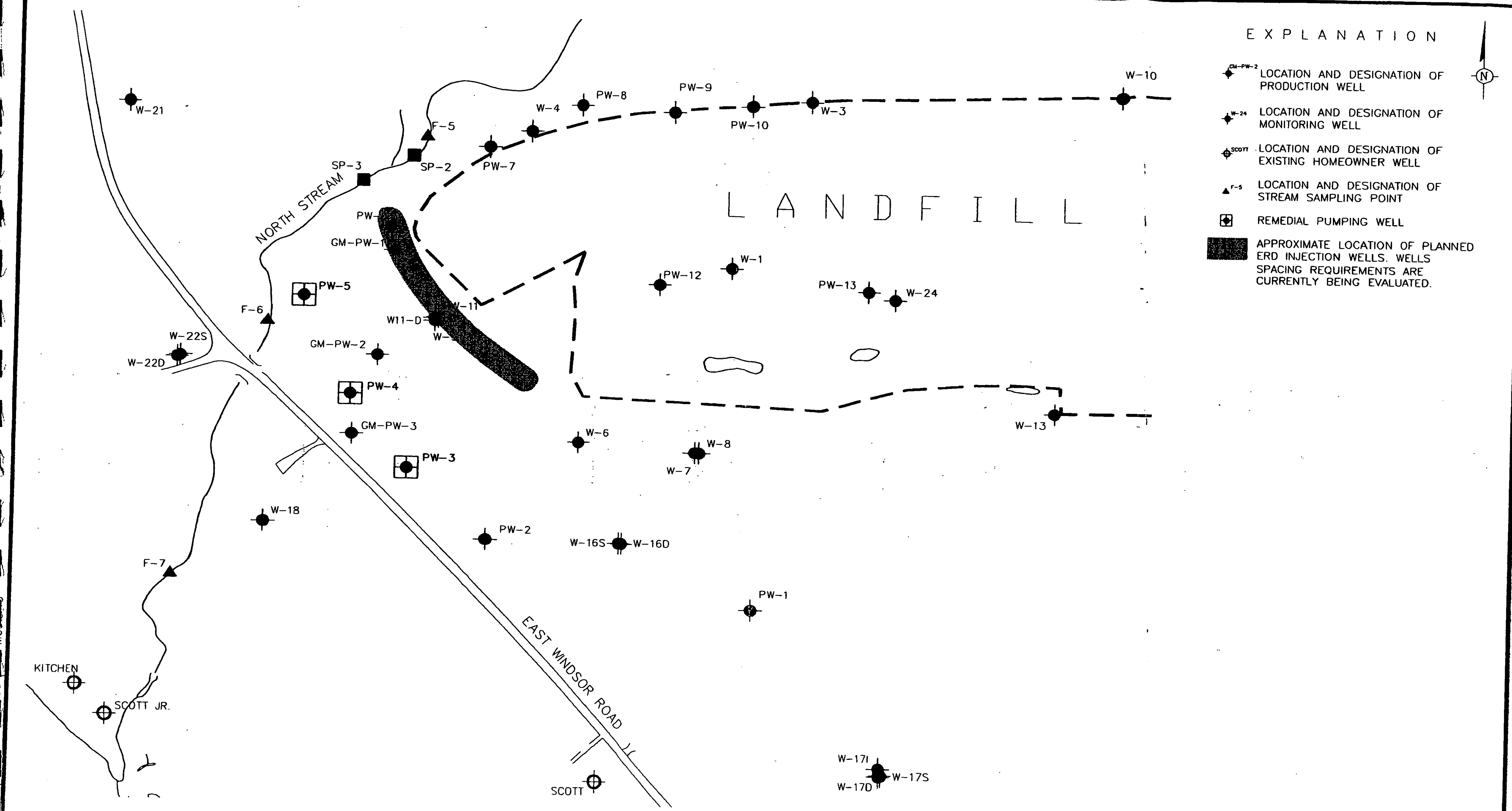
Constituent (ug/L)	Site ID: Date:	W-18 9/24/99	W-20S 06/13/95	W-20S 09/13/95	W-20S 12/12/95	W-20S 03/12/96
Benzene		< 1.0	< 1	< 1	< 1	< 1
Bromobenzene		< 1.0	< 1	< 1	< 1	< 1
Bromochloromethane		< 1.0	< 1	< 1	< 1	< 1
Bromodichloromethane		< 1.0	< 1	< 1	< 1	< 1
Bromoform		< 1.0	< 1	< 1	< 1	< 1
Bromomethane		< 1.0	< 1	< 1	< 1	< 1
n-Butylbenzene		< 1.0	< 1	< 1	< 1	< 1
sec-Butylbenzene		< 1.0	< 1	< 1	< 1	< 1
tert-Butylbenzene		< 1.0	< 1	< 1	< 1	3.2
Carbon tetrachloride		< 1.0	< 1	< 1	< 1	< 1
Chlorobenzene		< 1.0	< 1	< 1	< 1	< 1
Dibromochloromethane		< 1.0	< 1	< 1	< 1	< 1
Chloroethane		< 1.0	< 1	< 1	< 1	< 1
Chloroform		1.3	< 1	< 1	< 1	< 1
Chloromethane		< 1.0	< 1	< 1	< 1	< 1
2-Chlorotoluene		< 1.0	< 1	< 1	< 1	< 1
4-Chlorotoluene		< 1.0	< 1	< 1	< 1	< 1
1,2-Dibromo-3-chloropropane		< 1.0	< 1	< 1	< 1	< 1
1,2-Dibromoethane		< 1.0	< 1	< 1	< 1	< 1
Dibromomethane		< 1.0	< 1	< 1	< 1	< 1
1,2-Dichlorobenzene		< 1.0	< 1	< 1	< 1	< 1
1,3-Dichlorobenzene		< 1.0	< 1	< 1	< 1	< 1
1,4-Dichlorobenzene		< 1.0	< 1	< 1	< 1	< 1
Dichlorodifluoromethane		< 1.0	< 1	< 1	< 1	< 1
1,1-Dichloroethane		32	< 1	< 1	< 1	< 1
1,2-Dichloroethane		< 1.0	< 1	< 1	< 1	< 1
1,1-Dichloroethene		< 1.0	< 1	< 1	< 1	< 1
cis-1,2-Dichloroethene		19	< 1	< 1	< 1	< 1
trans-1,2-Dichloroethene		< 1.0	< 1	< 1	< 1	< 1
1,2-Dichloropropane		< 1.0	< 1	< 1	< 1	< 1
1,3-Dichloropropane		< 1.0	< 1	< 1	< 1	< 1
2,2-Dichloropropane		< 1.0	< 1	< 1	< 1	< 1
1,1-Dichloropropene		< 1.0	< 1	< 1	< 1	< 1
cis-1,3-Dichloropropene		< 1.0	< 1	< 1	< 1	< 1
trans-1,3-Dichloropropene		< 1.0	< 1	< 1	< 1	< 1
Ethylbenzene		< 1.0	< 1	< 1	< 1	< 1
Hexachlorobutadiene		< 1.0	< 1	< 1	< 1	< 1
Isopropylbenzene		< 1.0	< 1	< 1	< 1	< 1
p-Isopropyltoluene		< 1.0	< 1	< 1	< 1	< 1
Methylene chloride		< 1.0	< 1	< 1	< 1	< 1
Naphthalene		< 1.0	< 1	< 1	< 1	< 1
n-Propylbenzene		< 1.0	< 1	< 1	< 1	< 1
Styrene		< 1.0	< 1	< 1	< 1	0.6 J
1,1,1,2-Tetrachloroethane		< 1.0	< 1	< 1	< 1	< 1
1,1,2,2-Tetrachloroethane		< 1.0	< 1	< 1	< 1	< 1
Tetrachloroethene		< 1.0	< 1	< 1	< 1	< 1
Toluene		< 1.0	< 1	< 1	< 1	< 1
1,2,3-Trichlorobenzene		< 1.0	< 1	< 1	< 1	< 1
1,2,4-Trichlorobenzene		< 1.0	< 1	< 1	< 1	< 1
1,1,1-Trichloroethane		12	< 1	< 1	< 1	< 1
1,1,2-Trichloroethane		< 1.0	< 1	< 1	< 1	< 1
Trichloroethene		29	< 1	< 1	< 1	< 1
Trichlorofluoromethane		< 1.0	< 1	< 1	< 1	< 1
1,2,3-Trichloropropane		< 1.0	< 1	< 1	< 1	< 1
1,2,4-Trimethylbenzene		< 1.0	< 1	< 1	< 1	< 1
1,3,5-Trimethylbenzene		< 1.0	< 1	< 1	< 1	< 1
Vinyl chloride		< 1.0	< 1	< 1	< 1	< 1
o-Xylene		< 1.0	< 1	< 1	< 1	< 1
m/p-xylenes		< 2.0	< 1	< 1	< 1	< 1

Table 1. Historic Groundwater Quality Data, Colesville Landfill, Broome County, New York.

Constituent (ug/L)	Site ID: Date:	W-20S 06/27/96	W-20S 03/19/97	W-20S 07/17/97	W-20S 9/22/99	W-22S 06/13/95
Benzene		< 1	< 1	< 1	< 1.0	< 1
Bromobenzene		< 1	< 1	< 1	< 1.0	< 1
Bromochloromethane		< 1	< 1	< 1	< 1.0	< 1
Bromodichloromethane		< 1	< 1	< 1	< 1.0	< 1
Bromoform		< 1	< 1	< 1	< 1.0	< 1
Bromomethane		< 1	< 1	< 1	< 1.0	< 1
n-Butylbenzene		< 1	< 1	< 1	< 1.0	< 1
sec-Butylbenzene		< 1	< 1	< 1	< 1.0	< 1
tert-Butylbenzene		< 1	< 1	< 1	< 1.0	< 1
Carbon tetrachloride		< 1	< 1	< 1	< 1.0	< 1
Chlorobenzene		< 1	< 1	< 1	< 1.0	< 1
Dibromochloromethane		< 1	< 1	< 1	< 1.0	< 1
Chloroethane		< 1	< 1	< 1	< 1.0	< 1
Chloroform		< 1	< 1	< 1	< 1.0	< 1
Chloromethane		< 1	< 1	< 1	< 1.0	< 1
2-Chlorotoluene		< 1	< 1	< 1	< 1.0	< 1
4-Chlorotoluene		< 1	< 1	< 1	< 1.0	< 1
1,2-Dibromo-3-chloropropane		< 1	< 1	< 1	< 1.0	< 1
1,2-Dibromoethane		< 1	< 1	< 1	< 1.0	< 1
Dibromomethane		< 1	< 1	< 1	< 1.0	< 1
1,2-Dichlorobenzene		< 1	< 1	< 1	< 1.0	< 1
1,3-Dichlorobenzene		< 1	< 1	< 1	< 1.0	< 1
1,4-Dichlorobenzene		< 1	< 1	< 1	< 1.0	< 1
Dichlorodifluoromethane		< 1	< 1	< 1	< 1.0	< 1
1,1-Dichloroethane		< 1	< 1	< 1	< 1.0	< 1
1,2-Dichloroethane		< 1	< 1	< 1	< 1.0	< 1
1,1-Dichloroethene		< 1	< 1	< 1	< 1.0	< 1
cis-1,2-Dichloroethene		< 1	< 1	< 1	< 1.0	< 1
trans-1,2-Dichloroethene		< 1	< 1	< 1	< 1.0	< 1
1,2-Dichloropropane		< 1	< 1	< 1	< 1.0	< 1
1,3-Dichloropropane		< 1	< 1	< 1	< 1.0	< 1
2,2-Dichloropropane		< 1	< 1	< 1	< 1.0	< 1
1,1-Dichloropropene		< 1	< 1	< 1	< 1.0	< 1
cis-1,3-Dichloropropene		< 1	< 1	< 1	< 1.0	< 1
trans-1,3-Dichloropropene		< 1	< 1	< 1	< 1.0	< 1
Ethylbenzene		< 1	< 1	< 1	< 1.0	< 1
Hexachlorobutadiene		< 1	< 1	< 1	< 1.0	< 1
Isopropylbenzene		< 1	< 1	< 1	< 1.0	< 1
p-Isopropyltoluene		< 1	< 1	< 1	< 1.0	< 1
Methylene chloride		< 1	< 1	< 1	< 1.0	< 1
Naphthalene		< 1	< 1	< 1	< 1.0	< 1
n-Propylbenzene		< 1	< 1	< 1	< 1.0	< 1
Styrene		< 1	< 1	< 1	< 1.0	< 1
1,1,1,2-Tetrachloroethane		< 1	< 1	< 1	< 1.0	< 1
1,1,2,2-Tetrachloroethane		< 1	< 1	< 1	< 1.0	< 1
Tetrachloroethene		< 1	< 1	< 1	< 1.0	< 1
Toluene		< 1	< 1	< 1	< 1.0	< 1
1,2,3-Trichlorobenzene		< 1	< 1	< 1	< 1.0	< 1
1,2,4-Trichlorobenzene		< 1	< 1	< 1	< 1.0	< 1
1,1,1-Trichloroethane		< 1	< 1	< 1	< 1.0	< 1
1,1,2-Trichloroethane		< 1	< 1	< 1	< 1.0	< 1
Trichloroethene		< 1	< 1	< 1	< 1.0	< 1
Trichlorofluoromethane		< 1	< 1	< 1	< 1.0	< 1
1,2,3-Trichloropropane		< 1	< 1	< 1	< 1.0	< 1
1,2,4-Trimethylbenzene		< 1	< 1	< 1	< 1.0	< 1
1,3,5-Trimethylbenzene		< 1	< 1	< 1	< 1.0	< 1
Vinyl chloride		< 1	< 1	< 1	< 1.0	< 1
o-Xylene		< 1	< 1	< 1	< 1.0	< 1
m/p-xylenes		< 1	< 1	< 1	< 2.0	< 1

Constituent (ug/L)	Site ID: Date:	W-22S 09/13/95	W-22S 12/12/95	W-22S 03/12/96	W-22S 03/19/97	W-24 06/13/95
Benzene		< 1	< 1	< 1	< 1	9.6
Bromobenzene		< 1	< 1	< 1	< 1	< 1
Bromochloromethane		< 1	< 1	< 1	< 1	< 1
Bromodichloromethane		< 1	< 1	< 1	< 1	< 1
Bromoform		< 1	< 1	< 1	< 1	< 1
Bromomethane		< 1	< 1	< 1	< 1	< 1
n-Butylbenzene		< 1	< 1	< 1	< 1	< 1
sec-Butylbenzene		< 1	< 1	< 1	< 1	0.4 J
tert-Butylbenzene		< 1	< 1	< 1	< 1	< 1
Carbon tetrachloride		< 1	< 1	< 1	< 1	< 1
Chlorobenzene		< 1	< 1	< 1	< 1	13.7
Dibromochloromethane		< 1	< 1	< 1	< 1	< 1
Chloroethane		< 1	< 1	< 1	< 1	11.3
Chloroform		< 1	< 1	< 1	< 1	0.4 J
Chloromethane		< 1	< 1	< 1	< 1	14.1
2-Chlorotoluene		< 1	< 1	< 1	< 1	< 1
4-Chlorotoluene		< 1	< 1	< 1	< 1	< 1
1,2-Dibromo-3-chloropropane		< 1	< 1	< 1	< 1	< 1
1,2-Dibromoethane		< 1	< 1	< 1	< 1	< 1
Dibromomethane		< 1	< 1	< 1	< 1	< 1
1,2-Dichlorobenzene		< 1	< 1	< 1	< 1	< 1
1,3-Dichlorobenzene		< 1	< 1	< 1	< 1	< 1
1,4-Dichlorobenzene		< 1	< 1	< 1	< 1	< 1
Dichlorodifluoromethane		< 1	< 1	< 1	< 1	6.8
1,1-Dichloroethane		< 1	< 1	< 1	< 1	71.5
1,2-Dichloroethane		< 1	< 1	< 1	< 1	204
1,1-Dichloroethene		< 1	< 1	< 1	< 1	< 1
cis-1,2-Dichloroethene		< 1	< 1	< 1	< 1	17.8
trans-1,2-Dichloroethene		< 1	< 1	< 1	< 1	< 1
1,2-Dichloropropane		< 1	< 1	< 1	< 1	1.8
1,3-Dichloropropane		< 1	< 1	< 1	< 1	< 1
2,2-Dichloropropane		< 1	< 1	< 1	< 1	< 1
1,1-Dichloropropene		< 1	< 1	< 1	< 1	< 1
cis-1,3-Dichloropropene		< 1	< 1	< 1	< 1	< 1
trans-1,3-Dichloropropene		< 1	< 1	< 1	< 1	< 1
Ethylbenzene		< 1	< 1	< 1	< 1	< 1
Hexachlorobutadiene		< 1	< 1	< 1	< 1	< 1
Isopropylbenzene		< 1	< 1	< 1	< 1	< 1
p-Isopropyltoluene		< 1	< 1	< 1	< 1	< 1
Methylene chloride		< 1	< 1	< 1	< 1	0.9 J
Naphthalene		< 1	< 1	< 1	< 1	< 1
n-Propylbenzene		< 1	< 1	< 1	< 1	< 1
Styrene		< 1	< 1	< 1	< 1	< 1
1,1,1,2-Tetrachloroethane		< 1	< 1	< 1	< 1	< 1
1,1,2,2-Tetrachloroethane		< 1	< 1	< 1	< 1	< 1
Tetrachloroethene		< 1	< 1	< 1	< 1	< 1
Toluene		< 1	< 1	< 1	< 1	0.3 J
1,2,3-Trichlorobenzene		< 1	< 1	< 1	< 1	< 1
1,2,4-Trichlorobenzene		< 1	< 1	< 1	< 1	< 1
1,1,1-Trichloroethane		< 1	< 1	< 1	< 1	< 1
1,1,2-Trichloroethane		< 1	< 1	< 1	< 1	0.2 J
Trichloroethene		< 1	< 1	< 1	< 1	11.4
Trichlorofluoromethane		< 1	< 1	< 1	< 1	0.7 J
1,2,3-Trichloropropane		< 1	< 1	< 1	< 1	< 1
1,2,4-Trimethylbenzene		< 1	< 1	< 1	< 1	< 1
1,3,5-Trimethylbenzene		< 1	< 1	< 1	< 1	< 1
Vinyl chloride		< 1	< 1	< 1	< 1	13.4
o-Xylene		< 1	< 1	< 1	< 1	< 1
m/p-xylenes		< 1	< 1	< 1	< 1	< 1

ND	Not detected at the reporting limit
J	Analyte detected below quantitation limits
B	Analyte detected in the associated method blank
*	Value exceeds maximum contaminant level
S	Spike recovery outside accepted recovery limits
R	RPD outside accepted recovery limits
E	Value exceeds quantitation range.



NOTE: ALL LOCATIONS ARE APPROXIMATE

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0 200
SCALE IN FEET

NO.	DATE	REVISION DESCRIPTION	BY	CKD

ARCADIS GERAGHTY & MILLER

COLESVILLE LANDFILL
COLESVILLE, NEW YORK

DRAWN A.G.	DATE 9/25/99	PROJECT MANAGER S. FELDMAN	DEPARTMENT MANAGER
RECOMMENDED CONFIGURATION OF ENHANCED PUMP-AND-TREAT GROUNDWATER REMEDIATION SYSTEM		LEAD DESIGN PROF.	CHECKED D. STERN
		PROJECT NUMBER NY09490012T5	DRAWING NUMBER 1

APPENDIX D

ARCADIS GERAGHTY & MILLER

Appendix D

NYSDEC Air Facility Registration Form

Air Facility Registration

DEC ID
- -

Owner/Firm

Taxpayer ID			
Name: Broome County Division of Solid Waste Management			
Street Address: P.O. Box 1766			
City / Town / Village: Binghamton	State or Province: NY	Country: USA	Zip/Mail Code: 13902

Owner/Firm Contact

Name: Ray L. Standish	Phone No. (607) 778-2482

Facility

Name: Colesville Landfill	
Location Address: E. Windsor Road	
☐ City / ☒ Town / ☐ Village: Colesville	Zip 13787

Facility Information

Total Number of Emission Points: ____________ ☐ Cap by Rule

Description

Proposed groundwater treatment facility consists of one (1) low profile air stripping unit with one (1) emission source. Air stripper off-gas is below all AGC and SGC limits as defined in the NYSDEC Air Guide 1 (1994). Proposed facility is exempt from registration pursuant to 6 NYCRR Part 201.3.3 (L) (29)

Standard Industrial Classification Codes

HAP CAS Numbers

127-18-4	79-01-6	67-66-3	75-09-2	71-55-6	- -
- -	- -	- -	- -	- -	- -

Applicable Federal and New York State Requirements (Part No.s)

201-3.3 (C) (29)					

Certification

I certify that this facility will be operated in conformance with all provisions of existing regulations.

Responsible Official: Glenn Netuschil	Title: Project Engineer
Signature	Date ____ / ____ / ____

(7/29/96)

APPENDIX E

ARCADIS GERAGHTY & MILLER

Appendix E

SPDES Industrial Application Form

State Pollutant Discharge Elimination System (SPDES)
INDUSTRIAL APPLICATION FORM NY-2C
For New Permits and Permit Modifications to Discharge Industrial Wastewater and Storm Water
Section I - Permittee and Facility Information

Please type or print the requested information.

1. Current Permit Information (leave blank if for new discharge)

SPDES Number:	DEC Number:

2. Permit Action Requested: (Check applicable box)

[X] A NEW proposed discharge
[ ] An EBPS INFORMATION REQUEST response
[ ] A RENEWAL of an existing SPDES permit
[ ] A MODIFICATION of the existing permit
[ ] An EXISTING discharge currently without permit

Does this request include an increase in the quantity of water discharged from your facility to the waters of the State?

[ ] YES - Describe the increase:
[ ] NO - Go to item 3. below.

3. Permittee Name and Address

Name		Attention
Broome County Division of Solid Waste Management		Ray L. Standish
Street Address: P.O. Box 1766		
City or Village: Binghamton	State: NY	ZIP Code: 13902

4. Facility Name, Address and Location

Name: Colesville Landfill			
Street Address: E. Windsor Road		P.O. Box:	
City or Village:		State: NY	ZIP Code: 13787
Town: Colesville		County: Broome	
Telephone: N/A	FAX: N/A	NYTM - E:	NYTM - N:
Tax Map Info (New York City, Nassau County and Suffolk County only)			
Section:	Block:	Subblock:	Lot:

5. Facility Contact Person

Name: Glenn Netuschil		Title: Project Engineer	
Street Address: 88 Duryea Road			P.O. Box:
City or Village: Melville		State: NY	ZIP Code: 11747
Telephone: (631) 249-7600	FAX: (631) 249-7610	E-Mail or Internet: gnetusch@gmgw.com	

6. Discharge Monitoring Report (DMR) Mailing Address

Mailing Name: Glenn Netuschil			
Street Address: 88 Duryea Road			P.O. Box:
City or Village: Melville		State: NY	ZIP Code: 11747
Telephone: (631) 249-7600	FAX: (631) 249-7610	E-Mail or Internet: gnetusch@gmgw.com	
Name and Title of person responsible for signing DMRs: Glenn Netuschil Project Engineer		Signature:	

INDUSTRIAL APPLICATION FORM NY-2C
Section I - Permittee and Facility Information

Facility Name:	SPDES Number:
Colesville Groundwater Treatment Facility	

7. Summarize the outfalls present at the facility:

Outfall Number	Receiving Water	Type of discharge
1	North Stream	Effluent from Groundwater Remediation System.

8. Map of Facility and Discharge Locations:
Provide a detailed map showing the location of the facility, all buildings or structures present, wastewater discharge systems, outfall locations into receiving waters, nearby surface water bodies, water supply wells, and groundwater monitoring wells, and attach it to this application. Also submit proof, either by indication on the map or other documentation, that a right of way for the discharges exists from the facility property to a public right of way.

9. Water Flow Diagram:

See attached Figure 3.

INDUSTRIAL APPLICATION FORM NY-2C
Section I - Permittee and Facility Information

Facility Name:	SPDES Number:
Colesville Groundwater Treatment Facility	

10. Nature of business: (Describe the activities at the facility and the date(s) that operation(s) at the facility commenced)

Proposed treatment facility will consist of groundwater treatment system comprised of one (1) low profile air stripper. Treatment system operation is planned to begin in September, 2000.

11. List the 4-digit SIC codes which describe your facility in order of priority:

Priority	Description:	Priority	Description:
Priority 1		Priority 3	
Priority 2		Priority 4	

12. Is your facility a primary industry as listed in Table 1 of the Instructions?

[ ] YES - Complete the following table.

[X] NO - Go to item 13. below.

Industrial Category	40 CFR		Industrial Category	40 CFR	
	Part	Subpart		Part	Subpart

13. Does this facility manufacture, handle, or discharge recombinant-DNA, pathogens, or other potentially infectious or dangerous organisms?

[ ] YES - Attach a detailed explanation to this application.

[X] NO - Go to item 14 below.

14. Is storm runoff or leachate from a material storage area discharged by your facility?

[ ] YES - Complete the following table, and show the location of the stockpile(s) and discharge point(s) on the diagram in item 9.

[X] NO - Go to item 15 on the following page.

Size of area	Type(s) of material stored	Quantity of material stored	Runoff control devices

INDUSTRIAL APPLICATION FORM NY-2C
Section I - Permittee and Facility Information

Facility Name: Colesville Groundwater Treatment Facility	SPDES Number:

15. Facility Ownership: (Place an "X" in the appropriate box)

Corporate [ ] Sole Proprietorship [ ] Partnership [ ] Municipal [X] State [ ] Federal [ ] Other [ ]

Are any of the discharges applied for in this application on Indian lands? Yes [ ] No [ ]

16. List information on any other environmental permits for this facility:

Issuing Agency	Permit Type	Permit Number	Permit Status		
			Active	Applied for	Inactive
NYSDEC	Air			X	

17. Laboratory Certification:

Were any of the analyses reported in Section III of this application performed by a contract laboratory or a consulting firm?

[ ] YES - Complete the following table.

[ ] NO - Go to Item 18 below.

Name of laboratory or consulting firm	Address	Telephone (area code and number)	Pollutants analyzed

18. Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name and official title (type or print)		Date signed
Glenn Netuschil		
Signature	Telephone number: 631-249-7600	FAX number: 631-249-7610

INDUSTRIAL APPLICATION FORM NY-2C
Section I - Permittee and Facility Information

Facility Name: Colesville Groundwater Treatment Facility	SPDES Number:

19. Industrial Chemical Survey (ICS)

Complete all information for those substances your facility has used, produced, stored, distributed, or otherwise disposed of in the past five (5) years at or above the threshold values listed in the instructions. Include substances manufactured at your facility, as well as any substances that you have reason to know or believe present in materials used or manufactured at your facility. Do not include chemicals used only in analytical laboratory work, or small quantities of routine household cleaning chemicals. Enter the name and CAS number for each of the chemicals listed in Tables 6-10 of the instructions, and the table number which lists the chemical. You may use ranges (e.g. 10-100 lbs., 100-1000 lbs., 1000-10000 lbs., etc.) to describe the quantities used on an annual basis as well as for the amount presently on hand. For those chemicals listed in Tables 6, 7, or 8 which are indicated as being potentially present in discharge from one or more outfalls at the facility, indicate which outfalls may be affected in the appropriate column below, and include sampling results in Section III of this application for each of the potentially affected outfalls. Make additional copies of this sheet if necessary.

Name of Substance	Table	CAS Number	Average Annual Usage	Amount Now On Hand	Units (gallons, lbs, etc)	Purpose of Use (see codes in Table 2 of Instructions)	Present in Discharge? (Outfall(s)?)
Not Applicable	New	Facility					

This completes Section I of the SPDES Industrial Application Form NY-2C. Section II, which requires specific information for each of the outfalls at your facility, and Section III, which requires sampling information for each of the outfalls at your facility, must also be completed and submitted with this application.

State Pollutant Discharge Elimination System (SPDES)

INDUSTRIAL APPLICATION FORM NY-2C

For New Permits and Permit Modifications to Discharge Industrial Wastewater and Storm Water

Section II - Outfall Information

Please type or print the requested information.

Facility Name:	SPDES Number:
Colesville Groundwater Treatment Facility	

1. Outfall Number and Location

Outfall No.: 001		
Latitude ° ' "	Longitude ° ' "	Receiving Water: North Stream

2. Type of Discharge and Discharge Rate (List all information applicable to this outfall)

	Volume/Flow	Units: MGD	Units: GPM	Units: Other (specify)		Volume/Flow	Units: MGD	Units: GPM	Units: Other (specify)
a. Process Wastewater					f. Noncontact Cooling Water				
b. Process Wastewater					g. Remediation System Discharge	1		X	
c. Process Wastewater					h. Boiler Blowdown				
d. Process Wastewater					i. Storm Water				
e. Contact Cooling Water					j. Sanitary Wastewater				
k. Other discharge (specify):									
l. Other discharge (specify):									

3. List process information for the Process Wastewater streams identified in 2.a-d above:

a. Name of the process contributing to the discharge			Process SIC code:
Describe the contributing process	Category / Subcategory	Quantity per day	Units of measure
b. Name of the process contributing to the discharge			Process SIC code:
Describe the contributing process	Category / Subcategory	Quantity per day	Units of measure
c. Name of the process contributing to the discharge			Process SIC code:
Describe the contributing process	Category / Subcategory	Quantity per day	Units of measure
d. Name of the process contributing to the discharge			Process SIC code:
Describe the contributing process	Category / Subcategory	Quantity per day	Units of measure

4. Expected or Proposed Discharge Flow Rates for this outfall:

a. Total Annual Discharge	b. Daily Minimum Flow	c. Daily Average Flow	d. Daily Maximum Flow	e. Maximum Design flow rate
.526 MG	4.75×10^{-4} MGD	1.44×10^{-3} MGD	2.39×10^{-3} MGD	2.39×10^{-3} MGD

INDUSTRIAL APPLICATION FORM NY-2C
Section II - Outfall Information

	Outfall No.: 001
Facility Name: Colesville Groundwater Treatment Facility	SPDES Number:

5. Is this a seasonal discharge?

[ ] YES - Complete the following table.

[X] NO - Go to Item 6 below.

Operations contributing flow (list)	Discharge frequency		Flow				
	Batches per year	Duration per batch	Flow rate per day LTA	Flow rate per day Daily Max	Total volume per discharge	Units	Duration (Days)

6. Water Supply Source (Indicate all that apply)

	Name or owner of water supply source	Volume or flow rate	Units (check one)		
Municipal Supply			MGD	GPD	GPM
Private Surface Water Source	Broome County Division of Solid Waste Management	1	MGD	GPD	X GPM
Private Supply Well			MGD	GPD	GPM
Other (specify)			MGD	GPD	GPM

7. Outfall configuration: (Surface water discharges only)

A. Where is the discharge point located with respect to the receiving water?

In the streambank: [ ]

In the stream: [ ]

Within a lake or ponded water: [ ]

Within an estuary: [ ] Attach Supplement C, MIXING ZONE REQUIREMENTS FOR DISCHARGES TO ESTUARIES.

Discharge is equipped with diffuser: [ ] Attach description, including configuration and plan drawing of diffuser, if used.

Other: X Discharge to Swale which intersects North Stream

B. If located in a stream, approximately what percentage of stream width from shore is the discharge point located?

10% [ ] 25% [ ] 50% [ ] Other: [X] Discharge point is approx. 200 feet from North Stream.

C. If located in a stream, describe the stream geometry in the general vicinity of the discharge point, under low flow conditions:

Stream width	Stream depth	Stream velocity
Feet	Feet	Feet/Sec

Are the results of a mixing/diffusion study attached? [ ] YES [X] NO

INDUSTRIAL APPLICATION FORM NY-2C
Section II - Outfall Information

Outfall No.: 001
SPDES Number:

Facility Name:
Colesville Groundwater Treatment Facility

8. Thermal Discharge Criteria

Is your facility one of the applicable types of facilities listed in the instructions, and does the temperature of this discharge exceed the receiving water temperature by greater than three (3) degrees Fahrenheit?

[ ] YES - Complete the following table.

[ ] Information on the intake and discharge configuration of this outfall is attached.

[X] NO - Go to Item 9. below.

Discharge Temperature, deg. F			Duration of maximum discharge temperature		Dates of maximum discharge temperature		Maximum flow rate	Discharge configuration (e.g. subsurface, surface, effluent diffuser, diffusion well, etc.)
Average change in temperature (delta T)	Maximum change in temperature (delta T)	Maximum temperature	hours per day	days per year	From	To	MGD	

9. Are any water treament chemicals or additives that are used by your facility subsequently discharged through this outfall?

[ ] YES - Complete the following table and complete pages 1 of 3 and 2 of 3 of Form WTCFX for each water treatment chemical listed.

[X] NO - Go to Item 10. below.

Manufacturer	WTC trade name	Manufacturer	WTC trade name

10. Has any biological test for acute or chronic toxicity been performed on this outfall or on the receiving water in relation to this outfall in the past three (3) years?

[ ] YES - Complete the following table.

[X] NO - Go to Item 11. on the following page.

Water tested	Purpose of test	Type of test	Chronic or Acute?	Subject species	Testing date(s)		Submitted? (Date)
					Start	Finish	

INDUSTRIAL APPLICATION FORM NY-2C
Section II - Outfall Information

Facility Name:	Outfall No.: 001
Colesville Groundwater Treatment Facility	SPDES Number:

11. Is the discharge from this outfall treated to remove process wastes, water treatment additives, or other pollutants?

[X] YES - Complete the following table. Treatment codes are listed in Table 4.

[ ] NO - Go to Item 12 below.

Treatment process	Treatment Code(s)	Treatment used for the removal of:	Design Flow Rate (include units)
Recovered Groundwater is treated by one (1) low profile air stripper and seven (7) bag filters	1-Y	Chlorinated Solvent Total Iron	1 GPM

12. Does this facility have either a compliance agreement with a regulating agency, or have planned changes in production, which will materially alter the quantity and/or quality of the discharge from this outfall?

[X] YES - Complete the following table.

[ ] NO - Go to Section III on the following page.

Description of project	Subject to Condition or Agreement in existing permit or consent order? (List)	Change due to production increase?	Completion Date(s)	
			Required	Projected
NYSDEC Consent Order	#T010687			9/00

This completes Section II of the SPDES Industrial Application Form NY-2C. Section I, which requires general information regarding your facility, and Section III, which requires sampling information for each of the outfalls at your facility, must also be completed and submitted with this application.

INDUSTRIAL APPLICATION FORM NY-2C
Section III - Sampling Information

Facility Name:	SPDES No.:	Outfall No.:
Colesville Groundwater Treatment Facility		001

1. Sampling Information - Conventional Parameters

Provide the analytical results of at least one analysis for every pollutant in this table. If this outfall is subject to a waiver as listed in Table 5 of the instructions for one or more of the parameters listed below, provide the results for those parameters which are required for this type of outfall.

[illegible]

Pollutant	Concentration	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
a. Biochemical Oxygen Demand 5 day (BOD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
b. Chemical Oxygen Demand (COD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
c. Total Suspended Solids (TSS)	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
d. Total Dissolved Solids (TDS)	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
e. Oil & Grease	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
f. Chlorine, Total Residual (TRC)	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
g. Total Organic Nitrogen (TON)	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
h. Ammonia (as N)	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
i. Flow	Value 2.39×10^{-3} MG		Value 7.17×10^{-2} MG		Value 2.151 MG		N/A			Value		
j. Temperature, winter	Value N/A		Value N/A		Value N/A		N/A			Value		
k. Temperature, summer	Value N/A		Value N/A		Value N/A		N/A			Value		
l. pH	Minimum N/A	Maximum N/A	Minimum N/A	Maximum N/A			N/A			Minimum	Maximum	

2. Sampling Information - Priority Pollutants, Toxic Pollutants, and Hazardous Substances

a. Primary Industries: i. Does the discharge from this outfall contain process wastewater?

- [ ] **Yes** - Go to item ii. below.
- [X] **No** - Go to item b. below.

ii. Indicate which GC/MS fractions have been tested for: Volatiles: [ ] Acid: [ ] Base/Neutral: [ ] Pesticide: [ ]

b. All applicants: i. Do you know or have reason to believe that any of the pollutants listed in Tables 6, 7, or 8 of the instructions are present in the discharge from this outfall?

- [X] **Yes** - Concentration and mass data attached.
- [ ] **No** - Go to item ii. below.

ii. Do you know or have reason to believe that any of the pollutants listed in Table 9 or Table 10 of the instructions, or any other toxic, harmful, or injurious chemical substances not listed in Tables 6-10, are present in the discharge from this outfall?

- [ ] **Yes** - Source or reason for presence in discharge attached
- [ ] **Yes** - Quantitative or qualitative data attached
- [X] **No**

INDUSTRIAL APPLICATION FORM NY-2C
Section III - Sampling Information

Facility Name:	SPDES No.:	Outfall No.:
Colesville Groundwater Treatment Facility		001

3. Projected Effluent Quality - Priority Pollutants, Toxic Pollutants, and Hazardous Substances

Provide analytical results of at least one analysis for each pollutant that you know or have reason to believe is present in this discharge, as well as for any GC/MS fractions and metals required to be sampled from Section III Forms, Item 2.a on the preceding page.

List the name and CAS number for each pollutant that you know or have reason to believe is present in the discharge from this outfall. [illegible] as necessary for each outfall. Page of

Pollutant and CAS Number	Effluent data							Units		Intake (optional)			[illegible]
	a. Maximum daily value		b. Maximum 30 day value [illegible]		c. Long term avg. value [illegible]		d. Number of analyses	a. [illegible]	b. Mass	a. Long term average value		b. Number of analyses	
	(1) Concentration	(2) Mass	(1) Concentration	(2) Mass	(1) Concentration	(2) Mass				(1) Concentration	(2) Mass		
Tetrachloroethylene CAS Number: 00127-18-4	<1	N/A	<1	N/A	<1	N/A		ug/l					
Trichloroethylene CAS Number: 00079-01-6	<1	N/A	<1	N/A	<1	N/A		ug/l					
Methyl Chloroform CAS Number: 00071-55-6	<1	N/A	<1	N/A	<1	N/A		ug/l					
1,1 - Dichloroethane CAS Number: 00075-34-3	<1	N/A	<1	N/A	<1	N/A		ug/l					
Chloroform CAS Number: 00067-66-3	<1	N/A	<1	N/A	<1	N/A		ug/l					
Methylene Chloride CAS Number: 00075-09-2	<1	N/A	<1	N/A	<1	N/A		ug/l					
CES 1, 2 - Dichloroethylene CAS Number: 00156-59-2	<1	N/A	<1	N/A	<1	N/A		ug/l					
CAS Number:													
CAS Number:													
CAS Number:													
CAS Number:													
CAS Number:													
CAS Number:													

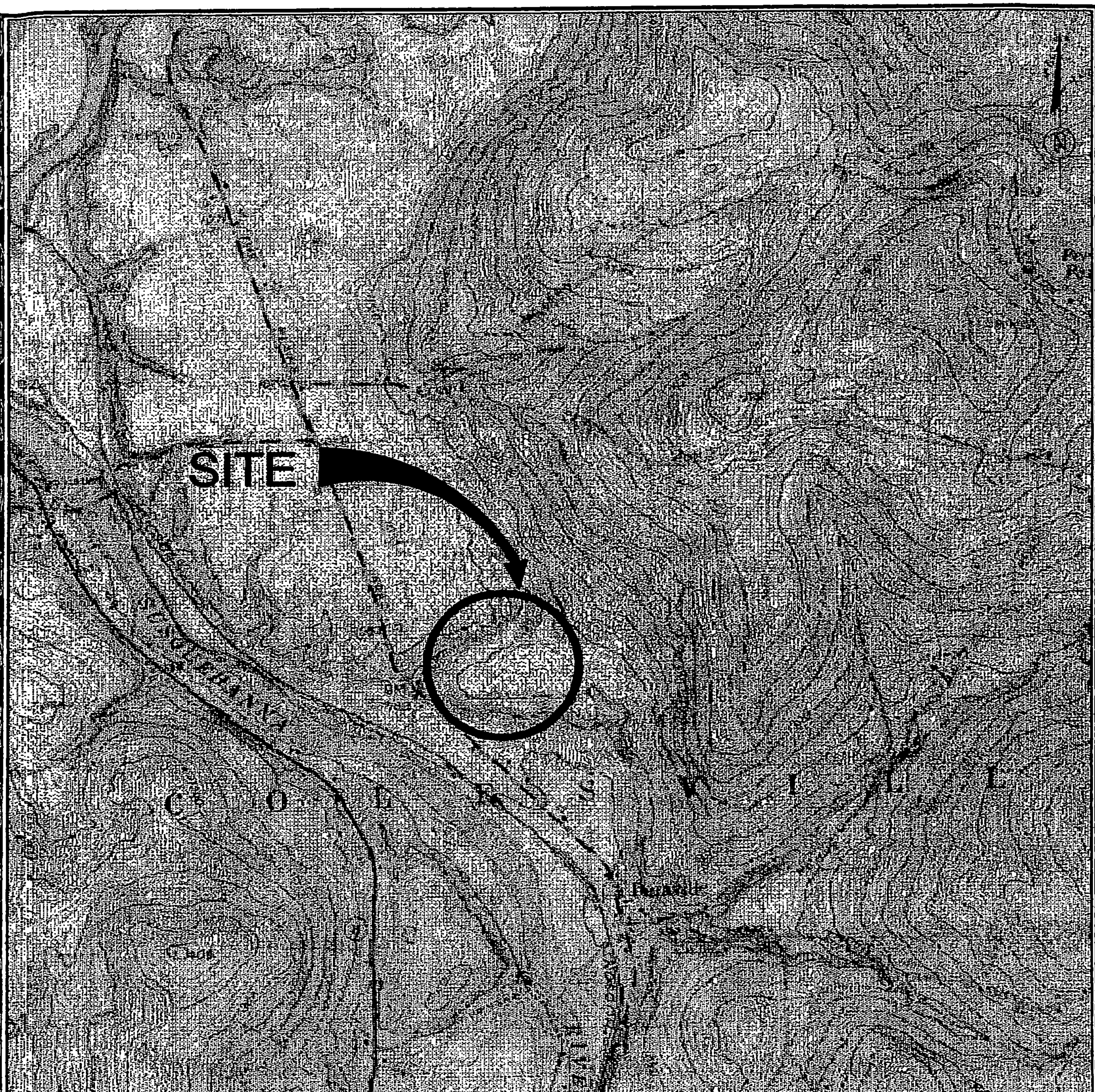
INDUSTRIAL APPLICATION FORM NY-2C
Section III - Sampling Information

Facility Name:	SPDES No.:	Outfall No.:
Colesville Groundwater Treatment Facility		001

4. Existing Effluent Quality - Priority Pollutants, Toxic Pollutants, and Hazardous Substances

Provide analytical results for the last three (3) years for each pollutant that you know or have reason to believe present in this discharge from this outfall, as well as for any GC/MS fractions and metals required to be sampled from Section III Forms, Item 2.a for this discharge.

Make as many copies of this table as [illegible] each [illegible]		Parameter name:	Parameter name:	Parameter name:	Parameter name:	Parameter name:	Parameter name:	Parameter name:
Page	Of	CAS Number:	CAS Number:	CAS Number:	CAS Number:	CAS Number:	CAS Number:	CAS Number:
Date	Flow rate	Concentration	Concentration	Concentration	Concentration	Concentration	Concentration	Concentration
	Units:	Units:	Units:	Units:	Units:	Units:	Units:	Units:
None Available - New Facility								



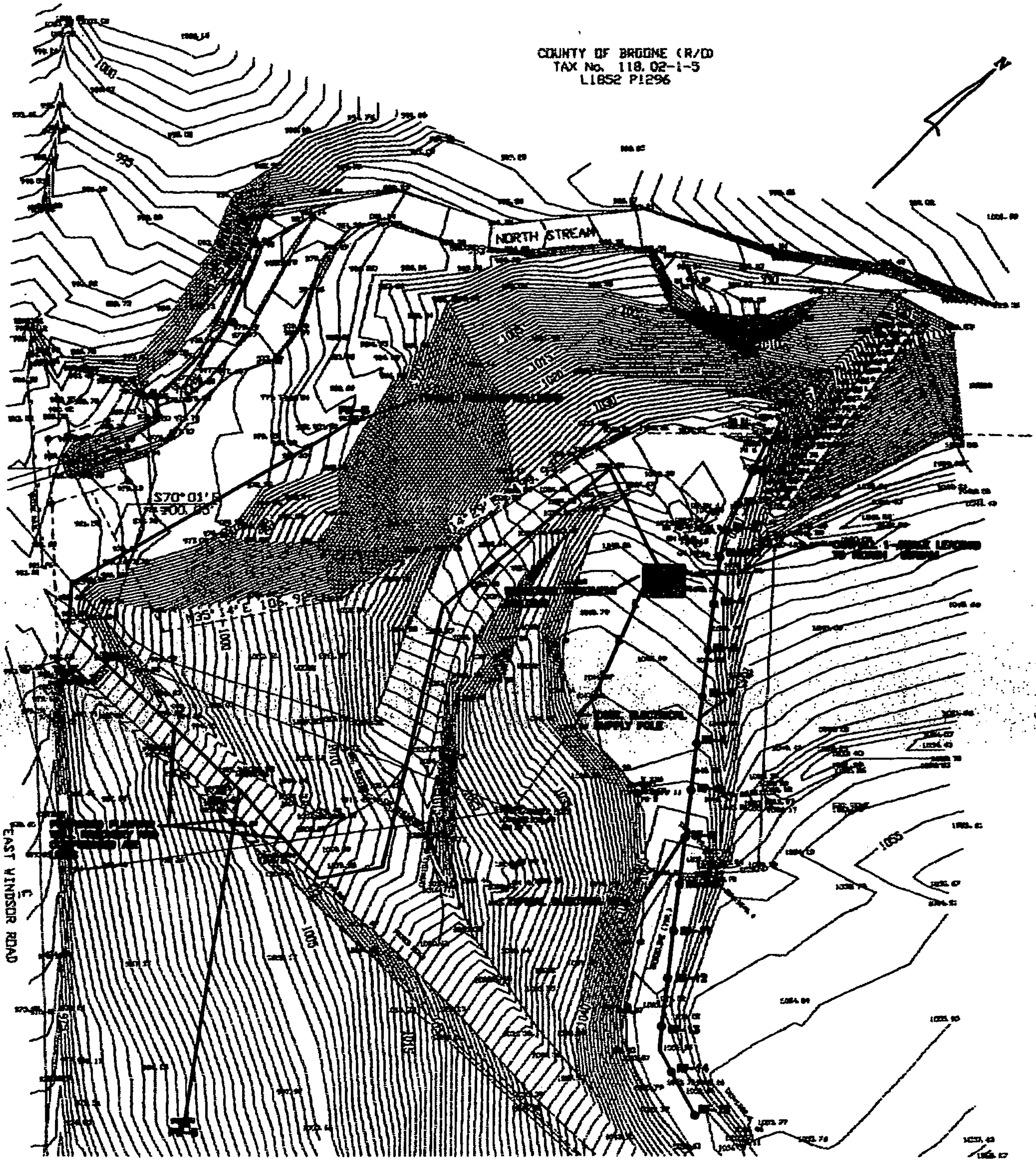
SOURCE: U.S.G.S. QUADRANGLES, 7.5 MINUTE SERIES,AFTON, N.Y. , REVISED 1957.

SCALE: 1" = 1,000'-0"

NO.	DATE	REVISION DESCRIPTION	BY / CKD

ARCADIS GERAGHTY & MILLER

DRAWN AG	DATE 1/25/00	PROJECT MANAGER SF	DEPARTMENT MANAGER
SITE LOCATION MAP		LEAD DESIGN PROF. GN	CHECKED KZ
COLESVILLE LANDFILL COLESVILLE, NEW YORK		PROJECT NUMBER NY0949.013	DRAWING NUMBER 1



SCALE: 1"=140'-0"

NO.	DATE	REVISION DESCRIPTION	BY / CKD

ARCADIS GERAGHTY&MILLER

DRAWN KZ	DATE 1/24/00	PROJECT MANAGER SF	DEPARTMENT MANAGER
SITE PLAN		LEAD DESIGN PROF. GN	CHECKED KZ
COLESVILLE LANDFILL COLESVILLE, NEW YORK		PROJECT NUMBER NY0949.0013	DRAWING NUMBER 2

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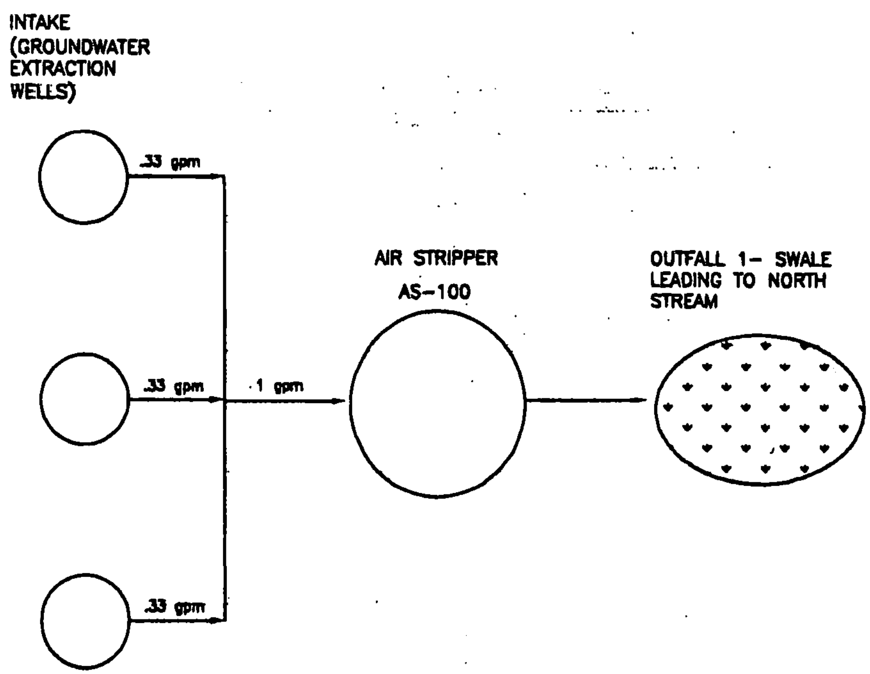
G:\APROJECT\GRUMMAN\CADD\GRUMMAN\FIGURE1B.DWG 1=2000



ARCADIS GERAGHTY&MILLER

GROUNDWATER REMEDIATION SYSTEM
COLESVILLE, NEW YORK

WATER FLOW DIAGRAM
SPDES DISCHARGE PERMIT

NY000949.0013

3

NO.	DATE	REVISION DESCRIPTION	BY CK

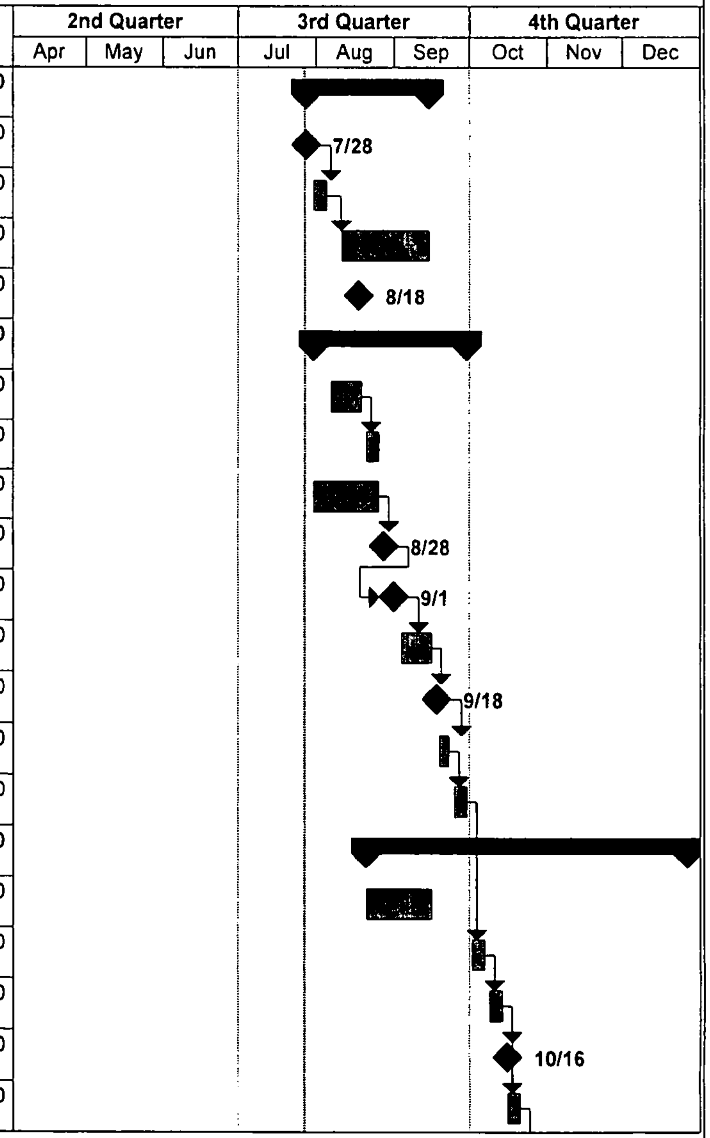
ARCADIS GERAGHTY & MILLER

Appendix F

Final Design and Construction Schedule

Final Design and Construction Schedule for the Groundwater Remediation System, Colesville Landfill, Broome County, New York.

ID	Task Name	Duration	Start	Finish
1	**Revise Engineering Drawings and Design Report**	**35d**	**Fri 7/28/00**	**Thu 9/14/00**
2	Professional Engineer Stamped Design Submitted to NYSDEC	1d	Fri 7/28/00	Fri 7/28/00
3	Apply for SPDES and Air Permits	5d	Mon 7/31/00	Fri 8/4/00
4	USEPA Issuance for ESD	25d	Fri 8/11/00	Thu 9/14/00
5	NYSDEC Approval of Design	1d	Fri 8/18/00	Fri 8/18/00
6	**Contractor Selection**	**45d**	**Mon 7/31/00**	**Fri 9/29/00**
7	Public Notice Period for Solicitation of Bidders	10d	Mon 8/7/00	Fri 8/18/00
8	Contractor List Selected	5d	Mon 8/21/00	Fri 8/25/00
9	Contractor Bid Package Prepared	20d	Mon 7/31/00	Fri 8/25/00
10	Bid Packages Submitted to Contractors	1d	Mon 8/28/00	Mon 8/28/00
11	Site walk with Contractors	1d	Fri 9/1/00	Fri 9/1/00
12	Bid preparation by Contractors	10d	Mon 9/4/00	Fri 9/15/00
13	Bid Submitted by Contractors	1d	Mon 9/18/00	Mon 9/18/00
14	Bid review and Contractor selection	4d	Tue 9/19/00	Fri 9/22/00
15	Sign contract	5d	Mon 9/25/00	Fri 9/29/00
16	**System Construction**	**92d**	**Mon 8/21/00**	**Tue 12/26/00**
17	Start Well Drilling	20d	Mon 8/21/00	Fri 9/15/00
18	General Contractor Shop Drawing Submittal	5d	Mon 10/2/00	Fri 10/6/00
19	Review and Approval of Shop Drawings	5d	Mon 10/9/00	Fri 10/13/00
20	Procurement of Equipment	1d	Mon 10/16/00	Mon 10/16/00
21	General Contractor Mobilization	5d	Mon 10/16/00	Fri 10/20/00



Project: Colesville Landfill
Date: Thu 7/27/00

Task | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Milestone | Rolled Up Progress

Final Design and Construction Schedule for the Groundwater Remediation System, Colesville Landfill, Broome County, New York.

ID	Task Name	Duration	Start	Finish	2nd Quarter: Apr	May	Jun	3rd Quarter: Jul	Aug	Sep	4th Quarter: Oct	Nov	Dec
22	Site Work	45d	Mon 10/23/00	Fri 12/22/00									
23	Contractor Demobilization	2d	Mon 12/25/00	Tue 12/26/00									

Project: Colesville Landfill
Date: Thu 7/27/00

Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress

File on eDOCs X Yes ____ No
Site Name Colesville
Site No. 704010
County Broome
Town Colesville
Foilable X Yes ____ No
File Name 2000-08-24 . GW Engineering Report
Scanned & eDOC ____ ____