FOCUSED REMEDIAL INVESTIGATION
DELPHI HARRISON THERMAL SYSTEMS
WEST LOCKPORT COMPLEX
LOCKPORT, NEW YORK
NYSDEC REGISTRY SITE # 932113

PREPARED FOR:
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1.0 INTRODUCTION

This report presents results of the Focused Remedial Investigation (FRI) done by GZA GeoEnvironmental of New York (GZA) for Delphi Harrison Thermal Systems (Delphi Thermal). Delphi Thermal has voluntarily been assessing a release of trichloroethylene (TCE) at the Delphi Thermal West Lockport Complex, in coordination with the New York State Department of Environmental Conservation (NYSDEC), following the discovery of the release in November 1994. The NYSDEC assigned the incident Spill Number 9410972. The Site is a Class 3 NYSDEC Inactive Hazardous Waste Disposal Site and was added to the NYSDEC Registry on March 30, 1999 as Site Number 932113. A Site Locus Plan is included as Figure 1 and a Site Plan is included as Figure 2.

The FRI was conducted under the Focused Remedial Investigation/Focused Feasibility Study (FRI/FFS) Order on Consent Index # B9-0553-99-066 between NYSDEC and Delphi Thermal and the incorporated FRI/FFS Work Plan dated April 2001.

Interpretations presented within this report are based primarily on the investigations described herein. Data and results from previous investigations are also presented to provide background to the investigation.

1.1 REPORT ORGANIZATION

The text of this report is divided into seven sections. Immediately following the text are the references, tables, figures, and appendices. A brief summary of each report section is provided below.

- **Section 1.0 Introduction:** The Site background including Site description, Site history and summary of previous studies; purpose of the FRI Report; and scope of work are discussed.

- **Section 2.0 Field Explorations:** Summarizes the field work conducted including test borings, monitoring well installations, water level measurements, health and safety and community air monitoring, environmental sampling, natural attenuation parameter monitoring, and well inventory and sump and basement assessment.

- **Section 3.0 Physical Characteristics of the Site:** Presents and interprets the various data collected and evaluates Site conditions (e.g., hydrogeology, geology, hydrology, etc.).

- **Section 4.0 Nature and Extent of Contamination:** The types of chemicals detected in the groundwater ~~and~~ are discussed. Subsections include contaminant types, source area identification, and groundwater conditions.

- **Section 5.0 Contaminant Fate and Transport:** An evaluation of the potential and observed migration pathways, contaminant persistence and predicted extent of contamination is presented.

- **Section 6.0 Qualitative Exposure Assessment:** Presents the results of a general human health exposure assessment conducted for the Site.

- **Section 7.0 Summary and Conclusions:** Summarizes the results and findings of the FRI and presents recommended remedial action objectives to be incorporated in the FFS.

1.2 BACKGROUND

1.2.1 Site Description

Delphi Thermal owns and operates an automotive component manufacturing complex in Lockport, New York. The complex consists of three plants (see Figure 1). Building 8 is located in the north central portion of the complex and has housed degreasing operations, which used TCE. An aboveground storage tank, which held TCE, was located at the southeast corner of Building 8 and is identified as the area of concern (AOC) (see Figure 2). TCE is no longer used at the Site.

The AOC is defined as the area of the former secondary containment structure associated with the former TCE aboveground tank. This area is approximately 27 by 22 feet in size. The AOC is situated between Building 8 to the north and west and a concrete steam chase to the east. The concrete in-ground utility chamber (steam chase) is believed to extend to bedrock (approximately 7 to 8 feet below the ground surface (bgs)). An equipment storage area is located to the south.

A water-cooling tower is located approximately 130 feet southeast of the AOC. The plant perimeter fence is located approximately 80 feet to the east of the AOC. Further to the east is an employee parking area, which slopes down to the east. The nearest public property is Route 93 located approximately 1200 feet to the east. The Delphi Thermal wastewater treatment plant is located east of Route 93.

There are two significant regional features that may affect groundwater flow at the AOC. The Niagara Escarpment is located approximately one-half mile northeast of the AOC. It is an east-west trending rock ledge, which marks the boundary between two physiographic regions. The crest of the escarpment is approximately 200 feet higher than the Lake Ontario Plain located to the north. The Niagara Escarpment is notched by a northeast to southwest trending gorge, which is known locally as “The Gulf”. The Gulf is located just east of the Delphi Thermal wastewater treatment plant. The difference in elevation between the crest and base of the Gulf is approximately 110 feet. The Gulf is further discussed in Section 3.4.

The second feature is a stone quarry located approximately 1 mile south of the AOC. It is understood that dewatering occurs at the quarry to facilitate mining operations. The base of the quarry is at an elevation approximately 60 feet below the surface elevation of the AOC.

The nearest surface water body to the AOC is a drainage swale, which carries plant runoff from an outfall. This swale is approximately 800 feet to the east and flows east, discharging to an onsite stream, which flows to the north. This onsite stream enters the Delphi Thermal Site from the southern property boundary. The onsite stream joins with the drainage swale, near MW-12 and crosses beneath Route 93 and flows down over a 30 to 35 ft high waterfall into The Gulf at a location north of the wastewater treatment plant.

1.2.2 Site History

The aboveground TCE storage tank was closed in May 1994. This tank was situated within a concrete containment dike with a concrete bottom. Prior to the installation of this tank, a previous "old" TCE tank was located about 35 feet to the south of the former containment area. It is believed by Delphi Thermal that the aboveground TCE storage tank and the “old” tank were the same tank. The fill port for one or both tanks was located at the southeast corner of Building 8. TCE is no longer in used at the Site.

Tetrachloroethylene (PCE) was also used as a degreasing solvent at the Delphi Thermal facility. Use of PCE as a manufacturing solvent was discontinued in 1992. In March 1994, PCE use was discontinued on the entire plant Site. In addition, PCE is sometimes found as an impurity within commercial TCE.

An underground gasoline storage tank was formerly located next to Building 8 near the former TCE tank. Delphi Thermal is not aware of any documented spills in the vicinity of the AOC. Research indicates that the tank was removed in June of 1980.

Four fire protection lines exist beneath the former TCE storage tank area at a depth of about 6 feet below ground surface (bgs). One of these pipes ruptured and flooded the area in October 1994. During excavation to repair the rupture, personnel working in the AOC noted a solvent odor. Subsequently, soils from an approximate 27 by 22-foot area were excavated to a depth of about 7.5 feet bgs and disposed by Delphi Thermal as a hazardous waste. Four soil samples were collected from the bottom of the excavation. TCE was measured at concentrations ranging between 0.38 mg/kg and 1800 mg/kg in the soil samples collected. The excavation was then backfilled with a manufactured crushed stone product. NYSDEC was notified of the release and assigned the incident Spill Number 9410972.

Written correspondence between the NYSDEC and Delphi Thermal (as General Motors Corporation, Harrison Division) regarding Spill Number 9410972 includes the following.

- Letter from NYSDEC to Harrison Division, General Motors Corporation dated December 2, 1994.

- Letter from Harrison Division, General Motors Corporation to NYSDEC dated December 22, 1994.

- Letter from Delphi Automotive Systems to NYSDEC dated April 13, 1995.

Copies of the noted correspondence are included in Appendix A.

1.2.3 Site Investigations

1.2.3.1 Summary of Investigations

Following the removal of the impacted soil and filling of the excavated area, Delphi Thermal retained GZA to provide environmental consulting services to investigate the AOC. Work plans were prepared and reviewed by the NYSDEC prior to the start of investigation activities. This section provides a summary of the investigations at the AOC and subsequent groundwater monitoring sampling events.

During the first Phase, GZA completed the following tasks.

- Reviewed existing data provided by Delphi Thermal.

- Developed a Sampling and Analysis Plan (SAP) and a Health and Safety Plan (HASP).

- Completed soil probes and collected samples of soil and utility bedding material (August - September 1995 and April 1996). Table 1 presents the analytical data for unsaturated soil samples and Table 2 contains the data for saturated soil samples (see Figure 3 for locations). Results from these sampling events indicated the presence of chlorinated volatile organics, petroleum related organics, and 2-butanone.

- Conducted a soil gas survey along buried utilities (August - September 1995). Table 3 presents the results from the investigation (See Figure 3 for locations).

- Installed shallow groundwater monitoring wells MW-1 (August 1995), MW-2 (August 1995), MW-3 (August 1995), MW-4 (April 1996), MW-5 (April 1996), MW-6 (April 1996) and MW-7 (April 1996).

- Installed deep groundwater monitoring well MW-3D (December 1995 through January 1996).

- Abandoned monitoring well MW-1 (December 1995) and installed replacement monitoring well MW-7 (April 1996).

- Abandoned monitoring well MW-2 (December 1995). No replacement well was required.

- Analytical testing of soil and groundwater samples.

The locations of Site monitoring wells are shown on Figure 2.

The key findings of the above described work, between August 1995 and April 1996, include the following:

- VOCs were detected in groundwater and subsurface soil in the immediate vicinity of the AOC above respective NYSDEC drinking water standards and soil cleanup guidance values. These contaminants included TCE and its breakdown products.

- The contaminant levels generally decrease with distance from the reported spill area.

- The extent of soil contamination was defined and it was found to be limited to the immediate area around the AOC.

- Utility beddings were not found to be providing a significant pathway for migration of contamination.

- Shallow bedrock groundwater is impacted with TCE and its breakdown products. The extent of shallow bedrock groundwater contamination downgradient (to the east) was not determined.

- Deep bedrock groundwater, at monitoring well MW-3D, was not found to be impacted by the AOC.

- DNAPL exists in the shallow bedrock in the area of monitoring well MW-5.

These studies were documented in GZA's September 11, 1996 report, which was forwarded to NYSDEC. Based on recommendations in this report, GZA conducted additional studies to further assess the horizontal extent of shallow bedrock groundwater contamination east of the AOC. The following is a summary of the work conducted.

- October 1996 – Work included the installation, hydraulic conductivity testing, and surveying of three monitoring wells (MW-8, MW-9 and MW-10); and, water level measurements, sampling and analysis of groundwater samples from these three wells and selected existing wells.

- August 1997 – Work included the installation, hydraulic conductivity testing, and surveying of two monitoring wells (MW-11 and MW-12); and water level measurements, sampling and analysis of groundwater samples from these two wells selected existing wells.

As requested by NYSDEC in an October 21, 1998 letter to Delphi Thermal, additional analytical testing was conducted to further assess natural attenuation processes at the Site. Two additional sample rounds were conducted in December 1998 and October 1999.

- December 1998 – Work included the sampling and analysis of groundwater samples from nine existing wells. Analytical test parameters included target VOCs and parameters associated with the evaluation of natural attenuation.

- October 1999 - Work included the sampling and analysis of groundwater samples from nine existing wells and one background upgradient well (TK-2). (See Figure 1 for the location of well TK-2). Analytical test parameters included target VOCs and parameters associated with the evaluation of natural attenuation. The upgradient well was tested for chloride and alkalinity only to confirm background concentrations for these parameters.

The results of these sampling events indicated that conditions conducive to and supporting natural attenuation exist at the Site. The results of the December 1998 sampling are contained in GZA's May 1999 report. The results of the October 1999 sampling are contained in GZA's August 2000 report.

In addition, as required by the FRI/FFS Work Plan, two additional groundwater sample rounds were conducted in August 2001 and October 2001.

- August 2001 – Work included the installation, hydraulic conductivity testing, and surveying of three monitoring wells (MW-13, MW-14 and MW-15); and water level measurements and sampling and analysis of groundwater samples from these three wells and select existing wells. Analytical test parameters included target VOCs and parameter associated with the evaluation of natural attenuation.

- October 2001 – Work included the sampling and analysis of groundwater samples from eight existing wells. Analytical test parameters included target VOCs and parameters associated with the evaluation of natural attenuation.

The results of these sampling events further indicated that conditions conducive to and supporting natural attenuation exist at the Site. The results of these sample rounds are contained in GZA's October 2001 and December 2001 reports, respectively.

Following NYSDEC and NYSDOH review of the October 2001 sample round data, NYSDEC suggested that Delphi Thermal proceed with the FRI report in a letter dated February 8, 2002. Copies of the noted correspondence are included in Appendix A.

1.2.3.2 Groundwater Sampling Project Documents

GZA has conducted twelve groundwater sample rounds at the Site (September 1995, October 1995, May 1996, June 1996, October 1996, November 1996, August 1997, October 1997, December 1998, October 1999, August 2001 and October 2001). Major project documents submitted and reviewed by NYSDEC included the following:

- Sampling and Analysis Plan, Phase III Extent of Contamination Study, August 1995.
- Addendum to Sampling and Analysis Plan, Phase III Extent of Contamination Study, February 1996.
- Phase III Extent of Contamination Study, September 1996.
- Supplemental Phase III Extent of Contamination Studies and Evaluation of Alternatives, February 1997.
- Supplemental Phase III Extent of Contamination Studies Data Report, May 1998.
- Supplemental Phase III Extent of Contamination Studies Data Report (December 1998 Sample Round), May 1999.
- Supplemental Phase III Extent of Contamination Studies Data Report (October 1999 Sample Round), August 2000.
- Supplemental Groundwater Sampling Data Report (August 2001 Sample Round), October 2001.
- Supplemental Groundwater Sampling Data Report (October 2001 Sample Round), December 2001.

1.2.4 Agency Involvement

NYSDEC became involved in 1994 when Delphi Thermal informed them about the TCE release in the AOC. Site investigations pertaining to the TCE release have been done in coordination with the NYSDEC since 1994, starting with assigning the incident Spill number 9410972. The Site was then added to the NYSDEC Registry on March 30, 1999 as Site Number 932113. The Site was given a classification 3 (does not present a significant threat to the public health or the environment – action may be deferred) by the NYSDEC.

Delphi Thermal has voluntarily conducted investigation activities from 1994 through 2001, as described in Section 1.2.3. NYSDEC letters to Delphi Thermal, which reflect NYSDEC's involvement in the facility's investigation effort, are included in

Appendix A. In 2001 Delphi Thermal signed an FRI Order on Consent, requiring Delphi to complete additional investigation work and a focused feasibility study as described in the FRI/FFS Work Plan.

1.3 PURPOSE

The purpose of this FRI is to characterize the nature and extent of the TCE related contamination in shallow bedrock at the Site. The FRI information will be used as a baseline to perform the FFS.

As agreed upon with NYSDEC, Delphi Thermal is utilizing a focused approach for the FRI. This focused approach is applicable to the Site due to specific Site factors including the following.

- Natural attenuation is occurring between the source of contamination and the Delphi Thermal property line. Contaminant concentrations at the property line are near the NYSDEC Class GA drinking water standard. The natural attenuation process at the Site is well understood, based on previous work.

- The on-Site contamination associated with the TCE release is limited to TCE, tetrachloroethene (PCE) and their degradation products.

- Based on previous work, groundwater and subsurface conditions at the Site are well documented.

- There are no significant exposure scenarios from the source of contamination to the property line. The potential exposure scenarios are limited (e.g., construction projects) and they can be addressed by administrative controls.

1.4 SCOPE OF WORK

The following tasks, as described in this FRI report, were completed.

- Coordinated work and discussed project details with Delphi Thermal and NYSDEC;
- Test borings;
- Installation/abandonment of groundwater monitoring wells;
- Hydraulic conductivity testing;
- Groundwater level measurements;
- Health and safety and community air monitoring;
- Environmental sampling (including groundwater and soil);
- Natural attenuation parameter monitoring (including using down-hole monitoring probe);
- Well inventory and sump/basement assessment;
- Baseline qualitative exposure assessment;
- Data evaluation; and

- Preparation of this report.

The FRI study and report were completed in general accordance with the following.

- The scope of work described in the "Focused Remedial Investigation and Focused Feasibility Study Work Plan, Delphi Harrison Thermal Systems, West Lockport Complex, Lockport, New York, NYSDEC Registry Site # 932113", dated April 2001 (with attachments including the Field Activities Plan (FAP), SAP and Addenda, HASP, and Citizen Participation Plan (CPP));

- United States Environmental Protection Agency (USEPA) Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, dated October 1988;

- NYSDEC Guidelines for Remedial Investigation/Feasibility Studies, Technical and Administrative Guidance Memorandum (TAGM) #4025, dated March 1989; and

- NYSDEC Selection of Remedial Actions at Inactive Hazardous Waste Sites, TAGM #4030, dated May 1990.

- Letter from NYSDEC to Delphi Thermal, dated June 5, 2001, regarding NYSDEC and NYSDOH approval of FRI/FFS Work Plan dated April 2001;

- Letter from Delphi Thermal to NYSDEC, dated June 20, 2001, with attachments including:

    - Revised Project Schedule (FRI/FFS Work Plan Figure 2);
    - Community Air Monitoring Plan (CAMP).

- Letter from Delphi Thermal to NYSDEC, dated July 9, 2001, concerning notification of the commencement of FRI fieldwork.

- Letter from NYSDEC to Delphi Thermal, dated February 8, 2002, concerning commencement of the FRI Report.

Copies of the noted correspondence are included in Appendix A.

1.5 DEFINITIONS

General definitions[1] of several technical terms included in this report are as follows.

- Natural Attenuation: The biodegradation, dispersion, dilution, sorption, volatilization, radioactive decay, and/or chemical or biological stabilization,

[1] Adapted from "Guidance Handbook on Natural Attenuation of Chlorinated Solvents", prepared by the Bioremediation of Chlorinated Solvents Consortium of the Remediation Technologies Development Forum (RTDF), September 1996.

transformation, or destruction of constituents in soil and groundwater, whereby constituent toxicity, mobility or volume is effectively reduced to levels that are protective of human health and the environment.

- Reductive Dechlorination/Dehalogenation: Replacement of a chlorine atom with a hydrogen atom on an organic compound, caused by microbially catalyzed reactions. In such a reaction, tetrachloroethene (PCE) and TCE are sequentially reduced to lower chlorinated ethenes, such as cis-1,2-dichloroethene (DCE) and vinyl chloride, and ultimately ethene.

- Biochemical Degradation: Process by which constituents are biologically or chemically converted from one compound to another.

2.0 FIELD EXPLORATIONS

FRI field explorations were completed at the Delphi Thermal Site in general accordance with the Site FAP and SAP and Addenda to further evaluate the subsurface conditions and to provide data pertaining to the extent of groundwater contamination east of the AOC. In addition, on-going groundwater investigation activities have been conducted at the Site since 1995. Descriptions of the field explorations conducted during this FRI and historically are presented in this section.

2.1 AUGER PROBES

Eighteen auger probes, AP-1 through AP-14 and AP-96-1 through AP-96-4 (See Figure 3), were completed within the vicinity of the former tank location to assess the extent of potential contamination and determine the potential for migration via overburden groundwater. The auger probes were completed between August 28, 1995 and September 8, 1996.

GZA collected soil samples at approximate 1-foot intervals for field characterization (soil type, color, and consistency) and for field screening for the presence of organic vapor (headspace screening). Headspacing screening of samples was completed as described in Section 2.~~1~~.2. Select samples were submitted for analytical testing.

2.2 SOIL GAS SURVEY

Several buried utilities are near the AOC. To assess the potential for lateral migration within associated bedding material, GZA completed a soil gas survey. Five soil gas probe locations, SG-1 through SG-5 (See Figure 3) were completed between August 29 and September 8, 1995. Probe locations were selected based on plans provided by Delphi Thermal.

Soil vapor samples were collected by driving galvanized steel probes with a removable tip in to the utility bedding with a slide hammer. The probe was then ~~be~~ pulled back slightly to free the removable tip and a bentonite slurry was placed between ground surface and the probe to seal out atmospheric air. New HDPE tubing was inserted to the bottom of the probe and sealed in place using a compression-type fitting located at the top of the probe.

Once the probe was in place, the soil vapor sample was pulled up the tubing by an air pump. The discharge from the air pump was connected to a organic vapor meter (OVM) equipped with a 10.2 eV bulb and calibrated to a benzene standard of 59 ppm in air. At the point of maximum response on the OVM, a sample of soil vapor was withdrawn using a gas-tight syringe from the syringe septum port. The soil vapor sample was then injected into a portable gas chromatograph (GC) for testing.

The soil vapor samples were analyzed in the field by GZA using a portable GC (Photovac Model 10S50) for select chlorinated compounds (target compounds).

2.3 TEST BORINGS

To investigate the soil and bedrock conditions east of the AOC, GZA subcontracted Earth Dimensions, Inc. (EDI) to complete overburden test borings, bedrock coring, and monitoring well installations. The locations and depths of borings/rock cores were approved by NYSDEC prior to the field activities. A total of 16 test borings have been completed at the Site, relating to the TCE release, between August 1995 and July 2001. The boring locations are shown on Figure 2. Logs prepared by GZA documenting observations made while completing the borings are included in Appendix B.

Drilling equipment and associated tools were steam cleaned upon arrival at the Site and between boreholes. Steam cleaning was done at an on-Site location (containment pad) away from the proposed test boring locations. Washwater was directed to a drain in the containment pad, which discharges to the Delphi Thermal Wastewater Treatment Facility. During drilling and sampling, the split spoon sampler was cleaned by initially rinsing it in potable water, washing with a solution of laboratory detergent and potable water, and allowing the sampler to air dry.

2.3.1 Overburden Sampling

Boreholes were advanced through the overburden using a truck-mounted rotary drill rig and 6-1/4 inch inside diameter (I.D.) hollow stem augers (HSA). Overburden samples from ahead of the HSA were collected continuously by driving a 1-3/8 inch I.D. by 24-inch long split spoon sampler 24 inches with a 140-pound hammer falling 30 inches, in general accordance with ASTM D1586 (Standard Penetration Test). Test borings were advanced with the HSAs until auger refusal (suspected to be the top of bedrock). Auger cuttings from the holes were containerized for subsequent disposal by Delphi Thermal.

Soil samples collected from the test borings were classified in the field by visual examination in accordance with a modified Burmeister Classification System. Boring logs that identify appropriate stratification lines, blow counts (if applicable), sample identification, sample depth interval and recovery, and date are included in Appendix B.

2.3.2 Headspacing

Representative portions of the overburden samples collected were placed in new glass jars with a screw top lid for headspace screening. Headspace screening was done using a organic vapor meter (OVM) equipped with a photoionization detector (HNu PI101). The OVM was calibrated daily during its use, in accordance to manufacturer's requirements, using a standard gas (Isobutylene). Prior to screening, the samples were allowed to equilibrate to room temperature. A hole was made in the lid of the sample jar and 30 ml of sample air was withdrawn from the headspace using a gas tight syringe. The test sample was immediately injected into the OVM and the peak response was recorded. A syringe blank was run between test samples to purge extraneous contamination, if detected. Headspace screening results are included on the boring logs included in Appendix B.

2.3.3 Rock Coring

Upon advancing the HSAs to the top of apparent bedrock as indicated by auger refusal, a 5-7/8 inch diameter rollerbit was used to form a socket hole in the top of bedrock. A 4-inch steel casing was then placed in the socket hole and grouted in place. The grout was allowed to set for at least 12 to 24 hours. A HQ size rock-coring device was used to drill into the rock. Coring continued until a suitable water-bearing zone was encountered (indicated by the loss of core water) or the hole was cored to a maximum depth of 15 feet from the top of rock. Following the completion of rock coring, the water used was containerized for disposal by Delphi Thermal.

The rock core samples were logged including run number, sample interval, length of sample recovered, rock quality designation (RQD), depth where drill water was lost, and a description of the rock mass and individual discontinuities (bedding planes, joints, voids, etc.). This information is included on the boring logs (see Appendix B). Table 4 contains a summary of the bedrock core samples. Rock core samples were placed in wooden core boxes. Each box was labeled with the project name and number, boring number, run number, depth interval of the run and date.

2.4 MONITORING WELL INSTALLATION

A monitoring well was installed in the 16 core holes. The wells were constructed of 2- inch I.D. flush-coupled polyvinyl chloride (PVC) riser and screen. Following placement of the screen and riser within the hole, the annular space around the screen was backfilled with sand extending approximately 2 feet above the screen. Bentonite pellets were placed approximately 2 to 5 feet above the sand pack, extending approximately 2 feet, and allowed to hydrate to form a seal. The hole was then filled with a cement bentonite grout to approximately 0 to 3 feet bgs. The monitoring wells were completed with a locking steel protective casing. Concrete was placed around the casing to form a surface seal. A summary of the monitoring well installation information is included on Table 5.

Following installation, the wells were developed to remove cuttings and check that the wells were functioning properly. The wells were pumped or bailed until the water quality was determined to be consistent with the water quality of the formation as evidenced by consistent measurements of pH (+/- 0.2 pH units), specific conductance (+/- 10%) and temperature (+/- 10%). The volume of water removed from the wells was a minimum of three times the volume of the well. Monitoring well development water was containerized for disposal by Delphi Thermal.

2.4.1 Hydraulic Conductivity Testing

The effective hydraulic conductivity of the rock surrounding the monitoring well screens were measured. Three methods were used to estimate the effective hydraulic conductivity of monitoring wells as follows.

- Slug Test Method – For MW-1 through MW-10, this testing included initially placing a four-foot long by 0.1 foot diameter stainless steel slug into the well to raise the water level. The rate of fall of the water within the well was then monitored using a water level indicator. The slug was then removed, and the test repeated as the water level within the well recovered. These data along with the static water level and monitoring well information (intake zone, diameter, etc.) were analyzed in accordance with methodologies outlined in Bouwer and Rice[2].

- Rising Head Test Method – For MW-11, MW-12, MW-14 and MW-15, this testing involved pumping water from the wells to draw down the water column inside the well to a sufficient level that the recharge of the well could be measured over time as it returned to its static level. The rate of recovery of the water was measured using a water level indicator. These data along with the monitoring well information (intake zone, diameter, etc.) were analyzed in accordance with methodologies outlined in Bouwer and Rice[2].

- Single-Well Pump Test Method – For MW-13, which was found to recover rapidly, this method involved pumping well at a constant rate and measuring the response of the water level within the well with respect to time. Data obtained using this test method were evaluated using methodologies outlined in Hvorslev 1951[3].

A summary of the results of these hydraulic conductivity analysis is included in Table 5. A discussion of Site hydrology is included in Section 3.4.

2.4.2 Survey

Ground surface and casing elevations were measured and monitoring points were established for each of the wells installed as part of this study. Elevations were measured relative to a point of known elevation (e.g., manhole rim located proximate to the AOC; MW-

[2] "The Bouwer and Rice Slug Test- An Update", Bouwer, H. Groundwater Journal, Vol. 27., No.3, May-June 1989.
[3] Lambe, T.W. and R.V. Whitman. Soil Mechanics. John Wiley & Sons, Inc. 1969. p. 284-286

12 well riser). The manhole rim reference elevation is based on the National Geodetic Vertical datum (NGVD). Monitoring wells were located horizontally using a tape measure referenced to nearby Site features. Elevation measurements are included on Table 6.

2.4.3 Monitoring Well Abandonment

As mentioned in Section 1.2.3, monitoring wells MW-1 and MW-2 were abandoned in December 1995 in accordance with NYSDEC procedures. Monitoring well MW-1 was replaced with MW-7 in April 1996. No replacement well was installed for MW-2.

The monitoring wells were abandoned by removing the protective casing and surface seal. The PVC riser pipe was removed to a depth of approximately 2 - 3 feet bgs. The remaining hole was backfilled with cement bentonite grout. The cement bentonite grout was pumped via tremie pipe extending to the bottom of the well screen.

2.5 GROUNDWATER LEVEL MEASUREMENTS

Fourteen rounds of water level measurements have been completed as part of these studies. Water levels were measured using an electronic water level indicator after the monitoring wells were allowed to stabilize. The measurements, collected from September 18, 1995 to October 20, 2001 are summarized on Table 6. The groundwater level measurements collected from later rounds (2001) are the most complete and provide the best depiction of groundwater flow at the Site.

2.6 HEALTH AND SAFETY AND COMMUNITY AIR MONITORING

A Site-specific HASP and CAMP were prepared by GZA for the field activities at the Delphi Thermal Site. The Site safety officer or field representative provided health and safety oversight during field activities. The health and safety monitoring equipment was maintained according to the HASP. Fieldwork was performed in Level D protection (e.g., hard hats, steel toe boots, work clothing, latex gloves, etc.). GZA did not detect elevated levels of VOCs (greater than 1 ppm) in the work zone during intrusive activities. Therefore, additional protective measures were not required. Additionally, dust/particulates were not generated during the intrusive work completed during the investigation (soils were moist and rock was cored using water), so dust/particulate monitoring was not necessary.

2.7 ENVIRONMENTAL SAMPLING

Various groundwater monitoring wells were sampled as part of the Site investigations between September 19, 1995 and October 31, 2001. Groundwater samples were collected by GZA representatives wearing disposable latex gloves. Three well volumes were purged from the wells prior to sampling. Also, pH, specific conductance and temperature were monitored and compared with previous measurements at the well such that representative samples were obtained.

Groundwater samples were collected and placed into sample containers which were then placed in an iced cooler for shipment to the analytical laboratory, Free-Col Laboratories Ltd., (Free Col) a NYSDOH certified laboratory. Samples were transported following chain-of-custody procedures. One trip blank (for VOC analysis) was kept with the samples during the sampling events to check for potential cross contamination or other extraneous sources of contamination within the samples. One blind duplicate sample (for target compound analysis) was also collected by GZA during the sample rounds to use as a quality control check. Analytical laboratory reports and a data usability evaluation are included in Appendix C. A summary of the analytical testing completed on groundwater at the Site is presented in Table 7.

2.7.1 Volatile Organic Compound Sampling

Groundwater sampling for VOCs relating to the TCE release has been conducted since 1995. Various analytical methodologies have been used since the commencement of the sample events and include USEPA Method 8240, Method 524.2, Method 8260A, and Method 8260B. A comprehensive list of compounds was analyzed for during the early part of the investigation. As the compounds of concern were identified (i.e., TCE and daughter products), the analytical testing list became focused on these chlorinated compounds. This focused list will be referred to as the Target Compound VOCs and includes the following compounds.

- Trichloroethene (TCE)
- Cis - 1,2-dichloroethene (1,2-DCE)
- Trans - 1,2-dichloroethene (1,2-DCE)
- Tetrachloroethylene (PCE)
- Vinyl chloride (VC).

Additionally, petroleum related compounds were tested for in select samples. These compounds included the following.

- Benzene
- Toluene
- Ethylbenzene
- Xylene.

2.7.2 Separate Phase Liquid Sampling

During sampling events conducted in 1996, a suspected dense non-aqueous phase liquid (DNAPL) was observed to accumulate at the bottom of the groundwater purge bucket while purging monitoring well MW-5. Since this liquid was observed to sink within the purge bucket, it was referred to as a suspected DNAPL. On October 31, 1996 GZA collected a sample of this liquid for analytical testing. The sample was collected with a low flow peristaltic pump. As water was withdrawn from the well, a dark suspected DNAPL was observed and collected. Approximately 20 ml of this liquid was submitted to Free Col for analytical testing. The thickness of the DNAPL in the bottom of the well (MW-5) was noted to be less than ¼-inch based on the use of a downhole interface probe.

2.7.3 Natural Attenuation Parameter Sampling

Beginning with the December 1998 groundwater-sampling event, samples were collected for natural attenuation parameter analyses. Groundwater samples to be tested for select natural attenuation parameters were collected from various monitoring wells during the investigation (see Tables 7 and 10). These parameters include the following.

- Methane
- Organic Carbon
- Alkalinity
- Ammonia
- Chloride
- Nitrate
- Nitrite
- Sulfate
- Sulfide
- Iron (total and dissolved)
- Magnesium (total and dissolved)
- Manganese (total and dissolved)
- Sodium (total and dissolved)
- Potassium (total and dissolved)
- Calcium (total and dissolved)

2.8 NATURAL ATTENUATION PARAMETER MONITORING

Down-hole measurements for natural attenuation parameters were conducted during four sampling rounds completed at the Site (December 1998, October 1999, August 2001, and October 2001). Down-hole measurements were completed on various monitoring wells (MW-3S, MW-4, MW-10, MW-11, MW-12, MW-13, MW-14, and MW-15) during the four sampling events.

Prior to collecting down-hole meter field measurements, the wells were purged using a variable-speed peristaltic pump and new ¼-inch I.D.-high density polyethylene (HDPE) tubing.

Down-hole measurements made during the monitoring events included: dissolved oxygen (DO), pH, temperature, specific conductivity and oxidation/reduction potential (ORP). These measurements were made using a sensor probe (YSI Model 600XLM). The probe was placed in the wells at about the center of the well intake zone. HDPE tubing was lowered into the well and attached to the variable speed peristaltic pump. New HDPE tubing was used at each well.

The pump was then started and down-hole meter readings were taken from the well as it was purged. The wells were purged until the meter readings stabilized and a minimum of three to five well volumes was removed. Stabilization of field parameter data (e.g., specific conductivity, pH, and temperature), prior to collection of analytical samples, provided an indication of proper well purging. The down-hole meter was calibrated at the factory prior to use and in accordance with the project SAP and Addenda.

2.9 WELL INVENTORY AND SUMP AND BASEMENT ASSESSMENT

A community well assessment was completed by NYSDEC in 1996. A compilation of private drinking water wells near the Delphi Thermal facility was completed as part of an investigation of the Lockport City Landfill, located east of the facility, across the Gulf. This information was provided to Delphi Thermal by NYSDEC (in a letter dated April 11, 1996 (Appendix A)) and indicated that private drinking water wells were not located in the area of the Delphi Thermal facility. They further concluded that "health impacts from potentially contaminated groundwater leaving the Harrison (Delphi Thermal) Site are extremely unlikely".

As discussed with NYSDEC following completion of the October 2001 sample round, a sump and basement assessment was not completed. Analytical results from groundwater collected from downgradient Site monitoring wells (e.g., MW-13) indicated that target compounds are not present at the downgradient edge of the plume (at Delphi Thermal property line), so the potential for exposure to off-Site populations is unlikely. Therefore, an assessment to evaluate the possible presence of basements and sumps on properties located downgradient of the Site along Route 93 was not conducted.

3.0 PHYSICAL CHARACTERISTICS OF SITE

3.1 SURFACE FEATURES

The ground surface in the vicinity of the AOC is generally level. A granular fill material is present at the ground surface. This is the granular material used to backfill the excavation following the soil removal. This material was found to extend to the top of bedrock within the AOC.

A concrete steam chase is located to the east of the AOC, extending north-south, separating the AOC from an adjacent paved driveway. Beyond the paved driveway is a grass area, followed by a paved parking area outside the facility security fence. The grass area is also generally level, however the ground surface in the vicinity of the cooling tower (located about 130 feet southeast of the AOC) is approximately 3 feet lower. The paved parking area slopes to the east-southeast, beyond which is a grass area. East of the grass area is Route 93. South of Building 8 is a generally level paved area with a slight slope towards the south.

3.2 METEOROLOGY

Niagara County is typified by moderately warm summers and cold winters with an average 93 inches of snowfall. Niagara County is bounded to the north by Lake Ontario and the Niagara River to the west. The proximity to Lake Ontario and Lake Erie has an effect on the temperature and precipitation in Niagara County.

Data regarding average annual precipitation and temperature were obtained from a 2001 Climatological Data and Atmospheric Annual Summary Report of New York. The data were collected from a National Oceanic and Atmospheric Administration (NOAA) weather station located at the Niagara Falls International Airport. This station, located approximately 12 miles southwest from the Site, has been recording data since 1988. The average yearly precipitation recorded at the station is about 36 inches. The average yearly temperature is 46.5 degrees Fahrenheit.

3.3 SURFACE WATER HYDROLOGY

3.3.1 Regional Surface Water Hydrology

The Niagara Escarpment, further discussed in Section 3.4, acts somewhat as a regional surface water hydrology divide. Surface water in the near vicinity and north of the escarpment flows northward towards Lake Ontario. Surface water bodies south of the escarpment generally flow to the south and southwest towards the Niagara River or the Erie Barge Canal. The Niagara River flows north discharging to Lake Ontario while the canal flows west to east. The Erie Barge Canal is located approximately 1 ¼ miles southeast from the Delphi Thermal Site.

3.3.2 Site Surface Water Hydrology

A drainage swale that carries Plant runoff is located on the Delphi Thermal Site (see Figure 2). This swale contains discharge from Stormwater Discharge Station 002, which consists generally of parking lot, roof drain, and roadway surface water runoff. This drainage swale flows east and connects with another stream, which enters onto the Delphi Thermal Site from the southern property boundary. These streams join between the location of MW-12 and MW-13, flow northeast beneath Route 93, and flow down into the Gulf at a location north of the Delphi Wastewater Treatment Plant.

3.4 REGIONAL GEOLOGY

The naturally existing topography in the vicinity of the Site is generally flat. The primary surface relief in the area is the Niagara Escarpment, which is located approximately one-half mile to the northeast. There is an approximate 200-foot difference in elevation from the ground surface elevation at the Site to the foot of the escarpment. This escarpment acts as surface water and groundwater divide.

Regionally, the stratigraphy from the top consists of glacially derived soils comprised of lacustrine clays and silts which overly bedrock. The upper-most bedrock unit is the Lockport Group, which consists of the Gasport Limestone Formation and the Lockport Dolomite. The Gasport Limestone was not observed in borings completed at the Site. Below the Lockport Group is the Clinton Group, which consists of the Rochester Shale Formation, the Irondequoit Limestone Formation, and the Rockway/Hickory Corners/Neahga Formation. This formation consists of dolostone, limestone, and shale units. Below the Rockway/Hickory Corners/Neahga Formation is the Medina Group, which consists of the Grisby Sandstone Formation, the Power Glen Shale Formation, and the Whirlpool Sandstone Formation. The Lockport, Clinton, and Medina groups are Middle to Lower Silurian in age and were deposited from 410 to 430 million years ago.

Bedrock in Western New York dips to the south to southwest at ~~of~~ about 40 feet per mile. The rock bedding is considered essentially flat over short distances. High angle to vertical joints are common to the rock.

The Gulf, located approximately 200 feet northeast of the Site, is a large topographic depression. The difference in elevation between the crest and base of the Gulf is approximately 110 feet. The Gulf acts as a giant sink, which draws regional groundwater flow towards it. The Gulf completely bisects the Rochester Shale and the underlying Irondequoit Limestone Formations.

3.5 SITE GEOLOGY

3.5.1 Overburden

Three cross-sections extending in the area of the groundwater contamination are included on Figures 4 and 5. The cross-sections show that soil consisting primarily of clay and silt, with a relatively small percentage of sand and gravel (less than 20%), covers the bedrock throughout the area of investigation. At the top of rock, the clay and silt materials contain a higher percentage of sand and gravel (20 to 40%). The soil thickness is variable, but typically is on the order of 3.5 to 8 feet thick.

Fill material encountered usually included a mixture of broken concrete, stone, sand and gravel. Fill was typically less than 2 feet thick. At location AP-5 and the utility probe locations (see Figure 3), fill material was found to greater depths and included intermixed silty clay with little sand and gravel. At MW-1, which was within the area of TCE-contaminated soil removal, fill material consisting of sand and gravel was encountered to the top of rock.

3.5.2 Bedrock

Bedrock underlying the Site is the Lockport Dolomite Formation. Beneath the Lockport Dolomite is the Rochester Shale Formation. The shallow monitoring wells installed as part of this study are in the Lockport Dolomite. As part of GZA's previous work, one core hole/monitoring well (MW-3D) was placed in the Rochester Shale formation. In addition, previous work done in the vicinity of the wastewater treatment plant included borings that are suspected to have extended into the Rochester Shale.

The Lockport Dolomite is gray dolomitic limestone, which is hard and fine-grained with horizontal to low angle fractures. The rock encountered within the vicinity of the AOC can be classified to be fair to excellent quality based on the rock quality designation (RQD) obtained from the bedrock coring done. A summary of core sample RQD values and recovery is included on Table 4.

RQD can be related to joint or fracture spacing. High RQD values indicate rock with few fractures or joints, and low RQD values indicate closely jointed rock. RQD values for cores obtained from the Site were relatively high and tended to increase with depth below the upper 5 feet of rock. The upper 5 feet of rock had RQD values between 10 percent and 88 percent with an average of about 63 percent. RQD values were typically above 85 percent at depths greater than 5 feet with the exception of MW-9, MW-10, MW-12, and MW-15, where RQD values were between about 60 percent and 70 percent. In general, the rock cored/sampled in the borings completed as part of this study did not exhibit extensive fractures or jointing.

Below the Lockport Dolomite Formation is the Rochester Shale Formation. This formation was encountered in core hole MW-3D. It is difficult to distinguish between the contact between the Lockport Dolomite and Rochester Shale formations, because it is a gradual transition. However, GZA estimates that the transition occurs at a depth of 40 to 45 feet below the top of rock at MW-3D. RQD values from core samples of the Rochester Shale Formation were above 90 percent.

In order to obtain a better understanding of the orientation of fractures in the vicinity of the Delphi Thermal facility, GZA observed and documented vertical fractures within the stream beds east of the AOC. GZA noted nine fractures within the stream beds. Five of the nine fractures had orientations between 107 degrees and 122 degrees (true north being 0 degrees). The remaining four had orientations between 62 and 77 degrees. This indicates a general fracture orientation trending east-west.

3.6 REGIONAL HYDROGEOLOGY

As mentioned in Section 3.4, the Gulf is a large topographic depression, which acts as a giant sink, drawing groundwater towards it. Groundwater from the Delphi Thermal Site flows east toward the Gulf.

3.7 SITE HYDROGEOLOGY

Flow through the rock at the Delphi Thermal facility is generally controlled by fractures and joints within the rock mass. The RQD values obtained during the subsurface explorations at the AOC indicate the rock encountered is not greatly fractured or jointed. However, localized variations can occur. Based on hydraulic conductivity tests completed within the shallow bedrock wells, the effective hydraulic conductivity within the shallow bedrock near the AOC (inclusive of MW-1 through MW-5 and MW-7) is relatively low and varies between $3x10^{-7}$ cm/s (MW-2) and $2x10^{-5}$ cm/s (MW-4). Towards the south, effective hydraulic conductivities were measured at MW-6 and MW-8 at $1x10^{-3}$ cm/s and $4x10^{-4}$ cm/s, respectively. To the east, effective hydraulic conductivities were measured at MW-9 and MW-10 at $7x10^{-4}$ cm/s and $2x10^{-3}$ cm/s, respectively. The wells furthest downgradient from the AOC have effective hydraulic conductivities ranging from $8x10^{-6}$ cm/s (MW-14) to $1x10^{-2}$ cm/s (MW-12 and MW-13). Table 5 contains the hydraulic conductivities calculated for the wells used as part of this investigation.

In other portions of the facility, a constant head test conducted at one of the core holes completed as part of a pump station siting study (located east of MW-10) indicated an effective hydraulic conductivity of about $2x10^{-2}$ cm/s in this area. A rising head test completed by others in the vicinity of Building 6 indicated a hydraulic conductivity on the order of $2x10^{-3}$ cm/s.

Rising head testing done in monitoring well MW-3D indicated an effective hydraulic conductivity of $1x10^{-5}$ cm/s within the Rochester shale. Hydraulic conductivity test results reported in the vicinity of the wastewater treatment plant in a well screened at a similar elevation as MW-3D indicate hydraulic conductivities between $1x10^{-4}$ cm/s and $1x10^{-7}$ cm/s.

Groundwater elevation measurements for the investigation are summarized on Table 6. A representative groundwater contour plot, based on measurements collected on October 29, 2001 is included as Figure 6.

Based on the measured hydraulic gradients at the Site, and the general east-west orientation of fractures observed within the streambed, groundwater flow is expected to be generally towards the Gulf, (to the east). A localized depression in the groundwater levels appears to be located in the vicinity of MW-6. This results in a localized southerly component of flow in the southern portion of the AOC (See Figure 6). MW-6 is located near a water cooling tower. The bottom elevations of piping and water storage reservoirs in the cooling tower are believed to be approximately three to four feet below the top of bedrock and about 2 feet below the groundwater table in this area. It is possible that construction activities completed at the time when the cooling tower was installed, has resulted in conditions that have lowered the water table in the vicinity of well MW-6.

Comparison of shallow and deep groundwater elevations at the MW-3 well cluster indicate a downward gradient.

Horizontal hydraulic gradients within the vicinity of the AOC are on the order of 0.01 to 0.02. Gradients to the east of the AOC are on the order of 0.03 to 0.04 (MW-4 to MW-10). Gradients in the downgradient portion of the plume (area of MW-10 and MW-13) are on the order of 0.01 to 0.02.

Secondary fracture porosity was estimated using methods presented by Snow[4] to be on the order of 0.01 to 0.4%. However, the method presented by Snow does not account for variable fracture thickness or the presence of highly weathered fractures. Published values of secondary porosity for fractured bedrock with hydraulic conductivity on the order of 10^{-2} to 10^{-4} cm/s ranges between about 5 and 20%.[5] Consequently, it is expected that the secondary porosity ranges from 0.01 to 20% at the Delphi Thermal Site for the shallow fractured bedrock.

Calculated groundwater velocities range between 30 to more than 3000 ft/yr. Given the low hydraulic conductivity and the low hydraulic gradient in the vicinity of the AOC, it is expected that groundwater velocities in this area are closer to the low end of the range (i.e., 30 ft/yr). To the east, hydraulic conductivities and hydraulic gradients are larger, thus, velocities are expected to be higher. If the geometric mean of effective hydraulic conductivity values of 3×10^{-5} cm/s, an estimated average fracture porosity of 0.5%, and an average hydraulic gradient of 0.03 were used, a Site averaged groundwater velocity of about 200 feet per year is calculated. This average velocity should be used with caution, and is only provided to assist in interpreting the attenuation rates for the purposes of this report.

3.8 LAND USE AND DEMOGRAPHY

The Delphi Thermal Site is located in both the City and Town of Lockport, which is located in Niagara County, New York. A portion of the facility including the AOC is located in the City of Lockport. The Town of Lockport is bordered by the Town of Newfane to the north, the Town of Hartland to the northeast, the Town of Royalton to the east, the Town of Pendleton to the south, and the Town of Cambria to the west. The Locus Plan (Figure 1) shows the approximate location of the Delphi Thermal Site and the surrounding areas.

The Delphi Thermal Site is located in an area of mixed residential, agricultural, commercial, and industrial settings along Route 93. Across Route 93, the Niagara Escarpment is located approximately one-half mile to the northeast. The Niagara Escarpment is notched by a northeast to southwest trending gorge, which is known locally as the "Gulf". A stone quarry and former steel facility are located approximately 1 mile south of the Delphi Thermal Site. Residential properties are generally present along the east and north sides of Route 93 and to the west of the Site.

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[4] "Rock Fracture Spacings, Openings and Porosities", Snow, D., Journal of Soil Mechanics and Foundations Division, Proceedings of the American Society of Civil Engineers, January 1968.
[5] Rock Mechanics; Jumikis, A. R.; Trans Tech Publications, 1983.

3.9 HABITAT ASSESSMENT

A habitat assessment was not conducted as part of the FRI, and the Site does not include significant wildlife or wetland resources. A small onsite stream is located along the eastern portion of the Site. Considering that this on-Site stream and associated drainage swale was observed to be intermittent (dry during periods of low precipitation in July and August), a physical barrier (35 foot waterfall) prevents aquatic life from migrating upstream from the off-Site stream area and the stream is located within and industrial complex, no significant aquatic organisms are expected in the onsite stream.

4.0 NATURE AND EXTENT OF CONTAMINATION

This section discusses the nature and extent of contamination at the Delphi Thermal Site. Detected chemical compounds in the groundwater sampled as part of this FRI and the analytical results are presented in this section. Free-Col Laboratories, LTD (Free-Col) of Meadville, Pennsylvania provided the analytical laboratory services for this project.

Data qualifiers and their definitions as defined by Free-Col are included in Appendix C. The presentation of results within this text does not include data qualifiers.

4.1 CONTAMINANT TYPES

This investigation focused on VOCs (primarily TCE and other chlorinated solvents) and petroleum related compounds, (benzene, toluene, ethylbenzene, and total xylene). Testing was not completed for semi-volatile organic compounds (SVOCs), pesticides, or polychlorinated biphenyls. Analyses for select inorganic compounds and water quality parameters were completed on groundwater samples to assist with the evaluation of natural attenuation. Table 7 contains a listing of the wells sampled during the groundwater sample events along with the analyses completed on the collected samples.

The physical and chemical properties of the VOCs, such as molecular weight, water solubility, specific gravity, Henry's Law Constant, organic carbon partition coefficient, and log octanol/water partition coefficient, are presented in Table 8.

Discussions of laboratory analytical results for the various identified environmental media (i.e., unsaturated soil, saturated soil, soil gas, and groundwater) are presented by chemical class (i.e., chlorinated solvents and petroleum related compounds). The chlorinated solvents represent those used in degreasing operations at the Site (specifically TCE). Daughter compounds of TCE, compounds resulting from TCE degradation were detected including cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-dichloroethene (trans-1,2-DCE), and vinyl chloride (VC). Additionally, tetrachloroethylene (PCE) was detected in some groundwater samples. PCE is not a daughter compound of TCE, but rather often an impurity in commercial grade TCE.

Compounds detected in groundwater tested during this FRI were compared to the following New York State guidance documents and standards.

- NYSDEC Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1. Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations dated October 1993; Revised June 1998; ERRATA Sheet dated January 1999; and Addendum dated April 2000 (NYSDEC Class GA).

4.2 SOURCE AREA

AOC-related contaminants (e.g., TCE) were detected sporadically in saturated and unsaturated soil in the vicinity AOC. However, these detections do not indicate the presence of a remaining source area soil. Therefore, the Source Area for the purposes of this FRI study is defined as the groundwater contamination associated with the AOC and the DNAPL identified in MW-5. Deep bedrock groundwater, as indicated by groundwater samples from MW-3D, was not found to be impacted by the AOC.

The DNAPL at MW-5 will continue to contribute to the groundwater plume at the Site, until it is depleted.

4.2.1 Auger Probe Results

Based on headspace screening and the analytical test results, the extent of unsaturated soil contamination appears minor and limited to the area between the driveway and Building 8 and extending south to AP-7 (See Figure 3). Concentrations of TCE exceeded NYSDEC Technical and Administrative Guidance Memorandum (TAGM) 4046 recommended soil cleanup objectives (RSCO) of 0.7 ppm at locations AP-1 (3.7 ppm) and AP-7 (43 ppm). These results show that the corrective action taken by Delphi Thermal to excavate contaminated soils from the source area was successful in removing the unsaturated source area.

Other VOCs reported above NYSDEC soil guidance values include 1,2-dichloroethylene (1,2-DCE) at AP-2 (5.6 mg/kg) and AP-7 (0.63 mg/kg) and 2-butanone at AP-2 (16 mg/kg) (See Table 1).

Headspace and analytical test results indicate that the extent of saturated soil contamination also appears to be limited to the vicinity of the former tank. Analytical testing results of saturated soils indicate soil concentrations exceed NYSDEC guidance values at several locations (see Table 2).

It should be noted that 2-butanone was detected in one unsaturated soil sample at auger probe location (AP-2 4-5 feet bgs). 2-butanone was not detected at the same location below the water table (AP-2, 7-8 feet bgs). 2-butanone is a common laboratory contaminant and its presence is therefore suspect. GZA and Delphi Thermal previously reviewed the 2-butanone findings with NYSDEC and agreed that the presence of this compound did not require further evaluation.

4.2.2 Soil Gas Results

The potential for preferential migration of contaminants along utility bedding was assessed by completing a soil gas survey consisting of five probe locations within the bedding material. Soil gas screening results (See Table 3) indicated the presence of TCE within bedding material around the fire lines extending east from the former tank containment area at SG-1 (52 ppm) and SG-2 (30 ppm) located approximately 20 and 63 feet east of the former containment area respectively (See Figure 3). At SG-3, located approximately 110 feet east of the former containment area, TCE in soil gas was reported at 0.08 ppm. TCE was also reported within soil gas on the east side of the steam chase, approximately 125 feet south of the former containment area at 0.15 ppm at SG-5. These soil gas results do not indicate that the utility bedding is a significant pathway for the TCE contamination.

4.3 GROUNDWATER ANALYTICAL RESULTS

Analytical testing results of samples from shallow bedrock monitoring wells indicate the presence of AOC-related contaminants (e.g., TCE) and petroleum related compounds (primarily in MW-3S). Analytical testing results also indicate that natural attenuation of the AOC-related contaminants is occurring. These results are summarized in Tables 9 and 10. Compounds reported above NYSDEC Class GA drinking water criteria include: TCE, PCE, 1,2-DCE, Vinyl Chloride, and petroleum-related compounds (benzene, toluene, ethylbenzene and xylenes).

4.3.1 Volatile Organic Compounds

4.3.1.1 Target Compound Chlorinated VOCs

4.3.1.1.1 Temporal Trends

Twelve groundwater sample rounds have been completed at the Site (between he period of September 1995 and October 2001). As approved by NYSDEC, various monitoring wells have been installed and abandoned during various phases of work. The total chlorinated compound concentrations between the first sample round and the October 2001 sample round were compared for the monitoring wells (MW-3S, MW-4, MW-6, MW-7, MW-8, MW-9, MW-10, MW-11, MW-12, MW-13, MW-14, and MW-15). In general, the concentrations in the groundwater samples from the evaluated wells did not significantly change. (Wells MW-1 (abandoned), MW-2 (abandoned), MW-3D (no target compound detections), and MW-5 (DNAPL present) were not evaluated.) Minor fluctuations in concentrations are noted within the data. These fluctuations are to be expected given the analytical laboratory accepted accuracy for the test procedures. Consequently no overall temporal trends, either increasing or decreasing were identified. Thus, it is believed that the contamination is in a near steady state condition[6].

4.3.1.1.2 Spacial Distribution

The following discussion on the spacial distribution of contaminant concentrations does not distinguish between sample rounds. This is consistent with the near steady-state assumption. Therefore, sample rounds from monitoring wells not recently sampled (e.g., MW-1 and MW-2 were sampled in 1995 and have since been abandoned) have been compared with analytical results from subsequent sample rounds (1996-2001).

In general, concentrations of parent compounds (TCE and PCE) are highest near the AOC. Moving eastward from the AOC, concentrations of parent compounds decrease consistently. Figure 7 presents a spacial distribution of the target volatile organic compound results. The highest concentrations of PCE were reported at MW-5. As discussed in the following section, DNAPL was found in MW-5, which contained both TCE and PCE. It is believed that this DNAPL is the reason for the high reported concentrations of TCE and PCE at MW-5. The groundwater test results obtained from sampling MW-5 are not expected to be representative of the quality of groundwater moving through the formation (see Section 4.3.1.3).

Parent compounds were not detected at the three furthest downgradient wells (MW-11, MW-12, and MW-13). Parent compounds were also not detected in MW-14, located at the southern downgradient area of the plume. PCE was detected at low concentrations (ranging from 0.013 to 0.020 mg/l) in MW-15, located at the northern downgradient area of the plume.

Parent compound breakdown products (daughter compounds), 1,2-DCE and vinyl chloride, reach maximum concentrations at intermediate wells such as MW-4, then decrease at downgradient wells (MW-10, MW-11, and MW-12). Daughter compounds were not detected in well MW-13, at the furthest downgradient edge of the plume (at the Delphi Thermal property line). Daughter compound 1,2-DCE was detected at low concentrations (approximately 0.005 mg/l) in MW-14. No daughter compounds were detected in MW-15.

[6] For purposes of this report, "steady state" refers to a condition of essential equilibrium between the production and attenuation of groundwater contaminant concentrations. Groundwater concentrations at "steady state" would not be expected to significantly increase with time. Concentrations will eventually decrease, however, once the source of contaminant mass has been depleted.

4.3.1.2 Petroleum-Related Compounds

Petroleum-related VOCs have been detected in MW-3S and MW-4 (see Table 9). These compounds were not detected at other monitoring well locations at the Site. Testing for petroleum-related compounds was specific to MW-3S only during the last two sampling rounds (August 2001 and October 2001) because past sampling rounds at other monitoring wells did not have significant detections (if at all) for these compounds above method detection limits.

4.3.1.3 DNAPL

A sample of DNAPL was collected from monitoring well MW-5 in 1996. The sample exhibited a brownish black appearance and was observed to sink in water. Similar observations were not made in other wells at the Site. The sample was submitted for testing during the October 1996 sampling round. Test results indicate the DNAPL contains approximately 430,000 mg/kg of TCE and 640,000 mg/kg of PCE. The specific gravity of the DNAPL was measured by GZA to be about 1.4. However, it could range from 1.5 to 1.6 based on the amount of PCE, which has a higher specific gravity than TCE.

The presence of DNAPL in this well renders the groundwater analytical test results for this well questionable. Specifically, during purging and sampling of the well, DNAPL mixes with groundwater resulting in abnormally high test results (above the compound solubility in water). It is not known how many of the fractures monitored by MW-5 contain DNAPL.

4.3.2 Natural Attenuation Parameters Testing Results

Groundwater samples were analyzed to measure concentrations of natural attenuation parameters during the December 1998, October 1999, August 2001, and October 2001 sample rounds. In general, the analytical results of the natural attenuation parameters provide supportive evidence that biochemical degradation is occurring at the Site and is responsible for the reductive dechlorination of chlorinated volatile organic compounds. A summary of the natural attenuation parameters testing results is provided in Table 10 and Appendix D. Evidence supporting biochemical degradation includes the following.

- Methane:

  Methane concentrations greater than 0.1 mg/l are supportive of biochemical degradation. Methane is a by-product of active bacteria. Methane ranged historically between less than detection limits to 5.5 mg/l. The presence of methane indicates that reductive daughter compounds (e.g., vinyl chloride) may be present. The methane concentrations are supportive of reductive dechlorination.

- Organic Carbon:

  Organic carbon provides an energy source for biological activity. The greater the amount of organic carbon, the greater the potential for biochemical degradation. Concentrations of organic carbon greater than 20 mg/l are generally considered favorable for biochemical degradation. Organic carbon concentrations at the Site ranged from 3.0 mg/l to 58 mg/l during the sample rounds. However, the average concentrations of organic carbon at the Site are generally sufficient to drive reductive dechlorination.

- Alkalinity:

  Alkalinity is an indicator of the buffering capacity of groundwater. Concentrations of alkalinity that exceed background are supportive of biochemical degradation. The upgradient well TK-2 contained 380 mg/l of alkalinity. The alkalinity concentrations downgradient of the source area ranged from 255mg/l to 487 mg/l, and are generally consistent with the result from TK-2.

- Ammonia:

  Ammonia is an inorganic nutrient. The ammonia concentration ranged between 0.05 mg/l and 1.85 mg/l. The presence of ammonia in groundwater at the Site is supportive of biochemical degradation.

- Chloride:

  Chloride concentrations that exceed two times the background concentrations are considered supportive of reductive dechlorination. The upgradient well, TK-2, contained 20.2 mg/l of chloride. Concentrations of chloride ranged from 138 mg/l to 2,800 mg/l at the Site. The chloride concentrations at the wells exceed twice the background concentration and therefore support the biochemical degradation process. The increased levels of chloride may also be associated with the use of road salt at the facility.

- Nitrate/Nitrite:

  Nitrate concentrations below 1 mg/l are supportive of reductive dechlorination, and nitrate concentrations above 1 mg/l inhibit dechlorination. The nitrate concentrations ranged between less than detection limit to 1.34 mg/l, but were generally below 1 mg/l. The result of 1.34 mg/l (MW-15, August 2001) was the only result that exceeded 1 mg/l during the sampling rounds.

  Nitrite was not detected above detection limits in the sampled wells, except for MW-13 (0.08 mg/l) in October 2001; and MW-10 (0.1 mg/l) in October 1999.

- Sulfate:

  Sulfate concentrations of less than 20 mg/l are generally considered supportive of biochemical degradation. Concentrations of sulfate detected at the Site ranged from 2 mg/l to 680 mg/l. High concentrations of sulfate may slow reductive dechlorination; however, reductive dechlorination can continue to occur.

- Sulfide:

  Sulfide concentrations at the Site ranged from below detection limits to 3.5 mg/l. Concentrations of sulfide above 1 mg/l are generally considered supportive of biochemical degradation.

- Inorganics:

  Select wells were sampled and tested for the presence of total and dissolved constituents at various sampling events during the investigation. The constituents are as follows: iron, magnesium, sodium, calcium, manganese and potassium. Inorganic nutrients (magnesium and potassium) that are supportive of biochemical degradation were detected in Site groundwater. Sodium and calcium reflects the impact of road salt on the groundwater.

- Total BTEX:

  BTEX (i.e., petroleum compounds) provides a source of carbon/energy for biodegradation. BTEX was detected at wells MW-3S and MW-4, which are located near the AOC. Therefore, the presence of BTEX at the Site is supportive of biodegradation.

4.4 NATURAL ATTENUATION PARAMETER MONITORING (FIELD) RESULTS

As discussed in Section 2.6.1, some natural attenuation parameters were monitored in the field using a down-hole meter and peristaltic pump. Results of the field monitoring provide further supportive evidence that biochemical degradation is present at the Site and is responsible for the reductive dechlorination of chlorinated volatile organic compounds. Measured natural attenuation parameters are summarized in Table 10. Evidence supporting biochemical degradation includes the following.

- Temperature:

  The biochemical process is accelerated as temperature increases. It is commonly accepted that temperatures above 20 degrees Celsius are supportive of biochemical degradation. Temperature measurements in monitoring well water samples ranged from 10.4 to 21.9 degrees Celsius during the various sample rounds. However, a majority of the temperature data is below 20 degrees Celsius.

- DO and ORP concentrations measured indicate that Site conditions are generally anaerobic, with some aerobic locations noted in downgradient areas of the plume.

  Dissolved Oxygen: DO concentrations below 1 mg/l support reductive dechlorination. DO concentrations at the Site ranged from 0.04 mg/l to 3.66 mg/l, with the majority of the Site concentrations below the 1 mg/l target value. The DO data collected at the Site are supportive of biochemical degradation.

  Oxidation Reduction Potential: ORP levels less than 50 millivolts (mv) indicate that the reductive dechlorination pathway is possible. Optimal ORP levels are below zero mv. ORP levels at the Site ranged from –248.8 mv to 330.7 mv. ORP values less than zero were measured at MW-4, MW-6, MW-7, MW-8 MW-11, MW-12, and MW-13 during past sampling rounds. ORP values greater than zero were measured at MW-9 and MW-15. The results from MW-3S, MW-10, and MW-14 varied between various sample rounds. ORP data collected at the Site are supportive of biochemical degradation.

- pH:

  pH levels of between 5 and 9 standard units are considered conducive to biochemical degradation. pH measurements at the Site ranged from 6.5 to 7.8 standard units.

5.0 CONTAMINANT FATE AND TRANSPORT

This section discusses the mechanisms that affect migration of contaminants at the Site. The discussion also evaluates the chemical, physical and biological behavioral characteristics of the compounds detected, including persistence of these chemical substances and that natural attenuation monitoring has provided supportive evidence that biochemical degradation is responsible for the reductive dechlorination of chlorinated volatile organic compounds at the Site. This information is compared with the Site specific data and observations to assist in assessing the extent of migration that has occurred and a prediction of the extent of contamination.

As further described in Section 4.2, the source of Site contamination is defined as the groundwater contamination in shallow bedrock associated with the AOC and the DNAPL identified in MW-5.

5.1 POTENTIAL ROUTES OF MIGRATION

The primary routes of contaminant migration at the Site is via the shallow bedrock groundwater and volatilization to soil gas/air.

5.1.1 Shallow Bedrock Groundwater

The primary source of the groundwater passing through/beneath the AOC is anticipated to originate from flow upgradient of the AOC in the shallow bedrock. Due to the presence of adjacent buildings and paved surfaces and the clay content of soils encountered, recharge from precipitation is expected to be limited with the exception of the relatively small area within the AOC where contaminated soils were excavated and replaced with a granular fill. Deep bedrock groundwater (MW-3D) was not found to be impacted by the AOC.

Groundwater flow through the bedrock beneath the facility is controlled primarily by fractures within the rock. Groundwater flow occurs within rock fractures and bedding planes. The orientation of fractures logged by GZA within the stream beds generally trend to the east/west. Based on the bedrock core samples observed and hydraulic conductivity test results, the rate of flow beneath the AOC is expected to be relatively low.

Groundwater flow in the vicinity of the Site appears to be generally towards the east. A localized depression is observed in the groundwater elevation data in the vicinity of MW-6 (see Section 3.7).

The data suggest that groundwater contaminant transport is in a near steady state condition. As such and as further explained later in this section, significant increases in the concentrations with time are not expected. As migration of TCE occurs away from the AOC, natural attenuation occurs resulting in a reduction of concentrations and mass of contaminant.

DNAPL was observed in MW-5. It is believed that the DNAPL is trapped within fractures monitored by MW-5 and that groundwater test results from this well may not be representative of groundwater moving through the formation. It is not believed that the DNAPL is migrating. Studies have shown that DNAPL in bedrock settles into place within fractures shortly after it is released (within months to a few years). Once the DNAPL is in the fractured rock, the physical properties (i.e., gravity, surface tension, viscosity) limit the potential for the DNAPL to migrate/move under stable groundwater conditions (such as those encountered at the Site).

Multiple sample rounds at the Site indicate consistent results or “steady state’ conditions at monitoring locations. If DNAPL at the Site were migrating, down gradient contaminant concentrations would likely increase over time. Additionally, DNAPL has not been observed in other down gradient monitoring locations. However, through dissolution it will provide a continuing source of groundwater contamination, until it is depleted.

5.1.2 Volatilization

Volatilization is expected to occur at the Site, based on the results of a soil gas survey performed at and proximate to the AOC. The potential for volatilization decreases with distance from the AOC; however, volatilization could occur within the area of groundwater contamination due to the presence of a chlorinated VOCs plume. Due to the depth to impacted groundwater (approximately 5 to 15 feet bgs), that groundwater is located in shallow bedrock, and that much of the Site area is paved, the extent of potential vapor migration is expected to be limited. Also, based on the soil gas survey, utility beddings were not found to provide a significant vapor migration pathway.

5.2 CONTAMINANT PERSISTENCE AND BEHAVIORAL CHARACTERISTICS

5.2.1 Physical Processes

Physical processes which govern the migration of contaminants within the fractured bedrock flow system at Delphi Thermal include advection, dispersion and to a lesser extent, molecular diffusion. Advection is the process whereby contaminants present within groundwater are transported with the groundwater as the groundwater moves in response to a hydraulic gradient. Within fractured systems, advection occurs primarily within fractures.

Dispersion is a spreading of contaminants both in the direction of flow and in transverse directions. Through dispersion, concentrations will decrease with distance from the source due to mixing with the ambient groundwater. In fracture flow systems, dispersion is due to mixing at fracture intersections and variations in fracture size and spacing. Dispersion is generally related to groundwater velocity. As groundwater velocity increases, the amount of dispersion increases.

Molecular diffusion occurs independent of groundwater movement. Through molecular diffusion, contaminants will penetrate micro- or dead-end pores or into the rock mass itself. The degree to which molecular diffusion occurs is dependent on a molecular diffussivity which is unique to individual chemicals. Molecular diffusion is a very slow process. This may be important at the Delphi Thermal Site, because once the contaminant has diffused into small dead end pores it is very difficult to remove.

The migration of DNAPL in fractures is governed primarily by DNAPL density, interfacial tension between the liquid and water, the mass of DNAPL released, and the fracture orientation. As the DNAPL moves through fractures, a residual film is left behind. Once a sufficient mass of DNAPL is not available to overcome capillary forces,[7] further migration is essentially stopped. This typically occurs in the narrow portion of the fractures. The migration of DNAPL typically occurs over a short time period from the time of release (i.e., weeks to months). Chemicals within the DNAPL will dissolve into the groundwater moving through the formation. Unlike flow through a porous media, in fracture flow systems the amount of DNAPL that can be dissolved is limited to the amount of water, which passes through the individual fractures, which contain the DNAPL.

5.2.2 Chemical Processes

The primary chemical processes expected to affect the transport of volatile organic compounds reported at the AOC include sorption, volatilization, and chemical degradation.

[7] Capillary forces are a function of interfacial tension between DNAPL and water and fracture aperture.

Sorption is a partitioning process whereby contaminants reach an equilibrium between aqueous and solid phases. Sorption of organic compounds is typically related to the organic carbon content of the media. Since the bedrock at Delphi Thermal is expected to have a low organic carbon content, sorption within bedrock is expected to be negligible. Volatilization is the process whereby contaminants enter the air phase from the aqueous phase. Due to the overlying low permeability soils at the Site, the effect of volatilization in reducing contaminant concentrations is considered negligible as are emissions of organic chemicals from the groundwater.

Chemical degradation includes hydrolysis. Hydrolysis is the chemical reaction between water and contaminant. Hydrolysis is often described as a first-order reaction.[8] Published values of the hydrolysis rate constant for TCE are included on Table 8.

5.2.3 Biological Processes

Biological degradation of chlorinated compounds such as the AOC-related contaminants may occur under both aerobic and anaerobic conditions. Compounds such as PCE and TCE are more likely to undergo reductive dechlorination under anaerobic, chemically reducing conditions and requires the presence of dissolved organic carbon. Less highly chlorinated compounds, such as Vinyl Chloride, are more likely to degrade via oxidation reactions within an aerobic environment. Case studies often report anaerobic conditions within the center of the plume and aerobic conditions at the edge of the plume. Published values of first order degradation rate constants for both aerobic and anaerobic degradation are summarized on Table 8.

5.3 OBSERVED MIGRATION

This section discusses the collected field and analytical data, as the data relate to the transport processes discussed above.

5.3.1 Groundwater Migration

As further described in Section 4.3, concentrations of parent compounds (TCE and PCE) in groundwater are generally highest near the AOC. Moving eastward from the AOC, concentrations of parent compounds decrease consistently such that they were not detected at the three furthest downgradient wells (MW-11, MW-12, and MW-13) or in MW-14. PCE was detected at low concentrations in MW-15, located at the northern downgradient area of the plume.

Parent compound breakdown products, 1,2-DCE and Vinyl Chloride, reach maximum concentrations at intermediate wells such as MW-4, then decrease at downgradient wells (MW-10, MW-11, and MW-12). This is consistent with the results of past sample rounds. Daughter compounds were not detected in well MW-13, at the furthest downgradient edge of the plume (at the Delphi Thermal property line). Daughter

[8] The rate of change of concentration in a first order reaction is the concentration multiplied by a rate constant.

compound 1,2-DCE was detected at low concentrations in MW-14. No daughter compounds were detected in MW-15.

5.3.1.1 Advection and Dispersion

Advection is occurring at the Site as indicated by detectable concentrations of AOC-related contaminants within downgradient wells to the east of the AOC. This pattern of migration is consistent with the general groundwater flow direction estimated based on measured hydraulic gradients and observations of fractures within the streambed. Concentrations of TCE within downgradient wells, approximately 500 to 600 feet away from the AOC, are roughly 1000 times less than the concentrations found at the AOC. No significant temporal trends are observed in the data over the sampling period. The groundwater contamination in the shallow bedrock appears to be in a near steady state condition.

The Site study area is more than 850 feet wide. Detectable concentrations of Site-related contaminants have been reported in the majority of the wells installed (except for MW-13, the furthest downgradient monitoring well). Therefore, it appears that transverse dispersion is occurring. This indicates that although the bedrock was observed to be competent with relatively few fractures and joints, the fractures appear to be sufficiently interconnected to allow for dispersion. It does not appear that contaminant migration is selectively occurring along a few large fractures.

5.3.1.2 Chemical and Biological Degradation

Analytical testing data indicate that degradation of TCE and PCE is occurring at the Site. This is demonstrated by the presence of breakdown products including 1,2-DCE and Vinyl Chloride at, in some instances, increasing concentrations downgradient of the AOC. It is not believed that these compounds were imported or used at the Site, although they could be an impurity within commercial TCE. In addition, based on monitored natural attenuation field and analytical data, there is supportive evidence that biochemical degradation is present at the Site and is responsible for the reductive dechlorination of chlorinated volatile organic compounds.

GZA performed a monitored natural attenuation evaluation to evaluate the extent to which natural processes control the fate and transport of chlorinated VOCs at the Site. The evaluation included:

- Evaluation of the hydrogeochemical data collected to date to assess the nature of the natural attenuation processes operating at the Site as well as the limitations of those processes for controlling fate and transport; and
- Computer modeling to evaluate the maximum anticipated extent of the plume and the time it might take for Site groundwater to comply with applicable groundwater quality standards.

The evaluation and associated computer modeling are presented in Appendix D. In general, the following are conclusions regarding the natural attenuation processes occurring at the Site.

- Indicator parameter data for samples collected from contaminated monitoring well locations (i.e., those locations with exceedances of regulatory standards) were compared with data obtained for samples from background (TK-2) and/or less contaminated locations. These data indicate that reductive dechlorination, the most significant biological natural attenuation process, is capable of occurring and likely occurring throughout the majority of Site areas.

- BTEX (i.e., petroleum compounds) are providing a source of carbon/energy for biodegradation. BTEX was detected at well MW-3S, and MW-4, which are located near the AOC.

- Historical TCE analytical data for groundwater collected from near the source area (i.e., MW-4 and MW-7) suggest that the elevated TCE concentrations reflect the presence of DNAPL within the source area. Also, TCE concentrations are being reduced via biological attenuation by reductive dechlorination, as well as other physical/chemical processes (e.g., dispersion).

- As summarized in Table 11, the ratios of parent (TCE and PCE) to daughter compounds (1,2-DEC and Vinyl Chloride) at the Site, both in source area wells and downgradient wells, suggest that chlorinated VOCs are being reductively dehalogenated in the source area and along the groundwater flow path such that generally only daughter compounds persist along the plume leading edge. Because daughter concentrations appear to have reached steady-state conditions along the plume leading edge, it is likely that the plume has reached steady state conditions and is now stabilized.

- According to the BIOCHLOR model, which was executed using information concerning physical Site conditions, the following scenario should be present.

    - TCE and PCE concentrations should be attenuated below their respective NYSDEC Class GA criteria within approximately 800 feet of the source.

    - Daughter compounds should persist above their respective NYSDEC Class GA criteria no greater than approximately 1,200 feet of the source.

- Chlorinated VOC concentrations at sidegradient wells (e.g., MW-6, MW-8) should be one order of magnitude lower than actual Site concentrations.

- These conditions should become established within ten years.

These conditions are apparent in the historic Site groundwater data presented in Table 9.

- According to the BIOCHLOR model, PCE concentrations at well MW-15 should not be detected above detection limits based on this well's sidegradient location. However, based on the groundwater flow direction in this area (i.e., between MW-10 and MW-15 as shown on Figure 6) and based on localized biogeochemistry (e.g., low concentrations of dissolved organic carbon, the presence of nitrate, and chemically oxidizing conditions as evidenced by ORP), the rate of PCE decay is lower than in the general area of the Site.

A summary of the evaluation of natural attenuation indicator parameters is presented in Table 12.

5.3.2 Volatilization and Soil Vapor Migration

TCE, PCE and breakdown products within the Site area groundwater may volatilize into the overburden soil zone. The thickness of the overburden soil zone is 3.5 to 8.0 feet thick. Migration of soil vapors (gases) occurs through the fractures within the bedrock and void spaces within the overburden soil. Soil vapors may discharge into the atmosphere and into subsurface structures such as manholes. In addition, volatilization of VOCs may occur at groundwater discharge locations, such as seeps or surface water features.

5.4 PREDICTED EXTENT OF CONTAMINATION

Based on the data presented in Section 4.0 and the discussion presented above, it is believed that the shallow bedrock contamination is in a near steady state condition. Therefore, the extent of contamination along the majority of the plume is currently established as being within the Delphi Thermal property, except potentially within the area of MW-15 on the northern downgradient area of the plume. Considering that the rate of decrease in PCE concentrations between MW-10 (average PCE concentration of 0.16 ppm) and MW-15 (average PCE concentration of 0.017 ppm) is about 0.15 ppm over a distance of about 460 feet in the downgradient direction; and assuming that the rate of PCE attenuation continues at the same rate in a downgradient direction from MW-15; it is anticipated that the PCE concentration at the Delphi Thermal property line at Route 93 (about 120 ft downgradient of MW-15) would decrease to less than 5 ppb (the NYSDEC Class GA criterion).

6.0 QUALITATIVE EXPOSURE ASSESSMENT

A qualitative baseline exposure assessment was conducted based on the information presented in Sections 1.0 through 5.0. Generally, the human health evaluation involves an exposure assessment, an evaluation of Site occurrence of contaminants and comparison to New York State risk-based criteria, and a qualitative exposure characterization.

6.1 EXPOSURE ASSESSMENT

This exposure assessment discusses potential migration routes by which chemicals in the environment may be able to reach human receptors. This discussion is based on current and hypothetical future Site conditions. It should be noted that several conservative assumptions were used in completing this assessment; and, thus, the actual risks are expected to be less than those identified. These risks are expected to be mitigated through potential future remedial activities at the Site, which could include implementing institutional controls, groundwater extraction and treatment system, in-situ chemical oxidation, or ~~monitoring~~ natural attenuation. These potential future remedial activities will be evaluated and further discussed in the FFS.

As shown on Figure 2, the Site area currently generally serves as employee parking and landscaped green space at the Delphi Thermal facility. The AOC is located between Building 8 to the north and west and a concrete steam chase to the east. In addition, a portion of the Site located south of the AOC is used as an equipment storage area, and a water cooling tower is located directly southeast of the AOC. Route 93 is the nearest public property to the Site, and bounds the Delphi Thermal property to the East. To the East of Route 93 are residential properties, the Delphi Thermal wastewater treatment plant, and the “Gulf”.

For the purposes of this evaluation, it is assumed that the general use of the area will remain unchanged. The hypothetical future conditions for the Site area includes future development and/or intrusive work on the Delphi Thermal property, workers completing work at the Site, or workers completing work along Route 93 who may be unaware of potential contamination.

A complete exposure pathway must exist for a population to be impacted by the chemicals at the Site. A complete exposure pathway consists of five components:

1. a source and mechanism of chemical release;
2. a transport medium;
3. a point of potential human contact with the contaminated medium;
4. an exposure route at the contact point; and
5. a receptor population.

Section 4.0 discusses nature and extent of contamination, and Section 5.0 discusses potential routes of migration of chemical substances and observed migration at the Site. This section focuses on exposure pathways identified for the shallow bedrock groundwater contaminant plume. A summary of potential exposure pathways is presented in Table 13.

6.1.1 Shallow Bedrock Groundwater

Exposure to groundwater, if used as a drinking water supply, includes ingestion, dermal contact and inhalation of vapors. However, human exposure due to the use of groundwater as drinking water is not expected due to various factors. First, a public potable water system services the area. Also, as described in Section 2.7, NYSDEC concluded that "health impacts from potentially contaminated groundwater leaving the Harrison (Delphi Thermal) Site are extremely unlikely", based on the lack of drinking water supply wells in the vicinity of the Site relative to the AOC. Thus, exposure to contaminated groundwater as a drinking water source is not expected.

Based on the groundwater flow direction, the contaminated groundwater emanating from the AOC flows to the east. Potential human exposure may occur at the point of groundwater contact, through ingestion, dermal contact, and inhalation of vapors. The likelihood of exposure to groundwater due to shallow construction or subsurface facility/utility maintenance activities is considered to be low, since the groundwater is situated in bedrock at approximately 5 to 15 feet bgs, unless such activities are conducted to depths into bedrock. A low potential for exposure exists associated with maintenance on existing subsurface facilities/utilities at the Site (e.g., sanitary lift station) that are installed into bedrock, or construction of facilities/utilities to such depths. Additionally, excavation work is not permitted at the Site unless the facility's excavation permit program is executed. The excavation permit process includes a provision for monitoring environmental conditions and proper protective equipment use and/or engineering controls. These scenarios provide a low likelihood for exposure.

As further described in Section 5.0, the elevation of the bed of the on-Site stream is such that the stream likely discharges to groundwater during much of the year. Therefore, the likelihood of human exposure via contaminated groundwater discharging to surface water in the stream is considered low.

Also, future exposure could result from on-site groundwater wells used for dewatering, cooling, and as a source of drinking water, if installed. However, it is assumed that since the Site is a Class 3 NYSDEC Inactive Hazardous Waste Disposal Site, the use of groundwater would be prohibited through administrative and/or institutional controls. Therefore, this scenario presents no likelihood for human exposure to groundwater. Additionally, a permit would be required for the installation or use a water supply well in the area of the Site by Niagara County Health District (Sanitary Code Title 10, Chapter 1, Part 5).

If basements or sumps exist in structures located east of Route 93 (off-site), a very low potential for exposure exists. However, as further described in Section 5.4, the concentrations of chlorinated VOCs from the Site are to be below the groundwater standard, except possibly in the area of MW-15. However, based on the rate of PCE attenuation at the Site, it is expected that the PCE concentration at the Delphi Thermal property line at Route 93 is below the NYSDEC groundwater standard.

6.1.2 Volatile Vapors

Potential inhalation exposure from volatilization of VOCs in contaminated groundwater may occur under current conditions and under the future development scenarios, through the migration of vapors into excavations, manholes, sumps, basements, and other outdoor areas.

Due to the depth to impacted groundwater (approximately 5 to 15 feet bgs), that groundwater is located in shallow bedrock, and that much of the Site area is paved, the on-Site inhalation exposure due to vapor migration is expected to be low. Also, based on the soil gas survey conducted at and proximate to the AOC, utility beddings were not found to provide a significant pathway for the migration of contamination.

Off-Site inhalation exposure from vapor migration is not expected due to the non-detect or low downgradient groundwater concentrations (at or below the groundwater standard).

6.2 CONTAMINANT IDENTIFICATIONS AND EVALUATION OF SITE OCCURRENCE

Table 14 presents the range of concentrations for the VOCs detected in the groundwater for the exposure scenarios discussed above. The summary includes the number of samples (well locations) analyzed, the number of times (i.e., locations) a chemical was detected, the maximum value reported, ~~and~~ the location where the maximum value was reported, and the range of detections (above the detection limit). For purposes of this qualitative and conservative assessment, the exposure point concentration is defined as the maximum reported concentration at the monitoring well locations from the various sample rounds. This value is compared to New York State risk-based criteria (discussed below). Data from duplicate samples were included for the purposes of determining a maximum detected value per monitoring well location.

6.3 QUALITATIVE EXPOSURE CHARACTERIZATION

The potential Site hazards due to human exposures to groundwater and volatile vapors were reviewed based on chemical-specific health exposure based criteria.

6.3.1 Shallow Bedrock Groundwater

Human health risks associated with exposure to shallow bedrock groundwater were examined by considering both:

- Use of the shallow bedrock groundwater as a drinking water source; and

- Potential exposure to groundwater at a point of contact, by construction, maintenance or utility workers.

Exposure to volatile vapors from overburden groundwater is addressed separately in Section 6.3.2.

The New York State criteria used for human health risks associated with use of groundwater at the Site as a drinking water source includes the following:

- NYSDEC Class GA Groundwater Quality Criteria, 6NYCRR Part 701-703, dated October 1993; revised June 1998; errata January 1999; and April 2000 Addendum.

Groundwater samples contained several VOCs exceeding risk-based criteria as a drinking water source based on the above-listed criteria. Eight VOCs exceeded risk-based criteria. However, the target Site compounds TCE, 1,2-DCE, Vinyl Chloride, and PCE were detected at concentrations greater than the above-listed criteria in the majority of the groundwater samples (locations) tested. BTEX compounds tested for were detected in two wells (primarily MW-3S).

6.3.2 Volatile Vapors

Human health risks associated with temporary exposure to volatile vapors via inhalation were assessed using the analytical data for groundwater VOC analytical results from Site groundwater monitoring wells. Based on the concentrations of contamination present and the depth to groundwater, it is possible for vapors to accumulate in enclosed on-Site areas (e.g., sanitary sewer lift station manhole). However, based on the soil gas survey conducted at and proximate to the AOC, utility beddings were not found to provide a significant pathway for the migration of contamination and vapors are not expected to be a significant concern in the Site buildings.

6.4 SUMMARY OF HUMAN HEALTH EXPOSURE ASSESSMENT

A qualitative human health risk assessment was completed for the Site. A summary of the results of the exposure assessment, listed by media, and a conclusion as to the apparent need to address each of the media considered during the FFS is presented below.

6.4.1 Shallow Bedrock Groundwater

The potential for exposure to chemical substances within the groundwater at the Site appears low. This is due to institutional controls (i.e., excavation permit) limiting potential exposure at a point of groundwater discharge into an excavation and at underground facilities/utilities or structure work. Additionally, the exposure to and the subsequent inhalation of volatile vapors are also considered low based on soil gas results and permits required for excavation work.

No potential for exposure due to use of groundwater as a drinking water source is expected, and the likelihood of human exposure via the stream is considered low. The contaminated groundwater in Site areas should be addressed during the FFS.

6.4.2 Volatile Vapors

Vapor migration associated with VOC contamination in groundwater may potentially impact underground structures and facilities.

7.0 SUMMARY AND CONCLUSIONS

7.1 SUMMARY

The purpose of this FRI is to characterize the nature and extent of the TCE related contamination in shallow bedrock at the Site. The FRI information will be used as a baseline to perform the FFS.

7.1.1 Nature and Extent of Contamination

An aboveground TCE storage tank, closed in May 1994, was situated within a concrete containment dike with a concrete bottom. The tank was located at the southeast corner of Building 8 (AOC). During excavation to repair a ruptured fire protection line, a solvent odor was detected. Subsequently, soils from an approximate 27 by 22 foot area were excavated to a depth of about 7.5 feet bgs and disposed by Delphi Thermal as a hazardous waste. The excavation was then backfilled with a manufactured crushed stone product. VOCs were detected in groundwater and subsurface soil in the immediate vicinity of the AOC above respective NYSDEC drinking water standards and soil cleanup guidance values. These contaminants included TCE, PCE and their breakdown products.

Groundwater flow in the vicinity of the site appears to be generally towards the east, as depicted on Figure 6.

The FRI source area, for purposes of the FRI, is defined as the groundwater contamination associated with the AOC and the DNAPL identified in MW-5. Contaminants in the vicinity of the AOC and the DNAPL at MW-5 will continue to contribute to the groundwater plume at the Site until sources are depleted.

Analytical testing results of samples from shallow bedrock monitoring wells indicate the presence of AOC-related contaminants (chlorinated solvents) in the majority of the wells installed as part of this study; and petroleum related compounds in wells MW-3S and MW-4. Compounds reported above NYSDEC Class GA drinking water criteria include; TCE, PCE 1,2-DCE, Vinyl Chloride, and petroleum related compounds (benzene, toluene, ethylbenzene and xylenes).

In general, concentrations of parent compounds (TCE and PCE) are highest near the AOC. Moving eastward from the AOC, concentrations of parent compounds decrease consistently. Parent compounds were not detected at the three furthest downgradient wells (MW-11, MW-12, and MW-13). Parent compounds were also not detected in MW-14, located at the southern downgradient area of the plume. PCE was detected at low concentrations in MW-15, located at the northern downgradient area of the plume.

Parent compound breakdown products (daughter compounds), 1,2-DCE and Vinyl Chloride, reach maximum concentrations at intermediate wells such as MW-4, then decrease at downgradient wells (MW-10, MW-11, and MW-12). Daughter compounds were not detected in well MW-13, at the furthest downgradient edge of the plume (at the Delphi Thermal property line). Daughter compound 1,2-DCE was detected at a low concentration in MW-14. No daughter compounds were detected in MW-15. Figure 7 shows a Site Plan with the analytical results from the twelve groundwater sampling rounds.

A sample of DNAPL was collected from monitoring well MW-5. The sample exhibited a brownish black appearance and was observed to sink in water. Test results indicate the DNAPL contains approximately 430,000 mg/kg of TCE and 640,000 mg/kg of PCE. It is not known how many of the fractures monitored by MW-5 contain DNAPL.

Twelve groundwater sample rounds have been completed to date between the period of September 1995 and October 2001. The total chlorinated compound concentrations between the first sample round and October 2001 sample round were compared for the monitoring wells. In general, the concentrations in the groundwater samples from the evaluated wells did not significantly change. Minor fluctuations in concentrations are noted within the data and are to be expected given the analytical laboratory accepted accuracy for the test procedures.

7.1.2 Contaminant Fate and Transportation

The primary routes of contaminant migration at the Site is via the shallow bedrock groundwater and volatilization to soil gas/air.

The primary source of the groundwater passing through/beneath the AOC is anticipated to originate from flow upgradient of the AOC in the shallow bedrock. Groundwater flow through the bedrock beneath the facility is controlled primarily by fractures within the rock. Groundwater flow occurs within rock fractures and bedding planes. Based on the bedrock core samples observed and hydraulic conductivity test results, the rate of flow beneath the AOC is expected to be relatively low.

The data suggest that groundwater contaminant transport is in a near steady state condition and significant increases in the concentrations with time are not expected. As migration of TCE and PCE occurs away from the AOC, natural attenuation occurs resulting in a reduction of concentrations and mass of contaminant.

DNAPL was observed in MW-5 and is trapped within fractures monitored by MW-5. It is not believed that the DNAPL is migrating. However, through dissolution it will provide a continuing source of groundwater contamination, until it is depleted.

Volatilization is expected to occur at the Site; however, the potential for volatilization decreases with distance from the AOC. Due to the depth to impacted groundwater (approximately 5 to 15 feet bgs), that groundwater is located in shallow bedrock, and that much of the Site area is paved, the extent of potential vapor migration is expected to be limited.

Physical, chemical and biological processes affect the migration of contaminants within the fractured bedrock flow system at the Delphi Thermal Site. The primary natural attenuation process occurring at the Site is biochemical degradation. Analytical data indicate that degradation of TCE and PCE is occurring at the Site, as is demonstrated by the presence of breakdown products including 1,2-DCE and vinyl chloride downgradient of the AOC. Furthermore, based on monitored natural attenuation field and analytical data, there is supportive evidence that biochemical degradation is occurring at the Site and is responsible for the reductive dechlorination of chlorinated volatile organic compounds.

The extent of contamination along the majority of the plume is currently established as being within the Delphi Thermal property (concentrations of chlorinated solvents in well MW-13 were not detected above detection limits), except potentially within the area of MW-15 on the northern downgradient area of the plume. It is expected that the PCE concentration at the Delphi Thermal property line at Route 93 would decrease to less than 5 ppb (the NYSDEC Class GA criterion). However, since less biochemical degradation is occurring in the area of MW-15 than at other areas of the Site, the actual concentration at the property line is difficult to estimate.

7.1.3 Qualitative Health Exposure Assessment

A qualitative baseline human health exposure assessment was completed based on the information and data obtained during the FRI study. This exposure assessment discusses potential migration routes by which chemicals in the environment may be able to reach human receptors. This discussion is based on current and hypothetical future Site conditions, and the risks identified are expected to be "worse case scenarios". These risks are expected to be mitigated through potential future remedial activities at the Site. A summary of the results of the exposure assessment, listed by media, and a conclusion as to the apparent need to address each of the media considered during the FFS is presented below.

Shallow Bedrock Groundwater

The potential for exposure to chemical substances within the groundwater at the Site appears low. This is due to institutional controls (i.e., excavation permit) limiting potential exposure at a point of groundwater discharge into an excavation and at underground facilities/utilities or structure work. Additionally, the exposure to and the subsequent inhalation of volatile vapors are also considered low based on soil gas results and permits required for excavation work.

No potential for exposure due to use of groundwater as a drinking water source is expected, and the likelihood of human exposure via the stream is considered low. The contaminated groundwater in Site areas should be addressed during the FFS.

Volatile Vapors

Vapor migration associated with VOC contamination in groundwater may potentially impact underground structures and facilities.

7.2 CONCLUSIONS AND RECOMMENDATIONS

Based on the FRI summarized above, the following are conclusions regarding the Site and the nature and extent of soil and groundwater contamination.

- VOCs were detected in groundwater and subsurface soil in the immediate vicinity of the AOC above respective NYSDEC drinking water standards and soil cleanup guidance values. These contaminants included TCE and its breakdown products.

- The contaminant levels generally decrease with distance from the reported spill area (AOC).

- The extent of soil contamination was defined and it was found to be limited to the immediate area around the AOC. The impacted soil in the vicinity of the AOC is not considered a significant source of contamination.

- Utility beddings were not found to be providing a significant pathway for migration of contamination.

- Shallow bedrock groundwater is impacted with TCE, PCE and their breakdown products.

- Deep bedrock groundwater, at monitoring well MW-3D, was not found to be impacted by the AOC.

- DNAPL exists in the shallow bedrock in the area of monitoring well MW-5. The highly contaminated groundwater in the main part of the plume (near MW-5) and the DNAPL are primary sources of contamination on-Site.

- Groundwater contaminant transport is in steady state condition.

- Natural attenuation is occurring at the Site, between the source of contamination and the Delphi Thermal property line, resulting in a reduction of concentrations and mass of chlorinated VOC contaminants. Contaminant concentrations at the property line are below or near the NYSDEC Class GA drinking water standard. This reduction is primarily associated with natural attenuation processes.

- There are no significant exposure scenarios from the source of contamination to the property line. The potential exposure scenarios are limited (e.g., construction and maintenance projects) and they can be addressed by administrative controls.

- Off-Site inhalation exposure from vapor migration is not expected due to the non-detect or low downgradient groundwater concentrations (at or below the groundwater standard). Exposure to off-site groundwater is not expected.

Contaminated groundwater and associated DNAPL are the primary environmental media that need to be addressed during the FFS.

TABLES

Table 1
Summary of Unsaturated Soil Analytical Test Results
Focused Remedial Investigation
Delphi Harrison Thermal Systems
West Lockport Complex
Lockport, New York

Parameter	units	Soil Cleanup Criteria	Sample Location (Depth Below Ground Surface)											
			AP-1 (1'-2')	AP-2 (1'-2')	AP-2 (4'-5')	AP-4 (1'-2')	AP-4 (4'-5')	AP-7 (1'-2')	AP-7 (5'-5.1')	AP-9 (3'-4')	AP-10 (3'-4')	AP-11 (2'-3')	AP-11 (5'-5.6')	AP-12 (3'-4')	MW-3 (4'-6')
Trichloroethylene	mg/kg	0.7	3.7	0.034		0.022		43	0.018					0.023	
1,2-Dichloroethene	mg/kg	0.4		0.054	5.6	0.1		0.63							
Tetrachloroethene	mg/kg	1.4						1.7							
Total Xylenes	mg/kg	1.2				0.045									
Toluene	mg/kg	1.5				0.027									
Ethylbenzene	mg/kg	5.5				0.012									
2-Butanone	mg/kg	0.3			16										
Chlorobenzene	mg/kg	1.7						0.006							

Notes:
1. Blank indicates that analyte was not detected above the respective detection limit.
2. Analytical Testing completed by Free-Col Laboratories, Inc.
3. NYSDEC Soil Cleanup Criteria obtained from NYSDEC Division of Hazardous Waste Remediation, Technical and Administrative Guidance Memorandum HWR-94-4046, Determination of Soil Cleanup Objectives and Cleanup Levels", January 24, 1994.
4. Samples were collected between August 28 and September 1, 1995.
5. Table contains detected compounds only.

Table 2
Summary of Saturated Soil Analytical Test Results
Focused Remedial Investigation
Delphi Harrison Thermal Systems
West Lockport Complex
Lockport, New York

Parameter	Units	Soil Cleanup Criteria	Sample Location (Depth Below Ground Surface)												
			AP-2 (7'-7.8')	AP-3 (6'-7')	AP-5 (7'-7.4')	AP-6 (6'-6.4')	AP-8 (6'-7')	AP-12 (6'-6.5')	AP-13 (7'-8')	AP-96-1 (6'-6.2')	AP-96-2 (4.5'-5.8')	AP-96-3 (6'-8')	AP-96-4 (4.9'-5.8')	MW-1 (6'-7')	MW-2 (8'-9')
Trichloroethylene	mg/kg	0.7	9.4	6.8	3.7		1.1	0.4						160	0.04
1,2-Dichloroethene	mg/kg	0.4	0.1	3.3	1.5			0.1							
Tetrachloroethene	mg/kg	1.4						0.025			0.49				
Total Xylenes	mg/kg	1.2		0.05					51						
Toluene	mg/kg	1.5												1.7	

Notes:
1. Blank indicates that analyte was not detected above the respective detection limit.
2. Analytical Testing completed by Free-Col Laboratories, Inc.
3. NYSDEC Soil Cleanup Criteria obtained from NYSDEC Division of Hazardous Waste Remediation, Technical and Administrative Guidance Memorandum HWR-94-4046, Determination of Soil Cleanup Objectives and Cleanup Levels", January 24, 1994.
4. Samples were collected between August 28 and September 1, 1995.
5. Table contains detected compounds only.

Table 3
Summary Soil Gas Screening Results
Focused Remedial Investigation
Delphi Harrison Thermal Systems
West Lockport Complex,
Lockport, New York

Sample Location	Sample Depth (feet)	Peak Organic Vapor Meter Reading (ppm)	Tentative Compound Identification and Estimated Concentration (ul/l or ppmv)			Remarks
			trans 1,2 Dichloroethene	Trichloroethylene	cis 1,2 Dichloroethylene	
SG-1	5.5 - 6	30	ND (0.05)	52	0.5	Sample diluted prior to screening
SG-2	5.5 - 6	20	ND (0.05)	30	0.2	Sample diluted prior to screening
SG-3	5.5 - 6	ND (1.0)	ND (0.05)	0.08	ND (0.05)	
SG-4	4.5 - 5	ND (1.0)	ND (0.05)	ND (0.05)	ND (0.05)	
SG-5	5 - 5.5	ND (1.0)	ND (0.05)	0.15	0.06	Several other compounds detected

Notes:
1. Soil gas survey was conducted in September 1995.
2. Sample depths are measured in feet below ground surface.
3. ppm = parts per million.
4. ul/l = microliter per liter.
5. ppmv = parts per million (vapor).

Table 4
Summary of Bedrock Core Samples
Focused Remedial Investigation
Delphi Harrison Thermal Systems
West Lockport Complex
Lockport, New York

Well	Sample No.	Depth from Ground Surface (feet)			Depth from Top of Rock (feet)			RQD (%)	Recovery (%)
MW-1	C-1	7	-	11.9	0	-	4.9	57	100
	C-2	11.9	-	17	4.9	-	10	88	100
	C-3	17	-	22.2	10	-	15.2	96	100
	C-4	22.2	-	26.3	15.2	-	19.3	96	100
MW-2	C-1	8.9	-	13.9	0	-	5	54	100
	C-2	13.9	-	19.2	5	-	10.3	92	100
	C-3	19.2	-	25.1	10.3	-	16.2	92	100
	C-4	25.1	-	30.0	16.2	-	21.1	100	100
MW-3	C-1	8.8	-	13.8	0.0	-	5.0	88	92
	C-2	13.8	-	19.0	5.0	-	10.2	100	100
	C-3	19.0	-	22.5	10.2	-	13.7	100	100
	C-4	22.5	-	27.7	13.7	-	18.9	100	100
MW-4	C-1	11.6	-	17.0	0.0	-	5.4	83	100
	C-2	17.0	-	22.2	5.4	-	10.6	98	98
	C-3	22.2	-	27.4	10.6	-	15.8	100	100
	C-4	27.4	-	32.5	15.8	-	20.9	96	100
MW-5	C-1	6.2	-	11.3	0.0	-	5.1	84	98
	C-2	11.3	-	16.4	5.1	-	10.2	100	100
	C-3	16.4	-	21.5	10.2	-	15.3	96	100
	C-4	21.5	-	26.6	15.3	-	20.4	98	100
MW-6	C-1	5.3	-	10.3	0.0	-	5.0	60	100
	C-2	10.3	-	13.9	5.0	-	8.6	96	96
MW-7	C-1	7.0	-	9.0	0.0	-	2.0	20	40
	C-2	9.0	-	14.0	2.0	-	7.0	74	100
	C-3	14.0	-	19.2	7.0	-	12.2	89	94
	C-4	19.2	-	24.1	12.2	-	17.1	100	100
	C-5	24.1	-	27.2	17.1	-	20.2	97	100
MW-8	C-1	8.1	-	13.3	0	-	5.2	87	100
	C-2	13.3	-	16.3	5.2	-	8.2	89	98
MW-9	C-1	6.5	-	11.5	0.0	-	5.0	70	91
	C-2	11.5	-	15.0	5.0	-	8.5	68	97
MW-10	C-1	10.8	-	16.2	0	-	5.4	37	98
	C-2	16.2	-	21.3	5.4	-	10.5	64	102
MW-11	C-1	6.5	-	10.0	2.3	-	5.8	10	96
	C-2	10.0	-	15.1	5.8	-	10.9	59	100
	C-3	15.1	-	20.1	10.9	-	15.9	94	98
	C-4	20.1	-	24.1	15.9	-	19.9	96	96
MW-12	C-1	6.0	-	11.0	3.9	-	8.9	54	96
	C-2	11.0	-	15.1	8.9	-	12.5	73	98
MW-13	C-1	5.0	-	10.0	0	-	5.0	74	88
	C-2	10.0	-	15.0	5.0	-	10.0	88	98
MW-14	C-1	4.1	-	9.1	0	-	5.0	65	98
	C-2	9.1	-	14.1	5.0	-	10.0	96	100
	C-3	14.1	-	19.1	10.0	-	15.0	96	98
MW-15	C-1	5.4	-	10.4	0	-	5.0	57	88
	C-2	10.4	-	15.4	5.0	-	10.0	70	96

Notes:
1. RQD is defined as the summation of all pieces of rock core greater than four inches divided by the length of the core run, expressed as a percentage.
2. Recovery is the total length of sample collected divided by the length of the core run, expressed as a percentage.

Table 5
Summary of Groundwater Monitoring Well Information
Focused Remedial Investigation/Focused Feasibility Study
Delphi Harrison Thermal Systems
West Lockport Complex
Lockport, New York

Well	Ground Surface Elevation (feet)	Top of Rock		Bottom of Hole		Top of Intake		Bottom of Intake		Hydraulic Conductivity (cm/sec)
		Depth (feet bgs)	Elevation (feet)	Depth (feet bgs)	Elevation (feet)	Depth (feet bgs)	Elevation (feet)	Depth (feet bgs)	Elevation (feet)	
MW-1 (Abandoned)	611.9	7.0	604.9	26.3	585.6	9.0	602.9	26.3	585.6	1.5E-06
MW-2 (Abandoned)	613.1	8.9	604.2	30.0	583.1	9.0	604.1	30.0	583.1	2.9E-07
MW-3S	611.9	8.8	606.2	27.7	587.3	10.5	604.5	27.7	587.3	1.3E-05
MW-3D	612.0	9.1	602.9	70.3	541.7	57.0	555.0	70.3	541.7	1.0E-05
MW-4	610.8	11.6	599.2	32.5	578.3	13.6	597.2	32.5	578.3	1.6E-05
MW-5	607.0	6.2	600.8	26.6	580.4	8.4	598.6	26.6	580.4	1.4E-05
MW-6	609.1	5.3	603.8	13.9	595.2	7.0	602.1	13.9	595.2	1.1E-03
MW-7	612.3	7.0	605.3	27.2	585.1	9.9	602.4	27.2	585.1	1.1E-06
MW-8	606.6	6.8	599.8	16.3	590.3	10.0	596.6	16.3	590.3	3.9E-04
MW-9	602.7	5.6	597.1	15.0	587.7	7.5	595.2	15.0	587.7	6.5E-04
MW-10	602.3	9.3	593.0	21.3	581.0	11.5	590.8	21.3	581.0	1.5E-03
MW-11	588.7	4.2	584.5	24.1	564.6	7.0	581.7	24.1	564.6	5.4E-05
MW-12	589.1	2.1	587.0	15.1	574.0	6.5	582.6	15.1	574.0	1.1E-02
MW-13	589.5	3.0	586.5	15.0	574.5	7.0	582.5	15.0	574.5	1.1E-02
MW-14	590.4	3.1	587.3	19.1	571.3	7.2	583.2	19.1	571.3	7.5E-06
MW-15	591.9	3.4	588.5	15.4	576.5	6.5	585.4	15.0	576.9	9.3E-05

Notes:
1. Total depth measured from top of riser to bottom of screen.
2. Elevations shown were calculated based on measurements made by GZA on 9/19/95, 1/10/96, 4/26/96, 10/31/96, 8/15/97, 7/24-7/27/01, and 8/22/01 using optical survey techniques with a Topcon Autolevel. The elevations are relative to a manhole rim of known elevation (611.5 feet) as shown on drawings provided by Delphi Thermal.
3. bgs = below ground surface.

Table 6
Summary of Groundwater Elevation Measurements
Focused Remedial Investigation
Delphi Harrison Thermal Systems
West Lockport Complex
Lockport, New York

Monitoring Point	Monitoring Point Elevation (feet)	09/18/1995 Groundwater Elevation (feet)	10/06/1995 Groundwater Elevation (feet)	04/26/1996 Groundwater Elevation (feet)	06/20/1996 Groundwater Elevation (feet)	07/26/1996 Groundwater Elevation (feet)	10/30/1996 Groundwater Elevation (feet)	11/21/1996 Groundwater Elevation (feet)	08/28/1997 Groundwater Elevation (feet)	10/10/1997 Groundwater Elevation (feet)	11/30/1998 Groundwater Elevation (feet)	10/06/1999 Groundwater Elevation (feet)	08/07/2001 Groundwater Elevation (feet)	08/22/2001 Groundwater Elevation (feet)	10/29/2001 Groundwater Elevation (feet)
MW-1 (Abandoned)	613.77	606.1	606.6	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned
MW-2 (Abandoned)	615.03	605.5	607.1	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned
MW-3S	613.28	604.5	605.4	605.1	605.1	605.2	605.4	605.4	605.1	605.2	603.9	604.7	604.2	604.3	604.7
MW-3D	614.81	NI	NI	577.8	NM	NM	576.6	576.0	573.4	574.5	NM	NM	570.2	569.6	568.9
MW-4	613.07	NI	NI	604.6	604.6	604.6	604.8	604.4	604.5	604.4	603.3	603.9	604.0	604.1	604.0
MW-5	609.05	NI	NI	603.4	602.5	603.0	604.5	603.6	602.4	603.2	601.6	603.2	601.6	601.5	603.7
MW-6	611.21	NI	NI	602.0	602.1	602.3	602.1	602.0	602.1	602.0	602.1	602.0	602.0	602.1	601.9
MW-7	613.86	NI	NI	606.8	604.5	606.4	606.8	606.3	606.3	606.2	605.2	605.8	605.9	605.8	605.9
MW-8	608.97	NI	NI	NI	NI	NI	603.5	603.2	602.8	603.0	602.2	602.7	602.1	602.0	603.0
MW-9	604.90	NI	NI	NI	NI	NI	596.1	595.9	595.0	595.7	593.1	595.2	593.7	593.6	595.9
MW-10	604.70	NI	NI	NI	NI	NI	590.5	590.1	589.5	589.8	587.2	588.8	587.8	587.6	589.8
MW-11	590.10	NI	NI	NI	NI	NI	NI	NI	584.2	584.4	583.6	582.5	583.0	582.7	584.5
MW-12	590.71	NI	NI	NI	NI	NI	NI	NI	584.6	584.7	584.6	584.6	584.7	584.6	584.6
MW-13 *	589.02	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	582.9	583.3	583.8
MW-14	592.77	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	584.6	584.8	586.5
MW-15	594.04	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	584.0	584.0	585.8

Notes:
1. Elevations shown were calculated based on measurements made by GZA on the dates and under the conditions indicated.
2. Monitoring points have been established at the top of the PVC casing for each well.
3. NM - Not measured.
4. NI - Not installed at the time of the measurement.
5. * = monitoring point is top of steel casing.

Table 7
Summary of Analytical Testing
Focused Remedial Investigation
Delphi Harrison Thermal Systems
West Lockport Complex
Lockport, New York

		Volatile Organic Compounds						Natural Attenuation Monitoring Analytical Parameters																				
Location	Sample Date	Method 8240 VOCs	Method 524.2 VOCs	Method 8260 B BTEX only	Method 8260 A Target Compounds	Method 8260 B Target Compounds	Method 8260 A BTEX only	Organic Carbon	Alkalinity	Ammonia	Chloride	Nitrate	Nitrite	Nitrate Nitrite	Sulfate	Sulfide	Calcium	Dissolved Calcium	Iron	Dissolved Iron	Magnesium	Dissolved Magnesium	Manganese	Dissolved Manganese	Sodium	Dissolved Sodium	Potassium	Dissolved Potassium
MW-1	09/19/1995	x																										
	10/11/1995 (DUP)	x																										
MW-2	09/19/1995	x																										
	10/11/1995 (DUP)	x																										
MW-3S	09/19/1995 (DUP)	x																										
	10/11/1995 (DUP)	x																										
	04/30/1996	x																										
	06/20/1996	x																										
	10/30/1996	x																										
	11/21/1996	x																										
	08/28/1997				x		x																					
	10/10/1997			x		x																						
	12/03/1998					x		x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
	10/07/1999					x		x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	08/10/2001			x																								
	10/30/2001			x																								
MW-3D	01/16/1996	x																										
	01/30/1996	x																										
	08/10/2001			x		x																						
MW-4	05/01/1996	x																										
	06/20/1996 (DUP)	x																										
	10/30/1996 (DUP)	x																										
	11/21/1996	x																										
	08/28/1997 (DUP)				x																							
	10/10/1997					x																						
	12/02/1998 (DUP)					x		x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
	10/07/1999					x		x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	08/09/2001					x		x	x	x	x	x	x		x	x	x		x		x		x		x		x	
	10/31/2001					x		x	x	x	x	x	x		x	x			x		x		x		x		x	
MW-5	04/30/1996	x																										
	06/20/1996	x																										
	10/31/1996	x																										
	10/31/1996 (DNAPL)	x																										
	11/21/1996	x																										
MW-6	04/30/1996 (DUP)	x																										
	06/20/1996	x																										
	10/30/1996	x																										
	11/21/1996	x																										
	08/28/1997				x																							
	10/10/1997					x																						
	12/02/1998					x		x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
	10/07/1999					x		x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
MW-7	04/30/1996	x																										
	06/20/1996	x																										
	10/30/1996	x																										
	11/21/1996	x																										
	08/28/1997				x																							
	10/10/1997					x																						
	12/03/1998					x		x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
	10/07/1999					x		x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Table 7
Summary of Analytical Testing
Focused Remedial Investigation
Delphi Harrison Thermal Systems
West Lockport Complex
Lockport, New York

		Volatile Organic Compounds						Natural Attenuation Monitoring Analytical Parameters																				
Location	Sample Date	Method 8240 VOCs	Method 524.2 VOCs	Method 8260 B BTEX only	Method 8260 A Target Compounds	Method 8260 B Target Compounds	Method 8260 A BTEX only	Organic Carbon	Alkalinity	Ammonia	Chloride	Nitrate	Nitrite	Nitrate Nitrite	Sulfate	Sulfide	Calcium	Dissolved Calcium	Iron	Dissolved Iron	Magnesium	Dissolved Magnesium	Manganese	Dissolved Manganese	Sodium	Dissolved Sodium	Potassium	Dissolved Potassium
MW-8	10/30/1996	x																										
	11/21/1996	x																										
	08/28/1997				x																							
	10/10/1997					x																						
	12/02/1998					x		x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
	10/07/1999					x		x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
MW-9	10/30/1996	x																										
	11/21/1996 (DUP)	x																										
	08/28/1997				x																							
	10/10/1997					x																						
	12/02/1998					x		x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
	10/06/1999 (DUP)					x		x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
MW-10	10/30/1996	x																										
	11/21/1996	x																										
	08/28/1997				x																							
	10/10/1997					x																						
	12/01/1998					x		x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
	10/06/1999					x		x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
	08/09/2001					x		x	x	x	x	x	x		x	x	x		x		x	x	x		x	x	x	
	10/31/2001					x		x	x	x	x	x	x		x	x			x		x		x		x		x	
MW-11	08/28/1997		x																									
	10/10/1997 (DUP)		x																									
	12/01/1998					x		x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
	10/05/1999					x		x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
	08/08/2001					x		x	x	x	x	x	x		x	x	x		x		x		x		x		x	
	10/30/2001					x		x	x	x	x	x	x		x	x			x		x		x		x		x	
MW-12	08/28/1997 (DUP)		x																									
	10/10/1997		x																									
	12/01/1998					x		x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
	10/06/1999					x		x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
	08/08/2001 (DUP)					x		x	x	x	x	x	x		x	x	x		x		x		x		x		x	
	10/30/2001					x		x	x	x	x	x	x		x	x			x		x		x		x		x	
MW-13	08/08/2001					x		x	x	x	x	x	x		x	x	x		x		x		x		x		x	
	10/29/2001					x		x	x	x	x	x	x		x	x			x		x		x		x		x	
MW-14	08/10/2001					x		x	x	x	x	x	x		x	x	x		x		x		x		x		x	
	10/30/2001					x		x	x	x	x	x	x		x	x			x		x		x		x		x	
MW-15	08/08/2001					x		x	x	x	x	x	x		x	x	x		x		x		x		x		x	
	10/30/2001 (DUP)					x		x	x	x	x	x	x		x	x			x		x		x		x		x	
TK-2	10/06/1999								x		x																	

Notes:
1. Analytical Testing completed by Free-Col Laboratories, Inc.
2. DUP indicates that a duplicate sample was collected from this location, DNAPL is Dense Nonaqueous Phase Liquid.
3. Blank = Not tested.
4. Method 8240 consists of compounds on the Hazardous Substance List.
5. Method 524.2 Target Compounds consist of Trichloroethylene (TCE), Tetrachloroethylene (PCE), Total 1,2-Dichloeoethene (1,2-DCE), and Vinyl Chloride (VC).
6. Method 8260A BTEX only consist of benzene, toluene, ethylbenzene, and xylene.
7. Method 8260B BTEX only consist of benzene, toluene, ethylbenzene, and xylene.
8. Method 8260A Target Compounds consist of TCE, PCE, Total 1,2-DCE, and VC.
9. Method 8260B Target Compounds consist of TCE, PCE, Total 1,2-DCE, and VC.

Table 8
Summary of Chemical Physical Properties and Degradation Rate Constants
Focused Remedial Investigation
Delphi Harrison Thermal Systems
West Lockport Complex
Lockport, New York

	Physical Properties at 20 Degrees C				First Order Degradation Rate Constants and Half Lives									
							Anaerobic Degradation				Aerobic Degradation			
	Molecular Weight	Water Solubility (mg/l)	Specific Gravity	Vapor Pressure (mm of Hg)	Hydrolysis		Low		High		Low		High	
					k (1/year)	Half Life (year)	k (1/year)	Half Life (year)	k (1/year)	Half Life (year)	k (1/year)	Half Life (year)	k (1/year)	Half Life (year)
Trichloroethylene	131.4	1000	1.462	58	0.78	0.90	0.15	4.50	2.59	0.27	0.69	1.00	1.39	0.50
Tetrachloroethylene	165.8	150	1.625	14	NA	NA	0.15	4.50	2.59	0.27	0.69	1.00	1.39	0.50
Total 1,2-Dichloroethylene	97	9800 [6]	1.27	180 - 265	NA	NA	0.35	2.00	2.31	0.30	1.39	0.50	8.66	0.08
Vinyl Chloride	62.5	1100	0.912	3.3 [4]	NA	NA	0.35	2.00	2.31	0.30	1.39	0.50	8.66	0.08
Total Xylenes	106.2	568 [6]	0.87	7 - 9	NA	NA	0.69	1.00	1.39	0.50	8.66	0.08	34.65	0.02
Toluene	92.1	515	0.867	21	NA	NA	1.16	0.60	4.62	0.15	11.55	0.06	69.30	0.01
Ethylbenzene	106.2	152	0.867	7	NA	NA	1.12	0.62	1.44	0.48	23.10	0.03	69.30	0.01
Benzene	78.1	1780	0.877	75	NA	NA	4.62	0.15	69.30	0.01	34.65	0.02	346.50	0.002

Notes:
1. Water Solubility and Density values obtained from "Evaluation of the Likelihood of DNAPL Presence at NPL Sites, National Results, Final Report", EPA/540/R-93-073, September 1993.
2. Degradation Rate Constants obtained from "Handbook of Environmental Degradation Rate", Howard, P, R. Boethling, W. Jarvis, W. Meylan and E. Michelenko, Lewis Publishers, 1991
3. NA - Not Available
4. Vapor pressure, measured in mm of mercury, from NIOSH Pocket Guide to Chemical Hazards.
5. Measured in atmospheres
6. The solubilites for these totals vary depending upon the exact mix of constituents.

Table 9
Summary of Groundwater Analytical Test Results for Target Volatile Organic Compounds
Focused Remedial Investigation
Delphi Harrison Thermal Systems
West Lockport Complex
Lockport, New York

			Target Chlorinated VOC Concentrations						Petroleum Related VOCs			
Location		Sample Date	Trichloroethylene (mg/l)	Tetrachloroethylene (mg/l)	Total 1,2-Dichloroethene (mg/l)	cis - 1, 2 - Dichloroethene (mg/l)	trans - 1, 2 - Dichloroethene (mg/l)	Vinyl Chloride (mg/l)	Total Xylenes (mg/l)	Toluene (mg/l)	Ethylbenzene (mg/l)	Benzene (mg/l)
MW-1		09/19/1995	6500	<0.5	11			<1.0	<0.5	<0.5	<0.5	<0.5
		10/11/1995	870	<0.5	19			<1.0	<0.5	<0.5	<0.5	<0.5
	DUP	10/11/1995	900	<0.5	21			<1.0	<0.5	<0.5	<0.5	<0.5
MW-2		09/19/1995	590	<0.5	93			3.5	<0.5	<0.5	<0.5	<0.5
		10/11/1995	450	<0.5	77			2.2	<0.5	<0.5	<0.5	<0.5
	DUP	10/11/1995	470	<0.5	77			1.7	<0.5	<0.5	<0.5	<0.5
MW-3S		09/19/1995	0.6	<0.5	160			1.1	2.6	2.7	1.5	2.7
	DUP	09/19/1995	0.6	<0.5	170			<1.0	2.8	2.6	1.5	2.7
		10/11/1995	0.7	<0.5	230			1.4	2.9	3	1.6	3.2
	DUP	10/11/1995	0.7	<0.5	220			1.7	2.9	3	1.7	3.2
		04/30/1996	0.6	<0.5	310			2.6	3.4	3.7	1.8	3.4
		06/20/1996	<0.5	<0.5	200			<1	0.7	1.2	<0.5	2
		10/30/1996	<0.5	<0.5	210			1.3	2.8	2.3	1.5	2.3
		11/21/1996	<0.5	<0.5	190			1.6	3.3	2.3	1.8	2.4
		08/28/1997	<0.2	<0.2	200			1.9	3.2	2.1	1.9	2.8
	DEC	08/28/1997	0.008	<0.01	150			1.8	3.3	1.8	2.9	2.8
		10/10/1997	<0.2	<0.2	230			4.7	0.8	1	<0.2	1.7
		12/03/1998	0.73	<0.02	240			2.3	1.8	1.2	1.2	1.7
		10/07/1999	0.04	<0.02	270.09	270	0.09	2.9	2.1	1.5	1.5	1.9
		08/10/2001							1.5	1.1	1.2	1.5
		10/30/2001							1.7	1.0	1.1	1.5
MW-3D		01/16/1996	<0.005	<0.005	<0.005			<0.010	<0.005	<0.005	<0.005	<0.005
		01/30/1996	<0.005	<0.005	<0.005			<0.010	<0.005	<0.005	<0.005	<0.005
		08/10/2001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002				
MW-4		04/30/1996	32	<0.5	170			40	<0.5	<0.5	<0.5	<0.5
		06/20/1996	19	<0.5	110			19	<0.5	<0.5	<0.5	<0.5
	DUP	06/20/1996	19	<0.5	120			20	<0.5	<0.5	<0.5	<0.5
		10/30/1996	34	<0.5	120			14	<0.5	<0.5	<0.5	<0.5
	DUP	10/30/1996	36	<0.5	120			13	<0.5	<0.5	<0.5	<0.5
		11/21/1996	37	<0.5	120			18	<0.5	<0.5	<0.5	<0.5
		08/28/1997	29	<0.2	100			14				
	DEC	08/28/1997	54	<0.01	190			23	0.004	0.008	0.002	0.007
		10/10/1997	33	<0.2	110			27				
		12/02/1998	21	<0.2	110			12	<0.2	<0.2	<0.2	<0.2
	DUP	12/02/1998	20	<0.2	120			13				
		10/07/1999	20	<0.05	100.14	100	0.14	14	<0.05	<0.05	<0.05	<0.05
		08/09/2001	30	0.003	93.28	93	0.28	18				
		10/31/2001	22	<0.002	84.25	84	0.25	18				
MW-5		04/30/1996	33	27	0.7			<1	<0.5	<0.5	<0.5	<0.5
		06/20/1996	680	110	4.3			<1	<0.5	<0.5	<0.5	<0.5
		10/31/1996	390	89	3.4			<1	<0.5	<0.5	<0.5	<0.5
		11/21/1996	260	120	1.8			<1	<0.5	<0.5	<0.5	<0.5
MW-6		04/30/1996	6.9	57	5.3			3.4	<0.5	<0.5	<0.5	<0.5
	DUP	04/30/1996	5.6	48	5.8			2.1	<0.5	<0.5	<0.5	<0.5
		06/20/1996	8.5	64	7.9			2.6	<0.5	<0.5	<0.5	<0.5
		10/30/1996	1.8	8.4	3.9			1.9	<0.05	<0.05	<0.05	<0.05
		11/21/1996	11	57	8.2			3.1	<0.05	<0.05	<0.05	<0.05
		08/28/1997	1.2	2.0	10			5.3				
		10/10/1997	12	44	16			5.5				
		12/02/1998	18	60	16			0.76				
		10/07/1999	19	44	14	14	<0.05	1.6	<0.05	<0.05	<0.05	<0.05
MW-7		04/30/1996	1300	<0.5	37			1.8	<0.5	<0.5	<0.5	<0.5
		06/20/1996	1100	<0.5	24			2.4	<0.5	<0.5	<0.5	<0.5
		10/30/1996	790	<0.5	32			2.3	<0.5	<0.5	<0.5	<0.5
		11/21/1996	850	<0.5	35			3.1	<0.5	<0.5	<0.5	<0.5
		08/28/1997	820	<0.2	22			1.1				
		10/10/1997	720	<0.2	43			4.8				
		12/03/1998	570	<0.2	55			4.2				
		10/07/1999	540	<0.05	41	41	<0.05	3.5	<0.05	<0.05	<0.05	<0.05
MW-8		10/30/1996	0.20	0.024	1.5			0.047	<0.05	<0.05	<0.05	<0.05
		11/21/1996	0.22	0.022	2.6			0.049	<0.005	<0.005	<0.005	<0.005
		08/28/1997	0.30	0.028	2.8			0.062				
		10/10/1997	0.35	0.018	4.3			0.11				
		12/02/1998	0.22	0.012	1.6			0.062				
		10/07/1999	0.20	0.011	2.802	2.8	0.002	0.18	<0.002	<0.002	<0.002	<0.002
MW-9		10/30/1996	2.2	0.21	3.3			0.1	<0.05	<0.05	<0.05	<0.05
		11/21/1996	2.0	0.06	3.2			0.16	<0.05	<0.05	<0.05	<0.05
	DUP	11/21/1996	1.9	0.07	2.9			0.15	<0.05	<0.05	<0.05	<0.05
		08/28/1997	1.4	0.027	2.5			0.056				
		10/10/1997	1.6	0.047	2.7			0.12				
		12/02/1998	1.9	0.066	2.5			0.030				
	DUP	10/06/1999	1.4	0.058	1.608	1.6	0.008	0.11	<0.002	<0.002	<0.002	<0.002
		10/06/1999	1.2	0.062	1.508	1.5	0.008	0.091	<0.002	<0.002	<0.002	<0.002
MW-10		10/30/1996	0.98	0.12	1.8			0.11	<0.05	<0.05	<0.05	<0.05
		11/21/1996	0.87	0.22	1.7			<0.1	<0.05	<0.05	<0.05	<0.05
		08/28/1997	0.38	0.16	1.1			0.070				
		10/10/1997	0.35	0.28	0.76			0.047				
		12/01/1998	0.46	0.016	1.3			0.11				
		10/06/1999	0.23	0.24	0.722	0.72	0.002	0.200	<0.002	<0.002	<0.002	<0.002
		08/09/2001	0.21	0.21	0.514	0.51	0.004	0.057				
		10/31/2001	0.25	0.023	0.473	0.47	0.003	0.053				
MW-11		08/28/1997	<0.0005	<0.0005	0.0045			0.0039				
	DEC	08/28/1997	<0.01	<0.01	0.002			0.002	<0.01	<0.01	<0.01	<0.01
		10/10/1997	<0.0005	<0.0005	0.0032			0.0012				
	DUP	10/10/1997	<0.0005	<0.0005	0.0030			0.0010				
		12/01/1998	<0.0005	<0.0005	0.013			0.0046				
		10/05/1999	<0.0005	<0.0005	0.010	0.010	<0.0005	0.0019	<0.0005	<0.0005	<0.0005	<0.0005
		08/08/2001	<0.002	<0.002	0.009	0.009	<0.002	0.008				
		10/30/2001	<0.002	<0.002	0.008	0.008	<0.002	0.006				
MW-12		08/28/1997	<0.0005	<0.0005	0.089			0.11				
	DUP	08/28/1997	<0.005	<0.005	0.13			0.19				
	DEC	08/28/1997	<0.01	<0.01	0.076			0.1	<0.01	<0.01	<0.01	<0.01
		10/10/1997	<0.0005	<0.0005	0.16			0.17				
		12/01/1998	<0.0005	<0.0005	0.047			0.088				
		10/06/1999	<0.0005	<0.0005	0.027	0.027	<0.0005	0.032	<0.0005	<0.0005	<0.0005	<0.0005
		08/08/2001	<0.002	<0.002	0.14	0.14	<0.002	0.13				
	DUP	08/08/2001	<0.002	<0.002	0.13	0.13	<0.002	0.12				
		10/30/2001	<0.002	<0.002	0.032	0.032	<0.002	0.011				
MW-13		08/08/2001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002				
		10/29/2001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002				
MW-14		08/10/2001	<0.002	<0.002	0.005	0.005	<0.002	<0.002				
		10/30/2001	<0.002	<0.002	0.004	0.004	<0.002	<0.002				
MW-15		08/08/2001	<0.002	0.013	<0.002	<0.002	<0.002	<0.002				
		10/30/2001	<0.002	0.018	<0.002	<0.002	<0.002	<0.002				
	DUP	10/30/2001	<0.002	0.020	<0.002	<0.002	<0.002	<0.002				
NYSDEC Class GA Criteria			0.005	0.005	0.005	0.005	0.005	0.002	0.005	0.005	0.005	0.001

Notes:
1. < - Indicates compound not detected above the specified detection limit.
2. Analytical Testing completed by Free-Col Laboratories, Inc.
3. DUP = Indicates that the presented results are from a duplicate sample.
4. DEC = Indicates that the presented results are from a split sample collected by GZA for the NYSDEC and tested by Recra Environmental, Inc.
5. Blank = Not tested.
6. NYSDEC Class GA Groundwater Criteria as promulgated in 6 NYCRR 703; Table 1 in Technical and Operational Guidance Series (1.1.1): Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, dated October 1993; revised June 1998; errata dated January 1999; addendum dated April 2000.
7. Concentrations presented for Total 1,2-Dichloroethene are the sum of the concentrations presented for cis- and trans-1,2-Dichloroethene, when analyzed for and reported separately.

Table 10
Summary of Groundwater Field Measurements and Analytical Test Results for Natural Attenuation Parameters
Focused Remedial Investigation/Focused Feasibility Study
Delphi Harrison Thermal Systems
West Lockport Complex
Lockport, New York

		Field Parameters					Analytical Test Results - Inorganic and Miscellaneous Water Quality Parameters																					
Location	Sample Date	Temp. (Deg. C)	Specific Cond. (mS/cm)	DO (mg/l)	ORP (mv)	pH (Std Units)	Methane (mg/l)	Organic Carbon (mg/l)	Alkalinity (mg/l)	Ammonia (mg/l)	Chloride (mg/l)	Nitrate (mg/l)	Nitrite (mg/l)	Nitrate Nitrite (mg/l)	Sulfate (mg/l)	Sulfide (mg/l)	Calcium (mg/l)	Dissolved Calcium (mg/l)	Iron (mg/l)	Dissolved Iron (mg/l)	Magnesium (mg/l)	Dissolved Magnesium (mg/l)	Manganese (mg/l)	Dissolved Manganese (mg/l)	Sodium (mg/l)	Dissolved Sodium (mg/l)	Potassium (mg/l)	Dissolved Potassium (mg/l)
MW-3S	12/03/1998	15.8	1300	1.27	-49	7.2	0.1	28	487	0.26	173	0.41	<0.05		2	0.3	238	223	7.31	6.84	35.6	31.8	1.31	1.17	67.1	66.5	5.46	4.71
MW-3S[2]	10/7/99 (during purging)	16.1	1422	0.67	-133	7.2																						
MW-3S[2]	10/7/99 (prior to sampling)	15.8	1254	7.8	24.3	7.0	0.007	51	480	0.16	233			0.07	14	0.3	190	184	1.01	0.10	35.8	36.4	1.00	0.98	55.4	64.3	4.1	4.4
MW-4	12/02/1998	14.2	2730	0.23	-56	6.6	2.9	19	354	1.23	986	0.30	<0.05		120	0.2	503	443	0.58	0.51	105	106	0.40	0.32	282	293	13.3	12.8
MW-4 DUP	12/02/1998	NA	NA	NA	NA	NA	5.5	8	368	1.57	971	0.05	<0.05		120	0.2	431	335	0.59	0.52	107	100	0.39	0.34	282	306	13.2	13.5
MW-4	10/07/1999	13.8	3412	0.08	-92.8	6.7	4.2	47	360	1.03	1010			0.08	110	0.3	269	318	0.42	0.45	98	116	0.23	0.34	240	305	10.4	13.1
MW-4	08/09/2001	12.6	3420	0.12	-5.1	6.5	0.12	20.2	366	1.20	1300	0.11	<0.05		190	0.2	371		1.01		107		0.54		384		12.7	
MW-4	10/31/2001	13.8	3444	0.10	-128.0	6.6	3.3	10.8	366	1.17	1100	<0.05	<0.05		160	1.2			0.77		102		0.46		358		12.3	
MW-6	12/02/1998	19.5	3740	0.30	-67	6.8	0.84	9	319	0.45	897	0.22	<0.05		160	0.2	161	156	7.98	1.13	35.6	28.8	0.48	0.29	619	638	9.64	9.51
MW-6	10/07/1999	21.9	3283	0.12	-145.8	7.1	0.34	30	260	0.32	476			0.09	140	0.4	86.4	108	3.62	0.55	24	30.2	0.24	0.19	300	311	7.4	8.8
MW-7	12/03/1998	17.3	3130	0.33	-35	7.0	0.06	36	376	1.43	944	0.29	<0.05		200	0.4	382	375	0.14	0.02	118	136	<0.01	<0.01	288	351	20.5	23.0
MW-7[3]	10/07/1999	19.4	3049	0.69	-52	7.1	0.02	58	420	1.10	1,180			0.11	180	0.4	286	255	0.86	0.05	138	145	0.05	0.02	292	306	21.4	24.0
MW-8	12/02/1998	16.7	3210	0.90	-68	6.9	0.09	12	300	0.40	138	<0.05	<0.05		550	0.2	215	227	0.33	0.17	76	78	0.31	0.32	102	114	6.31	6.67
MW-8	10/07/1999	19.7	1640	0.08	-116.1	7.1	0.04	19	280	0.33	144			0.10	570	0.3	174	188	0.22	0.15	82.4	97.5	0.30	0.31	112	110	7.6	8.1
MW-9	12/02/1998	16.2	7150	1.6	120	6.9	0.04	3	309	0.23	640	0.25	<0.05		680	<0.1	330	300	0.33	<0.01	89	84.5	1.74	0.93	444	445	5.52	5.91
MW-9	10/05/1999	18.7	4042	0.08	103.5	6.9	0.02	24	330	0.20	963	0.46	<0.05		520	<0.1	250	283	0.20	0.02	63.8	89	1.36	0.99	476	535	4.6	26.5
MW-9 DUP	10/05/1999	NA	NA	NA	NA	NA	0.02	27	340	0.14	833	0.63	<0.05		490	<0.1	252	284	0.20	0.02	72	86	1.46	0.94	478	560	5.0	5.6
MW-10	12/01/1998	14.5	4100	0.40	-13.7	6.7	0.23	11	320	0.32	1220	0.19	<0.05		270	0.2	310	305	1.95	0.76	54.6	85.5	2.30	2.07	584	645	13.4	13.2
MW-10	10/05/1999	14.2	4775	0.07	-2.0	6.8	0.14	24	280	0.29	1010	0.15	0.10		240	<0.1	39.8	254	0.73	0.04	9.94	102	0.99	1.12	33.2	635	18.8	10.1
MW-10	08/09/2001	12.2	5033	0.17	249.1	6.6	0.018	10.0	334	0.16	1700	0.08	<0.05		330	0.1	330		0.14		98.9	99.6	1.66		857	845	9.2	
MW-10	10/31/2001	14.4	3990	0.15	90.9	6.7	0.20	3.6	336	0.12	2800	0.17	<0.05		280	1.6			0.05		92.1		0.91		720		7.6	
MW-11	12/01/1998	11.9	4360	0.22	-271	7.6	0.01	17	275	0.58	188	0.17	<0.05		110	0.2	122	97.3	1.00	0.26	39.0	36.4	0.11	0.08	116	129	8.88	10.1
MW-11	10/05/1999	11.9	5228	2.34	-231	7.7	0.05	20	270	0.76	192	0.05	<0.05		210	0.5	93.4	150	0.34	0.30	46.4	103	0.08	0.08	180	695	10.9	27
MW-11	08/08/2001	10.4	3576	0.12	-73.6	7.4	<0.002	12.0	285	0.46	250	<0.05	<0.05		140	0.1	111		0.14		43.2		0.12		130		8.0	
MW-11	10/30/2001	12.0	4126	0.04	-248.8	7.5	<0.002	3.1	265	0.46	230	<0.05	<0.05		110	2.8			0.02		38.7		0.41		120		9.1	
MW-12	12/01/1998	13.4	2006	0.39	-41	6.9	0.5	7	284	0.94	294	0.48	<0.05		73	0.2	119	104	7.48	4.01	26.8	25.3	4.41	4.40	183	197	4.1	3.81
MW-12	10/05/1999	15.8	1849	0.10	-105.2	7.0	0.36	30	300	0.90	342	0.27	<0.05		66	0.2	104	126	<0.01	3.66	27.8	31.6	<0.01	4.90	166	226	4.9	5.3
MW-12	08/08/2001	13.5	3300	0.24	-38.5	6.6	0.50	13.9	336	1.77	920	<0.05	<0.05		160	<0.1	217		16.9		57.5		8.41		427		6.3	
MW-12 DUP	08/08/2001	NA	NA	NA	NA	NA	0.74	14.9	338	1.85	930	<0.05	<0.05		160	<0.1	217		14.8		56.2		8.14		433		6.0	
MW-12	10/30/2001	14.2	2850	0.14	-127.1	6.8	0.57	5.7	309	1.35	590	0.18	<0.05		110	3.5			4.73		37.0		4.69		342		5.0	
MW-13	08/08/2001	15.4	5742	0.23	-118.5	7.8	0.08	15.2	255	1.45	1,900	0.05	<0.05		160	<0.1	209		2.59		49.6		2.67		1200		12.1	
MW-13	10/29/2001	15.5	6625	0.20	-136	7.4	0.07	9.9	426	1.29	1,700	0.61	0.08		120	2.2			3.75		40.9		2.96		1160		8.2	
MW-14	08/09/2001	11.5	2064	3.66	330.7	7.2	<0.002	14.1	328	0.19	680	0.08	<0.05		130	<0.1	144		0.18		64.1		0.04		394		6.4	
MW-14	10/30/2001	13.2	2478	0.80	-39.1	7.2	0.013	4.3	334	0.31	770	<0.05	<0.05		120	2.5			0.06		64.8		0.06		466		7.3	
MW-15	08/08/2001	13.0	2011	0.20	289.1	6.7	<0.002	11.7	410	0.08	600	1.34	<0.05		160	0.1	281		2.33		70.4		0.46		204		4.9	
MW-15	10/30/2001	14.6	1656	0.16	83.9	6.8	<0.002	4.1	395	0.07	410	0.85	<0.05		110	1.4			0.02		47.5		0.40		196		3.8	
MW-15 DUP	10/30/2001	NA	NA	NA	NA	NA	<0.002	3.7	386	0.05	450	0.91	<0.05		110	1.5			0.03		47.6		0.39		198		4.0	
TK-2	10/06/1999	13.3	702	0.19	66.9	7.5			380		20.2																	
Stream (SS-1)	12/02/1998	8.0	300	10.0	50	8.0																						
Stream (SS-2)	10/07/1999	10.2	718	17.5	53.1	8.4																						
Stream (SS-3)	10/07/1999	8.5	1552	8.9	-28.9	7.7																						

Notes:
1. In general the field parameters were stable with very little variation. However, as noted, some readings varied.
2. The results from well MW-3 varied. After removing 1 to 2 1/2 well volumes, the field parameters were steady. The average of the values are shown. However, the values increased just prior to sample collection, as shown in the next row below.
3. Down-hole readings were not collected at the time of analytical sampling due to a malfunction of the probe.
4. Field Parameters measured using down-hole probe.
5. Analytical Testing completed by Free-Col Laboratories, Inc.
6. DUP = Indicates that the presented results are from a duplicate sample.
7. Stream sample locations are shown on Figure 4.
8. < - Indicates compound not detected above the specified detection limit.
9. Blank = Not tested.
10. NA = down-hole field measurements not collected.

Table 11
Summary of Percent Parent Compound Concentrations to Total Compound (Parent and Daughter) Concentrations Present
Focused Remedial Investigation
Delphi Harrison Thermal Systems
West Lockport Complex
Lockport, New York

Well Location	Distance In Feet Downgradient from AOC along Conceptual Groundwater Flow Path (1)	Well Location Offset from the Conceptual Groundwater Flow Path Line (1)	Sample Date	Parent Compound Concentrations (TCE + PCE) (mg/l)	Daughter Compound Concentrations (1,2-DCE + Vinyl Chloride) (mg/l)	Percent of Parent Compound to Total Compound (Parent and Daughter) Present
MW-1	0	near AOC	10/11/1995	870	19	98
MW-7	0	near AOC	10/07/1999	540	44.5	92
MW-2	60	east of AOC	10/11/1995	450	79.2	85
MW-6	90	110 ft south	10/07/1999	63	15.6	80
MW-3S	60	0	10/07/1999	0.04	273	0
MW-4	230	190 ft north	10/31/2001	22	102.3	18
MW-5 (4)	295	0	11/21/1996	380	1.8	100
MW-8	310	150 ft south	10/07/1999	0.21	3.0	7
MW-9	525	0	10/06/1999	1.5	1.7	47
MW-10	625	210 ft north	10/31/2001	0.27	0.5	35
MW-11	1215	210 ft north	10/30/2001	<0.002	0.014	0
MW-12	1250	80 ft south	10/30/2001	<0.002	0.043	0
MW-13	1405	0	10/29/2001	<0.002	<0.002	0
MW-14	1110	440 ft south	10/30/2001	<0.002	0.004	0
MW-15	1105	400 ft north	10/30/2001	0.02	<0.002	100

Notes:
1. The conceptual groundwater flow path is from the AOC through MW-5 and MW-9, and then to the furthest downgradient well (MW-13). See Figure 6 for groundwater contour map.
2. < - Indicates compound not detected above the specified detection limit.
3. Analytical testing completed by Free-Col Laboratories, Inc.
4. DNAPL was observed in well MW-5 purge water.
5. Data presented for each well location include those from the most recent sample round completed at that location.

Table 12
Evaluation of Groundwater Natural Attenuation Parameters Field Measurements and Analytical Test Results
Focused Remedial Investigation
Delphi Harrison Thermal Systems
West Lockport Complex
Lockport, New York

Parameter	Units	Concentration Range				Average Concentration	Concentration Supporting Biochemical Degradation Conditions (References 1, 2, 3)	Interpretation of Condition Supporting Biodegradation	Is Biochemical Degradation Anticipated Based on the Parameter Data ?
		min	max	min location	max location				
Temperature	deg C	10.4	21.9	MW-11	MW-6	13.3	> 20	Biochemical process is accelerated above 20 deg C.	No (See Section 4.0 of the report)
Specific Conductivity	mS/cm	702	6625	TK-2	MW-13	3315	--	Provides information regarding proper well purging.	See Section 4.0 of the report
DO	mg/l	0.04	3.66	MW-11	MW-14	0.71	< 0.5 - 1	Levels above 1 suppress reductive dechlorination. 6 of the 7 wells sampled had DO readings < 1 mg/l.	Yes
ORP	mv	-271	330.7	MW-11	MW-14	-27.2	< 50	Reductive pathway possible. Optimal reductive dechlorination is below 0.	Yes (See Section 4.0 of report)
pH	std units	6.5	7.8	MW-4	MW-13	7.0	5 to 9	Reductive dechlorination possible.	Yes (See Section 4.0 of report)
Methane	mg/l	<0.002	5.5	MW-11, MW-14, MW-15	MW-4	0.59	> 0.1 - 0.5	Indicates reductive daughter products.	Yes
Organic Carbon	mg/l	3.0	58	MW-9	MW-7	17.7	> 20	Energy source. Drives dechlorination.	No (See Section 4.0 of the report)
Alkalinity	mg/l	255	487	MW-13	MW-3S	340	> 2X background	Indicates buffering capacity of groundwater. Background for the site has not been established.	See Section 4.0 of the report
Ammonia	mg/l	0.05	1.85	MW-15	MW-12	0.68		Inorganic nutrient. Stable compound in anaerobic environment.	Yes
Chloride	mg/l	20.2	2800	TK-2	MW-10	789	> 2X background	Provides evidence of reductive dechlorination. Road salt may interfere. Monitoring well TK-2 (upgradient background monitoring well) had the lowest chloride concentration. The seven wells had greater than twice background.	Yes
Nitrate	mg/l	<0.05	1.34	MW-4, MW-8, MW-11, MW-12, MW-14	MW-15	0.28	< 1	May inhibit reductive dechlorination at higher concentrations.	Yes
Nitrite	mg/l	<0.05	0.1	ALL EXCEPT MW 10 & MW-13	MW-10	0.05		May be produced from nitrate under anaerobic conditions.	See Section 4.0 of the report
Sulfate	mg/l	2	680	MW-3S	MW-9	205	< 20	May inhibit reductive dechlorination at higher concentrations.	No (may slow dechlorination)
Sulfide	mg/l	<0.1	3.5	MW-9, MW-10, MW-12, MW-13, MW-14	MW-12	0.63	> 1	May not be detected due to reaction with various metals	No (See Section 4.0 of the report)
Total Iron	mg/l	<0.01	16.9	MW-12	MW-12	2.30		Ferrous is soluble form. Reductive dechlorination possible.	Yes
Dissolved Iron	mg/l	<0.01	6.84	MW-9	MW-3S	0.98	> 1		
Total Magnesium	mg/l	9.94	138	MW-10	MW-7	63.9		Parameter requested by NYSDEC.	See Section 4.0 of the report
Dissolved Magnesium	mg/l	25.3	145	MW-12	MW-7	78.5			
Total Sodium	mg/l	33.2	1200	MW-10	MW-13	358		Can be used to evaluate impact to chloride results from road salt. Ratio of chloride to sodium was highest (above average) at wells MW-4 (located in the plume) and MW-15. See chloride results.	See Section 4.0 of the report
Dissolved Sodium	mg/l	64.3	845	MW-3S	MW-10	370			
Total Calcium	mg/l	39.8	503	MW-10	MW-4	230			See Section 4.0 of the report
Dissolved Calcium	mg/l	97.3	443	MW-11	MW-4	236			
Total Manganese	mg/l	<0.01	8.41	MW-7, MW-12	MW-12	1.38		Inorganic nutrient. Indicator of iron and manganese reducing conditions.	See Section 4.0 of the report
Dissolved Manganese	mg/l	<0.01	4.9	MW-7	MW-12	0.99			
Total Potassium	mg/l	3.8	21.4	MW-15	MW-7	8.8		Inorganic nutrient.	See Section 4.0 of the report
Dissolved Potassium	mg/l	3.81	27	MW-12	MW-11	11.5			

References:
1): USEPA Proceedings of the Symposium on Natural Attenuation of Chlorinated Organics in Groundwater, "Overview of the Technical Protocol for Natural Attenuation of Aliphatic Hydrocarbons in Groundwater Under Development for the U.S. Air Force Center for Environmental Excellence", May 1997.
2): Bioremediation of Chlorinated Solvents Consortium of Remediation Technologies Development Forum (RTDF), "Guidance Handbook on Natural Attenuation of Chlorinated Solvents", September 1996.
3): USEPA, Office of Research and Development, "Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water", dated September 1998.

Notes:
1. Field Parameters measured using down-hole probe.
2. Analytical Testing completed by Free-Col Laboratories, Inc.
3. < - Indicates compound not detected above the specified detection limit.

Table 13
Summary of Potential Exposure Pathways
Focused Remedial Investigation
Delphi Harrison Thermal Systems
West Lockport Complex
Lockport, New York

Medium	Exposure Pathway	Likelihood of Exposure	Data Set	Standards
Shallow Bedrock Groundwater	Ingestion, Inhalation and Dermal Contact from use as a drinking water source.	None (see Note 2)	Groundwater Analytical Results (included in Table 9)	NYSDEC Class GA Groundwater Quality Criteria
	Ingestion, Inhalation and Dermal Contact at points of groundwater discharge (e.g., sumps; basements; bodies of water; groundwater wells used for dewatering, cooling, dewatering purposes, etc.)	Low	Groundwater Analytical Results (included in Table 9)	NYSDEC Class GA Groundwater Quality Criteria
Volatile Vapors	Inhalation within excavations, manholes, sumps, buildings/basements, other structures, or otherwise outdoors.	Low (see Note 3)	Groundwater Analytical Results (included in Table 9) and Soil Gas Data (included in Table 3)	According to NYSDOH, none are available.

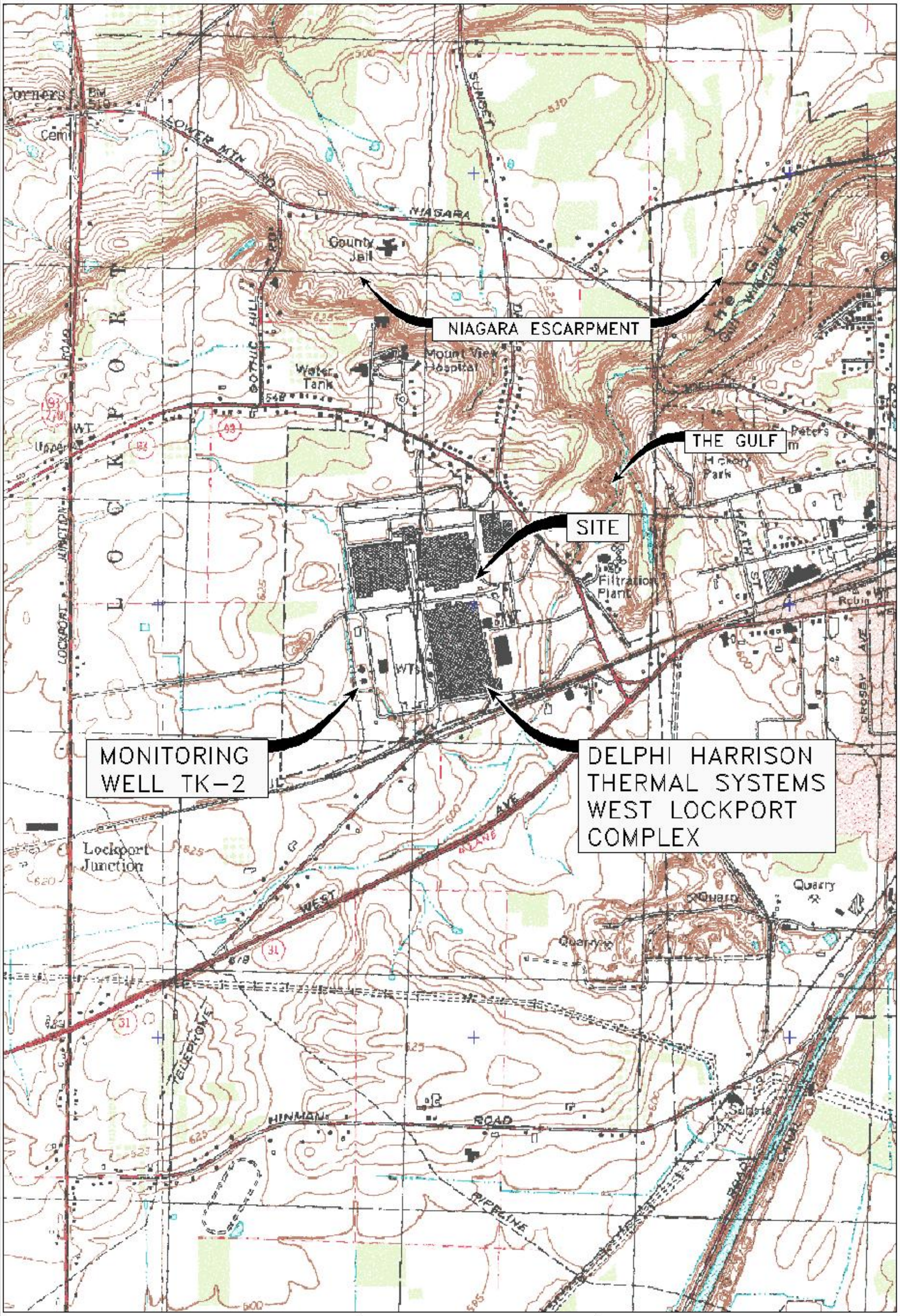
Notes:
1. Refer to text section 6.0 for further discussion of Likelihood of Exposure.
2. As further described in Section 2.7, the likelihood of exposure due to the use of groundwater as drinking water is not expected due to various factors, including the use of public potable water service in the area and based on the conclusion by NYSDEC concerning the locations of wells in the vicinity of the AOC that “health impacts from potentially contaminated groundwater leaving the Harrison (Delphi Thermal) Site are extremely unlikely”.
3. Based on the soil gas survey conducted at and proximate to the AOC, utility beddings were not found to provide a significant pathway for the migration of contamination.

Table 14
Summary of Site Occurrence and New York State Health-Based Groundwater Criteria
Focused Remedial Investigation
Delphi Harrison Thermal Systems
West Lockport Complex
Lockport, New York

Parameter	Summary of Occurrence					NYSDEC Class GA Groundwater Criterion (mg/L)	Percent of Locations Above Class GA Criterion[4]
	Number of Samples Tested	Number of Samples Detected	Maximum Detected Concentration (mg/L)	Location of Maximum Detection	Range of Detected Concentrations (mg/L)		
Trichloroethylene (TCE)	16	10	6,500	MW-1	0.008 - 6,500	0.005	63%
Tetrachloroethylene (PCE)	16	7	120	MW-5	0.003 - 120	0.005	38%
1,2-Dichloroethene (1,2-DCE)	16	13	310	MW-3S	0.002 - 310	0.005	75%
Vinyl Chloride	16	10	40	MW-4	0.001 - 40	0.002	63%
Total Xylenes	13	2	3.4	MW-3S	0.004 - 3.4	0.005	8%
Toluene	13	2	3.7	MW-3S	0.008 - 3.7	0.005	15%
Ethylbenzene	13	2	2.9	MW-3S	0.002 - 2.9	0.005	8%
Benzene	13	2	3.4	MW-3S	0.007 - 3.4	0.001	15%

Notes:
1. Site occurrence includes concentrations of the respective test parameters per monitoring well location (i.e., each monitoring well is counted one time). Refer to Table 9 for analytical test results.
2. NYSDEC Class GA Groundwater Criteria as promulgated in 6 NYCRR 703; Table 1 in Technical and Operational Guidance Series (1.1.1): Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, dated October 1993; revised June 1998; errata dated January 1999; addendum dated April 2000.
3. Detected concentrations are presented in mg/L = milligrams per Liter (parts per million).
4. Percent of maximum detected values (per location) that are above Class GA Criterion.

FIGURES



NOTE:
BASE MAP ADAPTED FROM DeLORME 3-D TOPOQUADS ON CD, COPYRIGHT 1999.
U.S.G.S. QUADRANGLE MAPS LOCKPORT, N.Y. – 1980 AND CAMBRIA, N.Y. – 1980.

DRAWN BY: BWS

DATE: APRIL 2002

GZA GeoEnvironmental of New York

SCALE IN FEET

0 1000 2000 4000

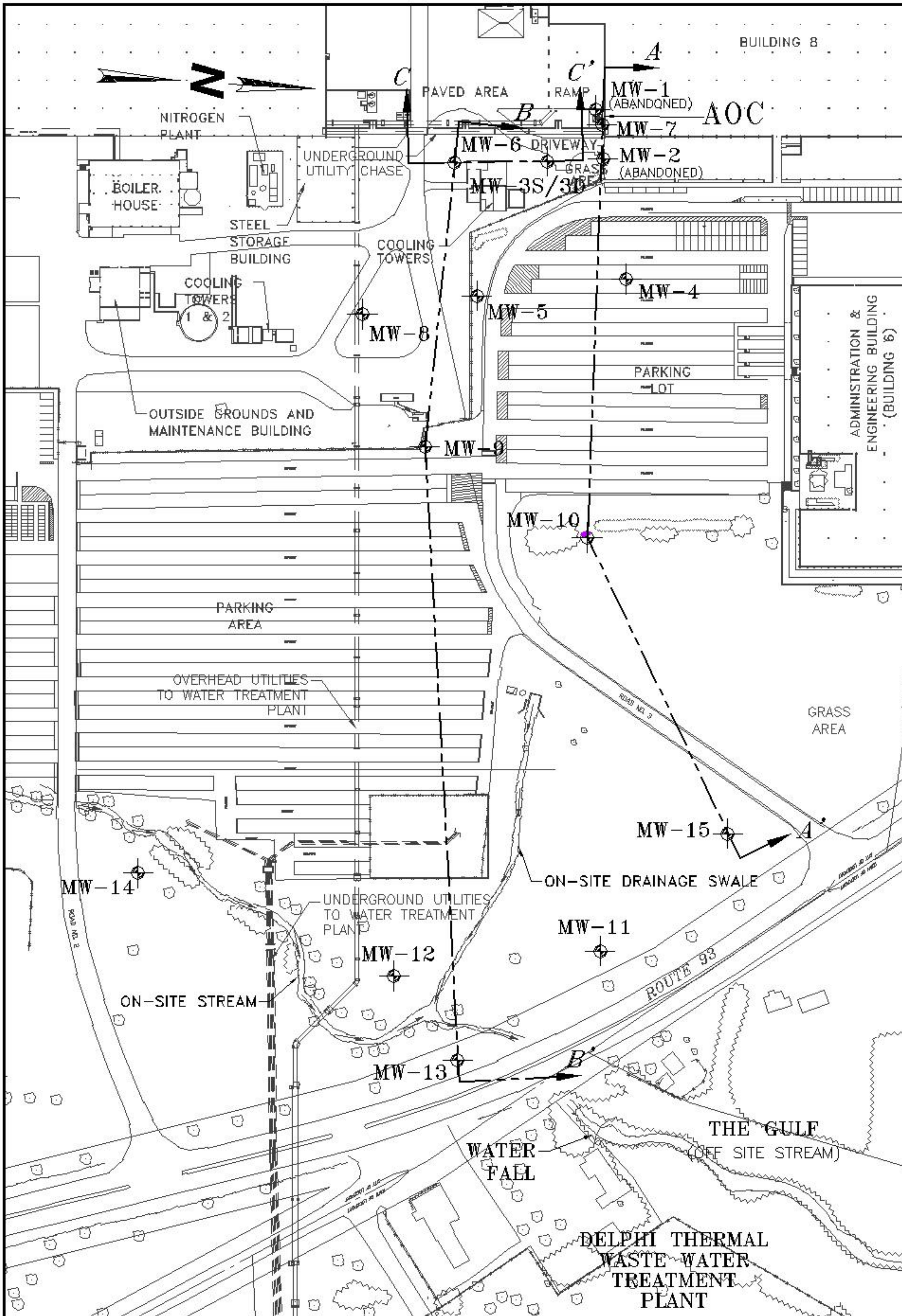
DELPHI HARRISON THERMAL SYSTEMS
LOCKPORT, NEW YORK

FOCUSED REMEDIAL INVESTIGATION

LOCUS PLAN

PROJECT No.
55039.2

FIGURE No.
1



LEGEND:

MW-3S — APPROXIMATE LOCATION AND DESIGNATION OF EXISTING MONITORING WELL INSTALLED BY GZA

AOC — DENOTES AREA OF CONCERN

NOTES:

1. BASE MAP ADAPTED FROM AN AUTOCAD FILE PROVIDED BY DELPHI HARRISON THERMAL SYSTEMS.

2. REFER TO FIGURES 4 AND 5 FOR CROSS-SECTIONS.

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DATE: APRIL 2002

GZA GeoEnvironmental of New York

SCALE IN FEET

0 100 200 400

DELPHI HARRISON THERMAL SYSTEMS

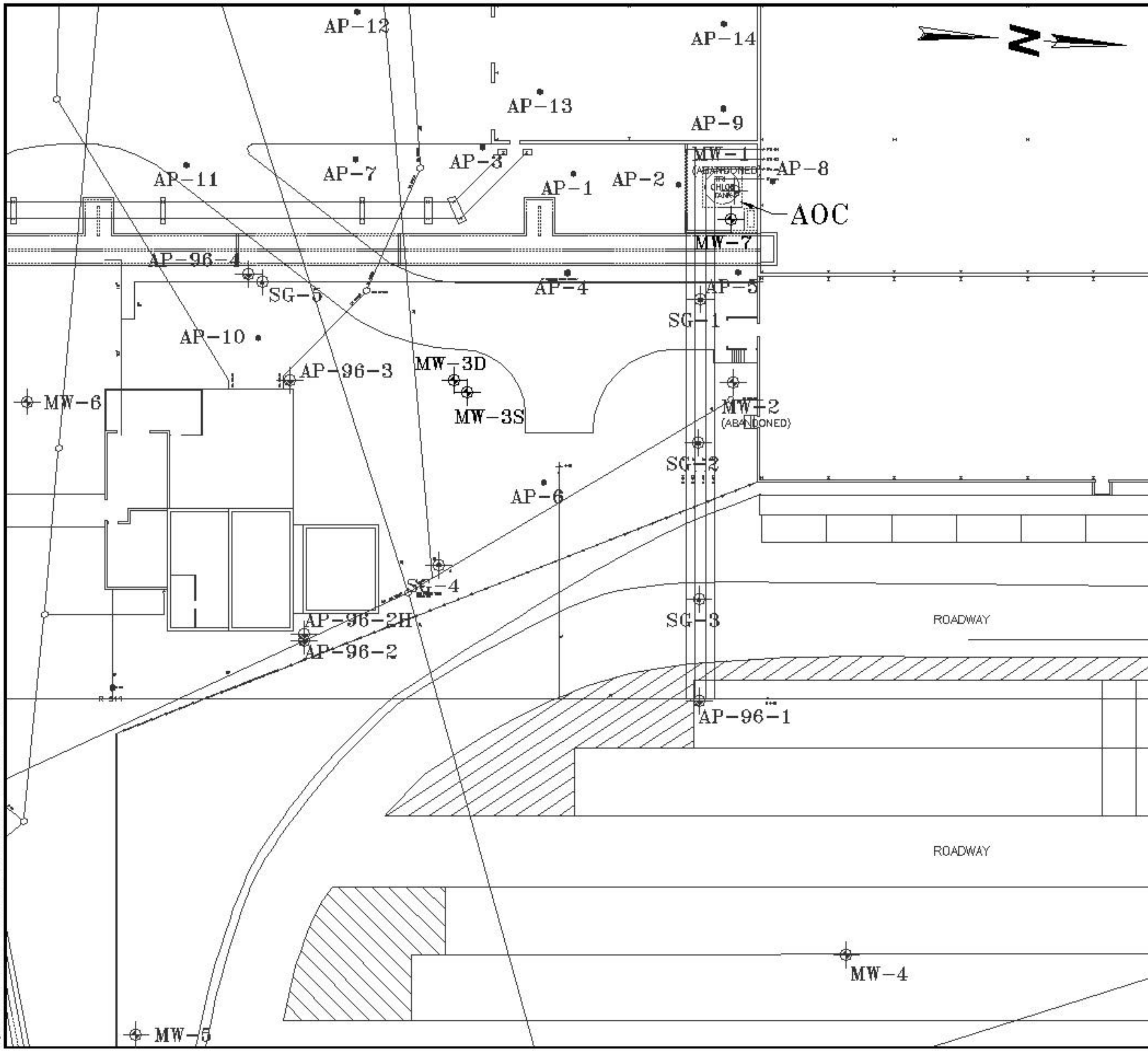
LOCKPORT, NEW YORK

FOCUSED REMEDIAL INVESTIGATION

SITE PLAN/MONITORING WELL LOCATION PLAN

PROJECT No. 55039.2

FIGURE No. 2



NOTE:

1. BASE MAP ADAPTED FROM AN AUTOCAD FILE PROVIDED BY DELPHI HARRISON THERMAL SYSTEMS.

LEGEND:

MW-3S	APPROXIMATE LOCATION AND DESIGNATION OF MONITORING WELL
AP-96-4	APPROXIMATE LOCATION AND DESIGNATION OF UTILITY BEDDING PROBE
AP-1	APPROXIMATE LOCATION AND DESIGNATION OF AUGER PROBE
SG-1	APPROXIMATE LOCATION AND DESIGNATION OF SOIL GAS PROBE

REV No.	DESCRIPTION	BY	DATE

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DATE: APRIL 2002

GZA GeoEnvironmental of New York

SCALE IN FEET

0 15 30 60

DELPHI HARRISON THERMAL SYSTEMS

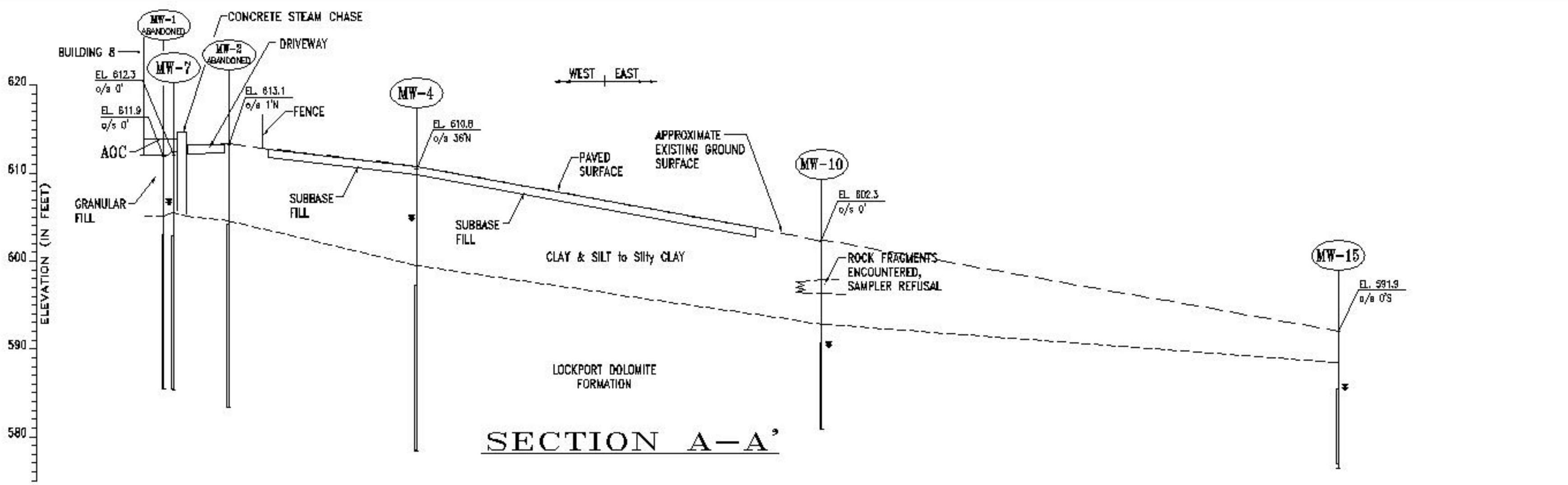
LOCKPORT, NEW YORK

FOCUSED REMEDIAL INVESTIGATION

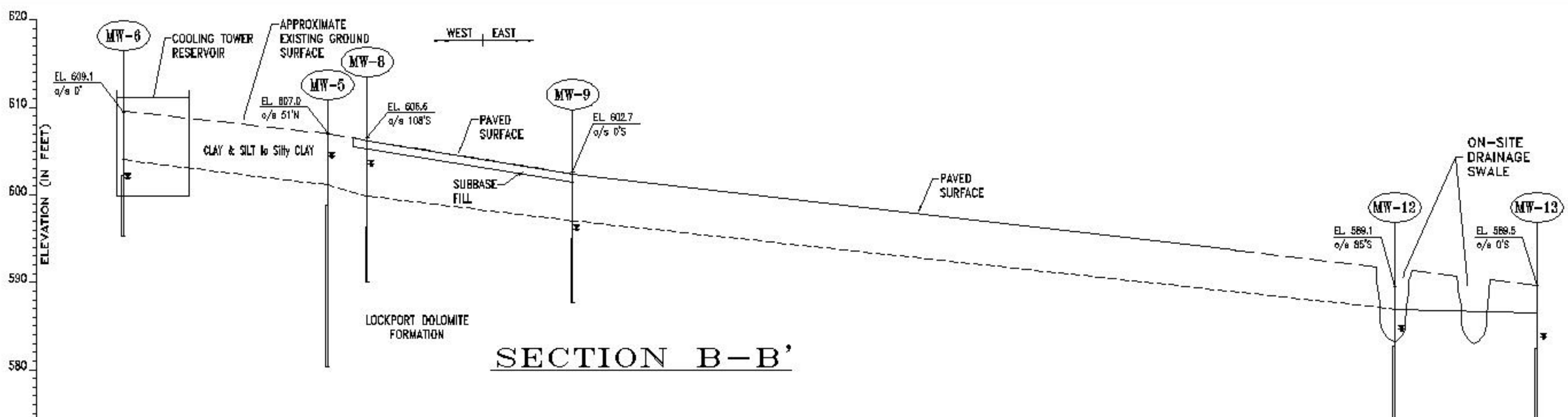
HISTORIC UTILITY BEDDING PROBE, AUGER PROBE, AND SOIL GAS PROBE LOCATION PLAN

PROJECT No. 55039.2

FIGURE No. 3



SECTION A–A'

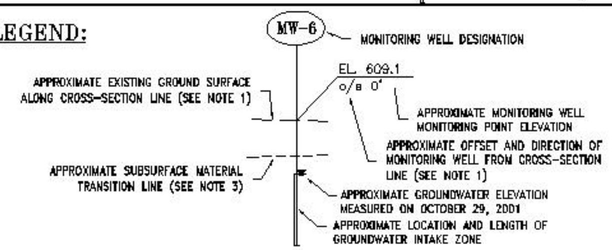


SECTION B–B'

NOTES:

1. SEE FIGURE No. 2 FOR APPROXIMATE LOCATION OF CROSS-SECTIONS A-A' AND B-B'.
2. AOC – AREA OF CONCERN.
3. THIS FIGURE WAS DEVELOPED FOR CONCEPTUAL DISCUSSION PURPOSES ONLY. THE FEATURES SHOWN ARE APPROXIMATED BASED ON INFORMATION IN GZA's FILES. THE GENERALIZED SOIL AND ROCK CROSS-SECTION SHOWN HAS BEEN DEVELOPED BY INTERPOLATING BETWEEN WIDELY SPACED EXPLORATIONS. THE ACTUAL SUBSURFACE CONDITIONS WILL VARY FROM THOSE SHOWN. FOR SPECIFIC INFORMATION, REFER TO THE BORING LOGS.
4. GROUNDWATER ELEVATIONS SHOWN WERE BASED ON MEASUREMENTS MADE BY GZA ON OCTOBER 29, 2001 AND UNDER THE CONDITIONS STATED WITHIN THE TEXT.
5. DEPTH OF COOLING TOWER RESERVOIR REPORTED BY DELPHI THERMAL.
6. WATER LEVEL READINGS HAVE BEEN MADE IN WELLS AT TIMES AND UNDER CONDITIONS STATED IN THE TEXT. IT MUST BE NOTED THAT FLUCTUATIONS IN THE GROUNDWATER ELEVATIONS MAY OCCUR DUE TO VARIATIONS IN RAINFALL, BAROMETRIC PRESSURE AND OTHER FACTORS.

LEGEND:



REV No.	DESCRIPTION	BY	DATE

DRAWN BY: BWS

DATE: APRIL 2002

GZA GeoEnvironmental of New York

SCALE IN FEET

HORIZONTAL 0 50 100 200

VERTICAL 0 12.5 25

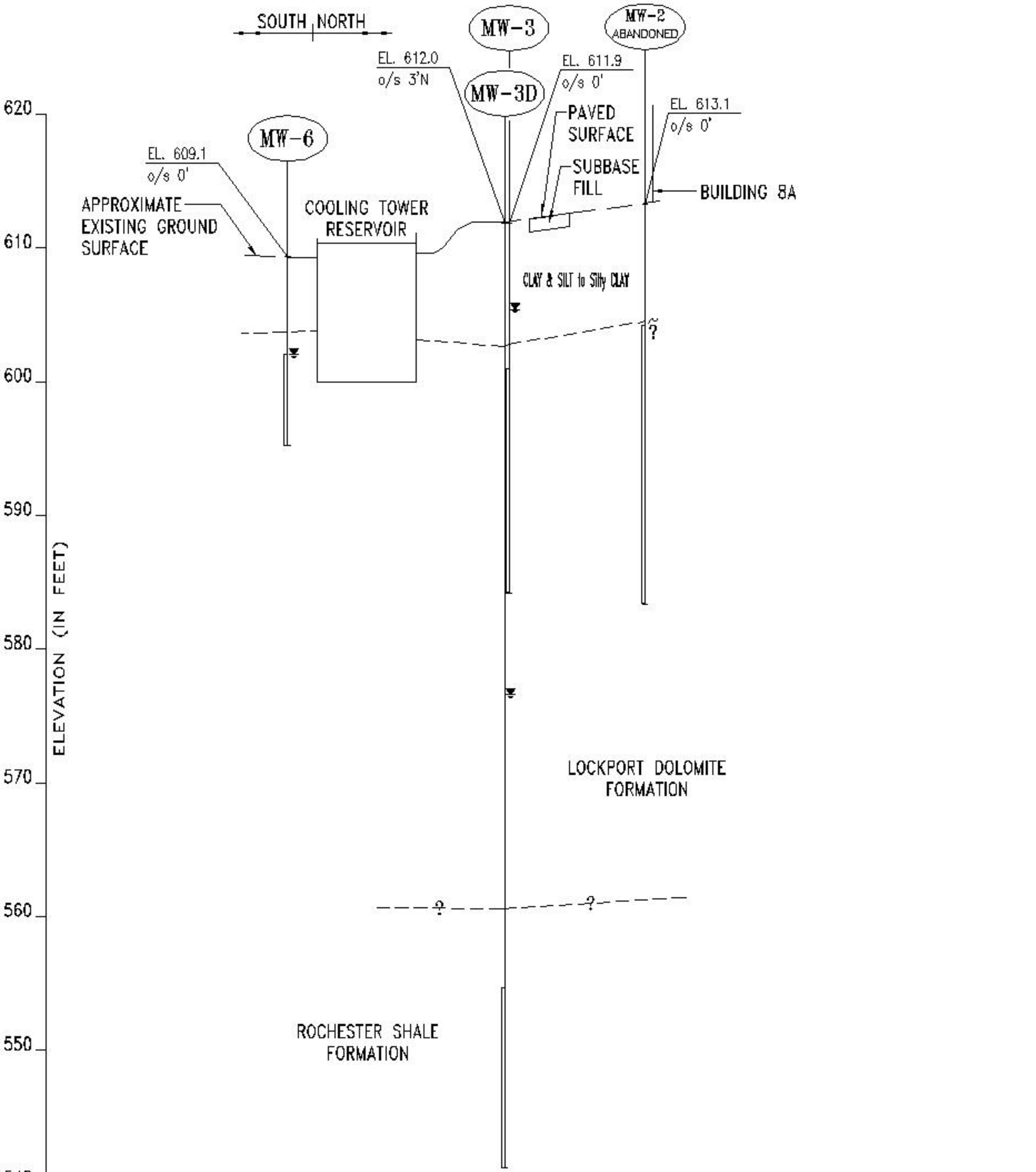
DELPHI HARRISON THERMAL SYSTEMS
LOCKPORT, NEW YORK

FOCUSED REMEDIAL INVESTIGATION

CROSS-SECTIONS A–A' AND B–B'

PROJECT No. 55039.2

FIGURE No. 4



SECTION C–C'

NOTES:

1. THE TRANSITION FROM THE LOCKPORT FORMATION TO ROCHESTER FORMATION IS TRANSITIONAL. THERE IS NO DISTINCT BOUNDARY BETWEEN THE TWO UNITS.

2. SEE FIGURE No. 2 FOR APPROXIMATE LOCATION OF CROSS–SECTION C–C'.

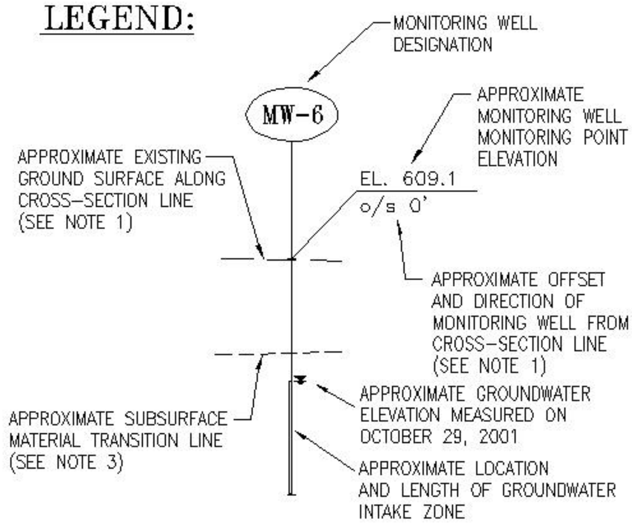
3. THIS FIGURE WAS DEVELOPED FOR CONCEPTUAL DISCUSSION PURPOSES ONLY. THE FEATURES SHOWN ARE APPROXIMATED BASED ON INFORMATION IN GZA's FILES. THE GENERALIZED SOIL AND ROCK CROSS–SECTION SHOWN HAS BEEN DEVELOPED BY INTERPOLATING BETWEEN WIDELY SPACED EXPLORATIONS. THE ACTUAL SUBSURFACE CONDITIONS WILL VARY FROM THOSE SHOWN. FOR SPECIFIC INFORMATION, REFER TO THE BORING LOGS.

4. GROUNDWATER ELEVATIONS SHOWN WERE BASED ON MEASUREMENTS MADE BY GZA ON OCTOBER 29, 2001 AND UNDER THE CONDITIONS STATED WITHIN THE TEXT.

5. DEPTH OF COOLING TOWER RESERVOIR REPORTED BY DELPHI THERMAL.

6. WATER LEVEL READINGS HAVE BEEN MADE IN WELLS AT TIMES AND UNDER CONDITIONS STATED IN THE TEXT. IT MUST BE NOTED THAT FLUCTUATIONS IN THE GROUNDWATER ELEVATIONS MAY OCCUR DUE TO VARIATIONS IN RAINFALL, BAROMETRIC PRESSURE AND OTHER FACTORS.

LEGEND:



DRAWN BY: DEW
DATE: APRIL 2002

GZA GeoEnvironmental of New York

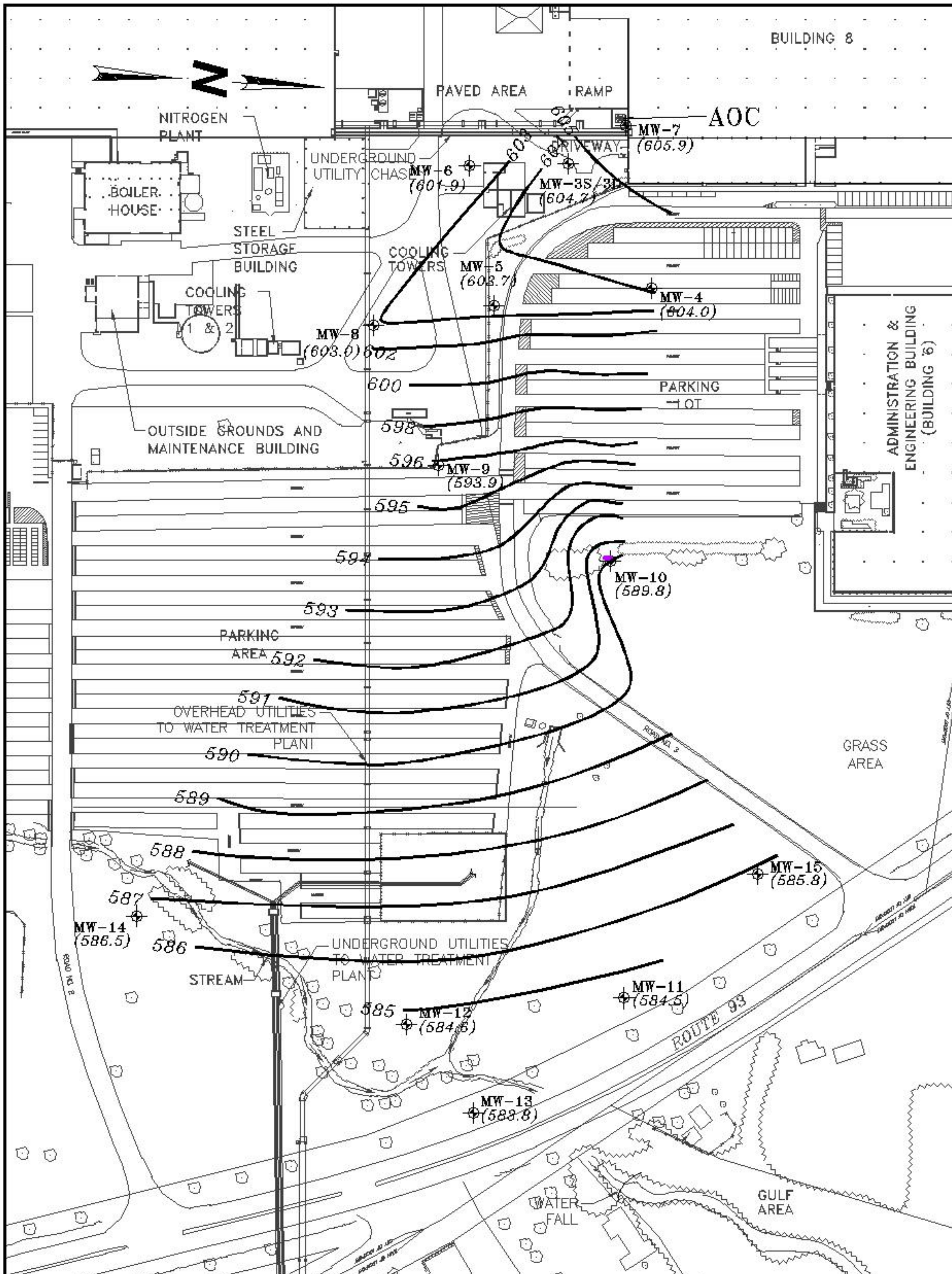
SCALE IN FEET
HORIZONTAL 0 50 100 200
VERTICAL 0 12.5 25

DELPHI HARRISON THERMAL SYSTEMS
LOCKPORT, NEW YORK
FOCUSED REMEDIAL INVESTIGATION

CROSS–SECTION C–C'

PROJECT No. 55039.2

FIGURE No. 5



LEGEND:

MW-3S (604.7) — APPROXIMATE LOCATION AND DESIGNATION OF EXISTING MONITORING WELL INSTALLED BY GZA

APPROXIMATE GROUNDWATER ELEVATION MEASURED ON OCTOBER 29, 2001

AOC — DENOTES AREA OF CONCERN

NOTES:

1. BASE MAP ADAPTED FROM AN AUTOCAD FILE PROVIDED BY DELPHI HARRISON THERMAL SYSTEMS.

2. WATER LEVEL READINGS HAVE BEEN MADE IN WELLS AT TIMES AND UNDER CONDITIONS PRESENTED IN THE REPORT. FLUCTUATIONS IN GROUNDWATER ELEVATIONS MAY OCCUR DUE TO VARIATIONS IN RAINFALL, BAROMETRIC PRESSURE, AND OTHER FACTORS.

DRAWN BY: BWS
DATE: APRIL 2002

GZA GeoEnvironmental of New York

SCALE IN FEET
0 100 200 400

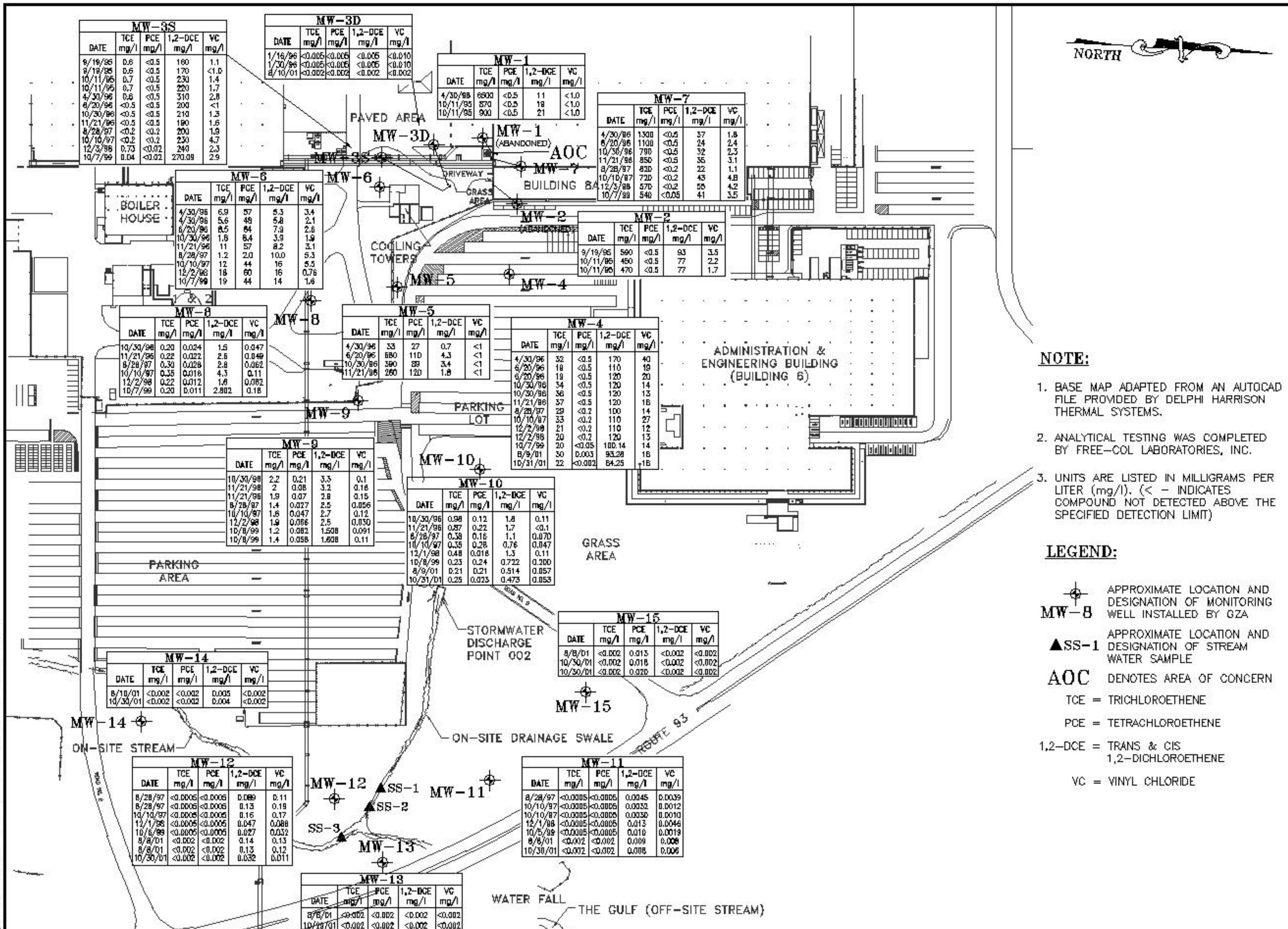
DELPHI HARRISON THERMAL SYSTEMS
LOCKPORT, NEW YORK

FOCUSED REMEDIAL INVESTIGATION

GROUNDWATER CONTOUR PLAN
(OCTOBER 29, 2001)

PROJECT No. 55039.2

FIGURE No. 6



MW-3S

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
9/19/95	0.6	<0.5	160	1.1
9/19/95	0.6	<0.5	170	<1.0
10/11/95	0.7	<0.5	230	1.4
10/11/95	0.7	<0.5	220	1.7
4/30/96	0.6	<0.5	310	2.8
6/20/96	<0.5	<0.5	200	<1
10/30/96	<0.5	<0.5	210	1.3
11/21/96	<0.5	<0.5	190	1.6
8/28/97	<0.2	<0.2	200	1.9
10/10/97	<0.2	<0.2	230	4.7
12/3/98	0.73	<0.02	240	2.3
10/7/99	0.04	<0.02	270.09	2.9

MW-3D

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
1/16/96	<0.005	<0.005	<0.005	<0.010
1/30/96	<0.005	<0.005	<0.005	<0.010
8/10/01	<0.002	<0.002	<0.002	<0.002

MW-1

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
4/30/98	6500	<0.5	11	<1.0
10/11/95	870	<0.5	18	<1.0
10/11/95	900	<0.5	21	<1.0

MW-7

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
4/30/96	1300	<0.5	37	1.8
6/20/96	1100	<0.5	24	2.4
10/30/96	790	<0.5	32	2.3
11/21/98	850	<0.5	35	3.1
8/28/97	820	<0.2	22	1.1
10/10/97	720	<0.2	43	4.8
12/3/98	570	<0.2	55	4.2
10/7/99	540	<0.05	41	3.5

MW-6

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
4/30/96	6.9	57	5.3	3.4
4/30/96	5.6	49	5.8	2.1
6/20/96	8.5	64	7.9	2.6
10/30/96	1.6	6.4	3.9	1.9
11/21/96	11	57	8.2	3.1
8/28/97	1.2	2.0	10.0	5.3
10/10/97	12	44	16	5.5
12/2/98	18	60	16	0.76
10/7/99	19	44	14	1.6

MW-2

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
9/19/95	590	<0.5	93	3.5
10/11/95	450	<0.5	77	2.2
10/11/95	470	<0.5	77	1.7

MW-8

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
10/30/96	0.20	0.024	1.5	0.047
11/21/95	0.22	0.022	2.6	0.049
8/28/97	0.30	0.028	2.8	0.062
10/10/97	0.35	0.018	4.3	0.11
12/2/98	0.22	0.012	1.6	0.082
10/7/99	0.20	0.011	2.802	0.18

MW-5

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
4/30/96	33	27	0.7	<1
6/20/96	680	110	4.3	<1
10/30/96	390	89	3.4	<1
11/21/96	260	120	1.8	<1

MW-4

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
4/30/96	32	<0.5	170	40
6/20/96	18	<0.5	110	19
6/20/96	19	<0.5	120	20
10/30/96	34	<0.5	120	14
10/30/96	36	<0.5	120	13
11/21/96	37	<0.5	120	16
8/28/97	29	<0.2	100	14
10/10/97	33	<0.2	110	27
12/2/98	21	<0.2	110	12
12/2/96	20	<0.2	120	13
10/7/99	20	<0.05	100.14	14
8/9/01	30	0.003	93.28	16
10/31/01	22	<0.002	84.25	16

MW-9

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
10/30/98	2.2	0.21	3.3	0.1
11/21/98	2	0.08	3.2	0.18
11/21/96	1.9	0.07	2.8	0.15
8/28/97	1.4	0.027	2.5	0.056
10/10/97	1.6	0.047	2.7	0.12
12/2/98	1.9	0.066	2.5	0.030
10/8/99	1.2	0.082	1.508	0.091
10/8/99	1.4	0.058	1.608	0.11

MW-10

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
10/30/96	0.98	0.12	1.8	0.11
11/21/96	0.87	0.22	1.7	<0.1
8/28/97	0.39	0.16	1.1	0.070
10/10/97	0.35	0.28	0.76	0.047
12/1/98	0.48	0.018	1.3	0.11
10/8/99	0.23	0.24	0.722	0.200
8/9/01	0.21	0.21	0.514	0.057
10/31/01	0.25	0.023	0.473	0.053

MW-15

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
8/8/01	<0.002	0.013	<0.002	<0.002
10/30/01	<0.002	0.018	<0.002	<0.002
10/30/01	<0.002	0.020	<0.002	<0.002

MW-14

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
8/10/01	<0.002	<0.002	0.005	<0.002
10/30/01	<0.002	<0.002	0.004	<0.002

MW-12

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
8/28/97	<0.0005	<0.0005	0.089	0.11
8/28/97	<0.0005	<0.0005	0.13	0.19
10/10/97	<0.0005	<0.0005	0.16	0.17
12/1/98	<0.0005	<0.0005	0.047	0.088
10/6/99	<0.0005	<0.0005	0.027	0.032
8/8/01	<0.002	<0.002	0.14	0.13
8/8/01	<0.002	<0.002	0.13	0.12
10/30/01	<0.002	<0.002	0.032	0.011

MW-11

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
8/28/97	<0.0005	<0.0005	0.0045	0.0039
10/10/97	<0.0005	<0.0005	0.0032	0.0012
10/10/97	<0.0005	<0.0005	0.0030	0.0010
12/1/98	<0.0005	<0.0005	0.013	0.0046
10/5/99	<0.0005	<0.0005	0.010	0.0019
8/8/01	<0.002	<0.002	0.009	0.008
10/30/01	<0.002	<0.002	0.008	0.006

MW-13

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
8/8/01	<0.002	<0.002	<0.002	<0.002
10/29/01	<0.002	<0.002	<0.002	<0.002

NOTE:

1. BASE MAP ADAPTED FROM AN AUTOCAD FILE PROVIDED BY DELPHI HARRISON THERMAL SYSTEMS.
2. ANALYTICAL TESTING WAS COMPLETED BY FREE-COL LABORATORIES, INC.
3. UNITS ARE LISTED IN MILLIGRAMS PER LITER (mg/l). (< - INDICATES COMPOUND NOT DETECTED ABOVE THE SPECIFIED DETECTION LIMIT)

LEGEND:

MW-8 — APPROXIMATE LOCATION AND DESIGNATION OF MONITORING WELL INSTALLED BY GZA

▲SS-1 — APPROXIMATE LOCATION AND DESIGNATION OF STREAM WATER SAMPLE

AOC — DENOTES AREA OF CONCERN

TCE = TRICHLOROETHENE

PCE = TETRACHLOROETHENE

1,2-DCE = TRANS & CIS 1,2-DICHLOROETHENE

VC = VINYL CHLORIDE

REV No.	DESCRIPTION	BY	DATE

DRAWN BY: DEW

DATE: APRIL 2002

SCALE IN FEET: 0 85 170 340

GZA GeoEnvironmental of New York

DELPHI HARRISON THERMAL SYSTEMS
LOCKPORT, NEW YORK

FOCUSED REMEDIAL INVESTIGATION

GROUNDWATER ANALYTICAL TEST RESULTS FOR TARGET CHLORINATED COMPOUNDS

PROJECT No. 55039.2

FIGURE: 7

APPENDIX A

NYSDEC AND DELPHI THERMAL LETTERS

INCLUDING LETTERS DATED:

- December 2, 1994;
- December 22, 1994;
- April 13, 1995;
- April 11, 1996;
- May 15, 1998;
- October 21, 1998;
- August 12, 1999;
- March 10, 2000;
- June 20, 2000;
- September 18, 2000;
- September 25, 2000;
- November 16, 2000;
- February 2, 2001;
- June 5, 2001;
- June 20, 2001;
- July 9, 2001; and
- February 8, 2002.

New York State Department of Environmental Conservation
270 Michigan Avenue, Buffalo, New York 14203-2999
(716) 851-7220

Langdon Marsh
Commissioner

December 2, 1994

HARRISON DIV.
GENERAL MOTORS CORP.
RECEIVED
DEC 9 1994
ENVIRONMENTAL ACTIVITIES

Ms. Amy S. Buckenheimer
Senior Environmental Engineer
Environmental Activities
Harrison Division
General Motors Corporation
Lockport, NY 14094

Dear Ms. Buckenheimer:

Spill Number 9410972
SE Corner of Building 8-Trichlor
Lockport
Niagara

On December 1, 1994, we discussed the above referenced spill and you must do the following:

1. Submit a copy of the results for the analyses on the soil.

2. Submit a copy of a site plan indicating the affected area and where samples have been taken.

Based on the documentation provided, further remediation may be required. Please submit the documentation by December 23, 1994.

Your cooperation is appreciated. If you have any questions, please call me at 851-7220.

Sincerely,

Salvatore A. Calandra

Salvatore A. Calandra
Environmental Engineer I

SAC/ad
cc: Mr. David Drust, NCHD

HARRISON

Harrison Division
General Motors Corporation
200 Upper Mountain Road
Lockport, New York 14094

CERTIFIED
P 884 920 573
MAIL

December 22, 1994

Mr. Salvatore A. Calandra
Environmental Engineer I
New York State Department of Environmental Conservation
270 Michigan Avenue
Buffalo, New York 14203-2999

Subject: ***SPILL NUMBER 9410972***
SE CORNER OF BUILDING 8
LOCKPORT, NEW YORK

Dear Mr. Calandra:

As per your request, please find enclosed:

1.) Site Plan of excavation area on the SE corner of Building 8 showing where samples were taken.
2.) Facility Plan showing excavation area in relation to entire West Lockport facility.
3.) Results of soil analysis - Total trichloroethylene and TCLP trichloroethylene for four samples.

Summary of Events

Please refer to the attached site plan. The six inch fire protection line which is located approximately six feet below ground, failed causing water to fill a containment area located directly above the line. The above-ground tank 8-18, which previously held trichloroethylene and was closed-in-place on 5-1-94, was located in the containment area.

In order to repair the water line, our maintenance crew removed the tank, containment pad, and soil above the water lines.

During excavation to repair the water line, solvent fumes were noticed. Excavation was completed and soil samples were taken from the bottom of the site as shown in the site plan to determine if trichloroethylene existed in the soil. As discussed in our December 1, 1994, telephone conversation, Harrison needed to protect the water lines from movement and freezing by backfilling the hole with sand and crushed stone.
The excavation area was backfilled on December 3, 1994, with 2 feet of sand to cover the pipes and then crushed concrete to fill to grade.

Preliminary results suggest that additional investigation may be warranted to determine the extent of trichloroethylene contamination in this area. The investigation could include the development of a work plan for further actions if deemed necessary. In early 1995, we will be retaining the services of an area environmental consulting firm to lead us in this review.

Harrison will continue to keep the Department of Environmental Conservation informed as to the progress of the assessment of this area and resulting recommended work plans.

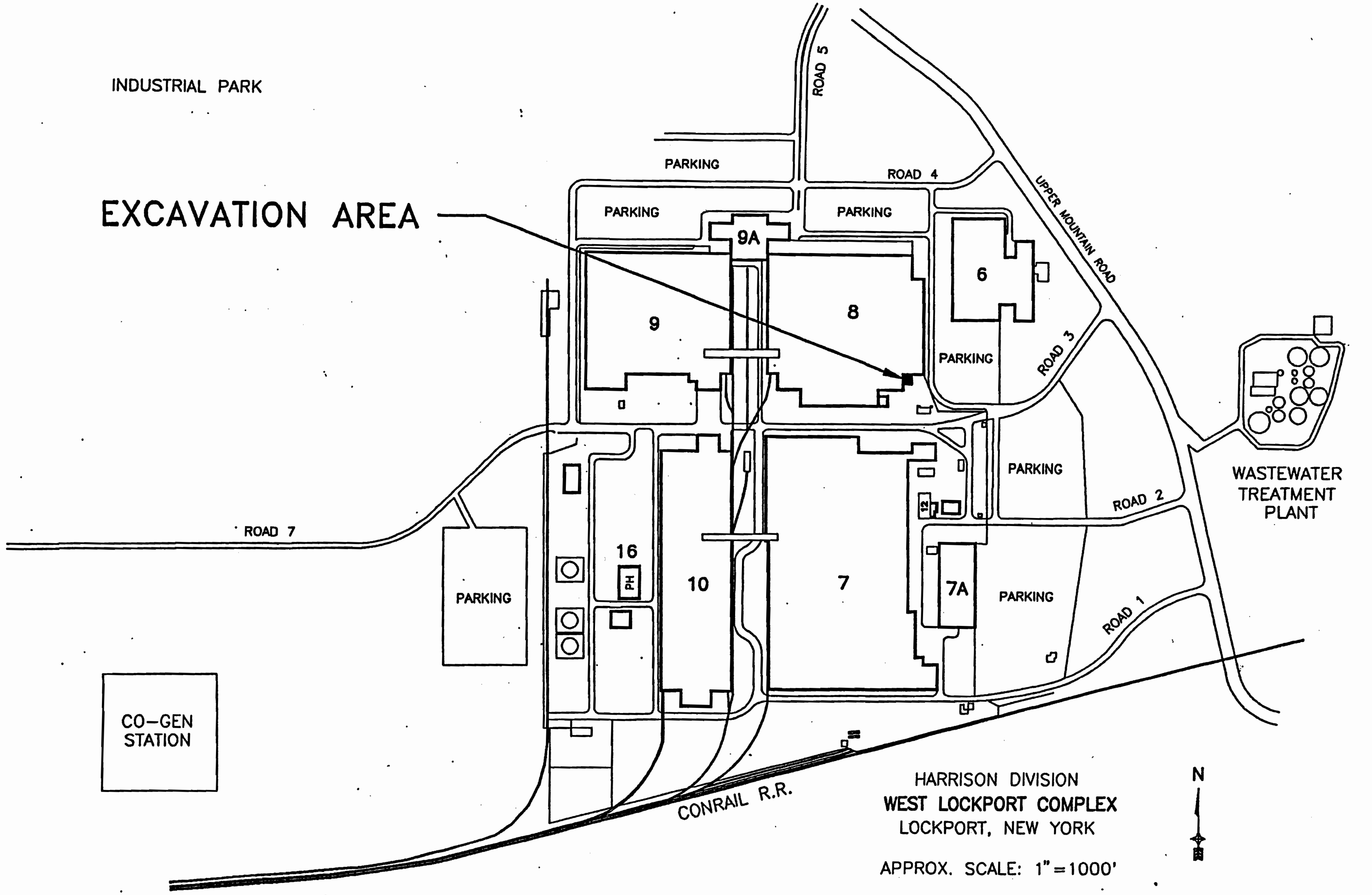
If you have any questions, please call me at (716) 439-2689. Please note that our office will be closed for the holidays from December 24, 1994 thru January 2, 1995.

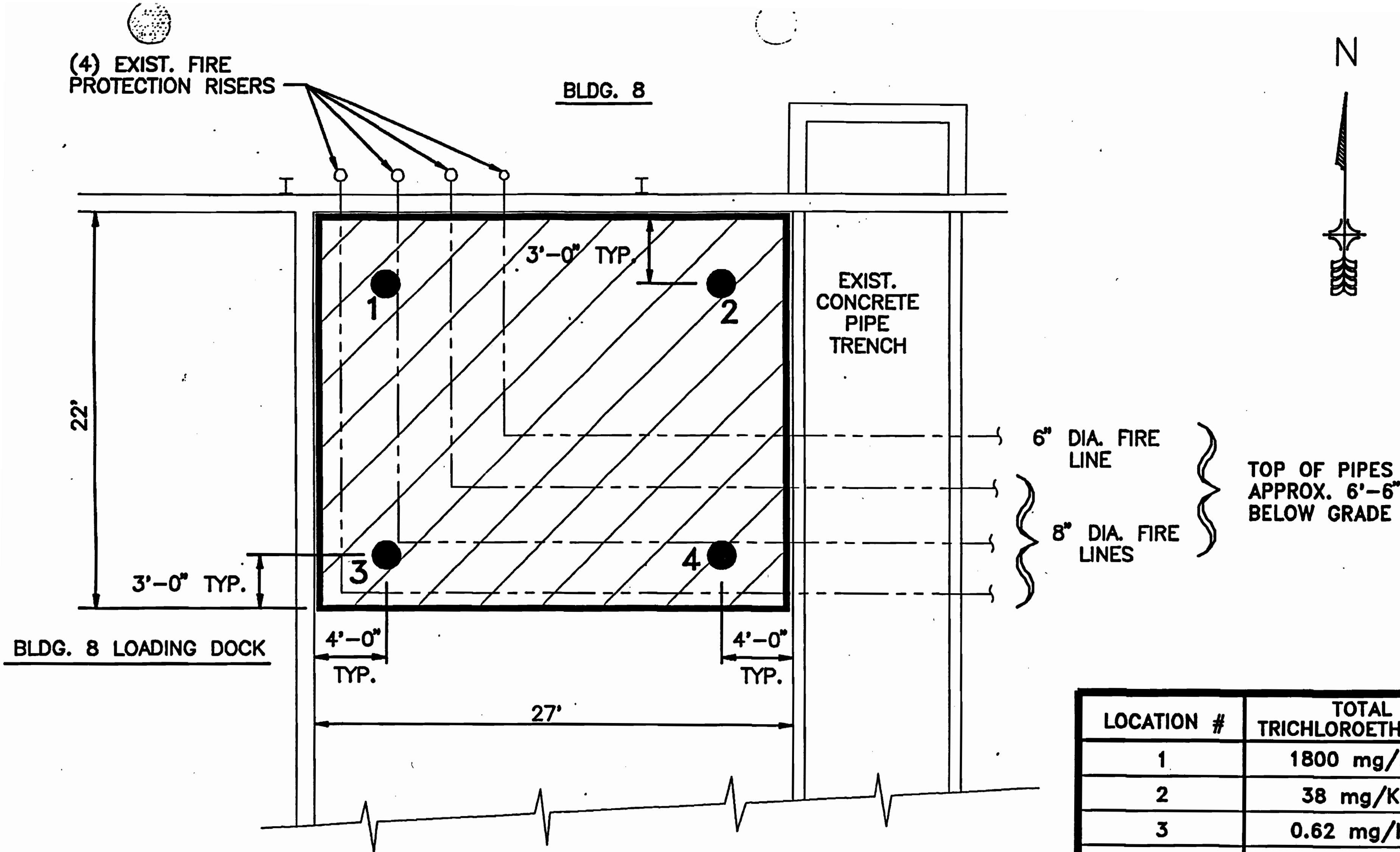
Amy S. Buckenheimer

Amy S. Buckenheimer
Sr. Environmental Engineer

Lets Get It Together
SAFETY BELTS SAVE LIVES

Enclosures


INDUSTRIAL PARK
EXCAVATION AREA
PARKING
ROAD 5
ROAD 4
PARKING
PARKING
9A
UPPER MOUNTAIN ROAD
6
9
8
PARKING
ROAD 3
PARKING
WASTEWATER TREATMENT PLANT
ROAD 2
12
ROAD 7
16
PH
10
7
7A
PARKING
PARKING
ROAD 1
CO-GEN STATION
CONRAIL R.R.
HARRISON DIVISION
WEST LOCKPORT COMPLEX
LOCKPORT, NEW YORK
APPROX. SCALE: 1"=1000'
N



LOCATION #	TOTAL TRICHLOROETHYLENE
1	1800 mg/Kg
2	38 mg/Kg
3	0.62 mg/Kg
4	99 mg/Kg

SAMPLE DATE: 11/30/94

APPROX. EXCAVATION DEPTH: 7'–6"

PRESENT EXCAVATION SITUATION: AREA BACKFILLED WITH: 2' OF SAND FOR PIPE BEDDING, AND #2 CRUSHER RUN (CRUSHED CONCRETE) TO GRADE.

SITE PLAN
EXCAVATION AREA
SOUTH EAST CORNER
OF BLDG. 8
12-20-94

DELPHI
Automotive Systems

Certified Mail # P884 920 580

April 13, 1995

Mr. Abul Barkat, PE
Remediation Group
New York State Department of Environmental Conservation
270 Michigan Avenue
Buffalo, New York 14203-2999

Subject: **SPILL NUMBER 9410972**
SE CORNER OF BUILDING 8
LOCKPORT, NEW YORK

Dear Mr. Barkat:

As part of the continuing communication on Spill Number 9410972 reported on November 16, 1994 and in follow-up to the letter sent to Mr. Salvatore Calandra on December 22, 1994, Delphi Harrison Thermal Systems is providing this update.

General Motors recommends a phased approach. Phases One and Two are identification and confirmation of the potential area of environmental concern (PAOC's) at the site. These Phases have been completed. Based on Phases One and Two, Phase Three is recommended.

Phase Three is determination of the extent and magnitude of the PAOC. This Phase shall include the consolidation and development of data to characterize the nature, extent and magnitude of the contaminant and assess potential risks to human health and the environment.

Phase Four involves a Feasibility study which develops, screens and performs a detailed evaluation of an array of protective and practicable remedial alternatives to address potential areas of environmental concern identified in Phase Two. Phase Four also includes, if necessary, treatability studies to evaluate technologies, development of a residual and transient remedy risk assessment and recommends a selected remedial action.

Delphi Harrison Thermal Systems is in the process of preparing a bid package to area consultants for assessment of the SE Corner of Building 8 area and their recommended work plans. It is anticipated that bids will be received and the consultant selected to complete Phase Three by early June.

Based on the outcome of Phase Three, a decision will be made if Phase Four will be necessary. Delphi Thermal will continue to keep the Department of Environmental Conservation informed as to the progress of the assessment of this area and the resulting Feasibility Study.

Please call me at (716) 439- 2942 if you have any questions. Please note that our office will be closed for the holidays from April 14, 1995 through April 17, 1995.

Sincerely,

Catherine A. Ver

Catherine A. Ver
Sr. Environmental Engineer

New York State Department of Environmental Conservation
270 Michigan Avenue, Buffalo, New York, 14203-2999

Michael D. Zagata
Commissioner

HARRISON DIV.
GENERAL MOTORS CORP.
RECEIVED
APR 11 1996
ENVIRONMENTAL ACTIVITIES

April 11, 1996

Ms. Cathy Ver
Delphi Harrison Thermal Systems
200 Upper Mountain Road
Lockport, New York 14094

Community Well Assessment, Spill Number 9410972

Dear Ms. Ver:

This letter is a follow up to our recent conversation concerning the location and status of private drinking wells near the Delphi Harrison Thermal Systems facility in Lockport. Delphi, in the Addendum to the Phase III Sampling and Analysis Plan dated March 16, 1996, discusses their intent to conduct an exposure assessment to identify potential risks to human health or the environment related to the subject spill. Identification of private drinking wells near the facility is part of this assessment.. The Department, by way of letter dated March 25, 1996, informed Delphi that such a compilation was completed during the City of Lockport Landfill investigation. During our conversation, however, I indicated that a recent summary of this information had been completed as part of the Department's reclassification package for the Harrison inactive hazardous waste site (Site Number 932017). Following are excerpts from this memo that deal specifically with the private drinking water wells in the area.

Assessment

Based upon the direction of groundwater flow under the Harrison inactive hazardous waste site (Figures 2-5), eleven wells are located downgradient of the site. Information concerning these wells is summarized in Table 1. Of these wells, none are known to be utilized; two have been abandoned/plugged, two are open, and the status of the remainder is unknown. Although private wells downgradient of the Harrison site are not being utilized, additional assessment on the potential impact of the site on private wells has been completed. The general stratigraphy of the area is shown in Figure 3-4. At the Harrison site, the principal groundwater flow zone occurs within the Lockport Dolostone; this unit is absent at the Lockport City Landfill site located approximately one mile to the northeast (Figure C-1). At the latter site, located near seven of the private wells of concern, the principal groundwater flow zone occurs within the Rochester Shale, which is stratigraphically older than (below) the Lockport Dolostone (Figure 3-4). As a result, two distinct groundwater flow regimes characterize the two sites. For potentially contaminated groundwater from the Harrison site to impact the downgradient private wells near the Lockport City

Landfill site, downward migration of contaminants from the Lockport Dolostone to the Rochester Shale would have to take place. Information from the Harrison site does not address this issue, however, information regarding regional groundwater flow provides insight on the ultimate fate of this groundwater.

Located between the Harrison and Lockport City Landfill sites is a large topographic depression known as "the Gulf" (Figures 3-10 and 3-13). This feature acts as a giant sink to regional groundwater flow; groundwater at the Harrison site flows east toward the Gulf (Figures 2-5), while groundwater at the Lockport City Landfill site flows west toward this depression (Plate 6). In addition, the Gulf completely bisects the Rochester Shale and the underlying Irondequoit Formation. As a result, even if potentially contaminated groundwater at the Harrison site was migrating downward into the Rochester Shale, it would discharge into the Gulf. The presence of the Gulf, therefore, would prevent potentially contaminated groundwater from the Harrison site from impacting the private wells farther east (locations 3,4,8,10,11,14, and 38). The only wells, therefore, that could be potentially impacted by the Harrison site are locations 21-24 (Figure C-1), which as stated above are not being utilized (Table 1).

Conclusion

Of principal concern to the reclassification of the Harrison inactive hazardous waste site is the potential impact on downgradient private wells. A detailed evaluation of this issue, however, suggests that health impacts from potentially contaminated groundwater leaving the Harrison site are extremely unlikely. Proof of this statement includes the following:

1. Of the eleven private wells located downgradient, none are actively being utilized.

2. Two distinct flow regimes characterize the Harrison and Lockport City Landfill sites. Groundwater underlying the Harrison site flows east toward the Gulf, while groundwater beneath the Lockport City Landfill site flows west toward this topographic depression. As a result, seven private wells located downgradient of the Harrison site could not be impacted by the site as groundwater discharges to the Gulf before reaching the wells.

Please feel free to contact me at 851-7220 if you have any comments of questions.

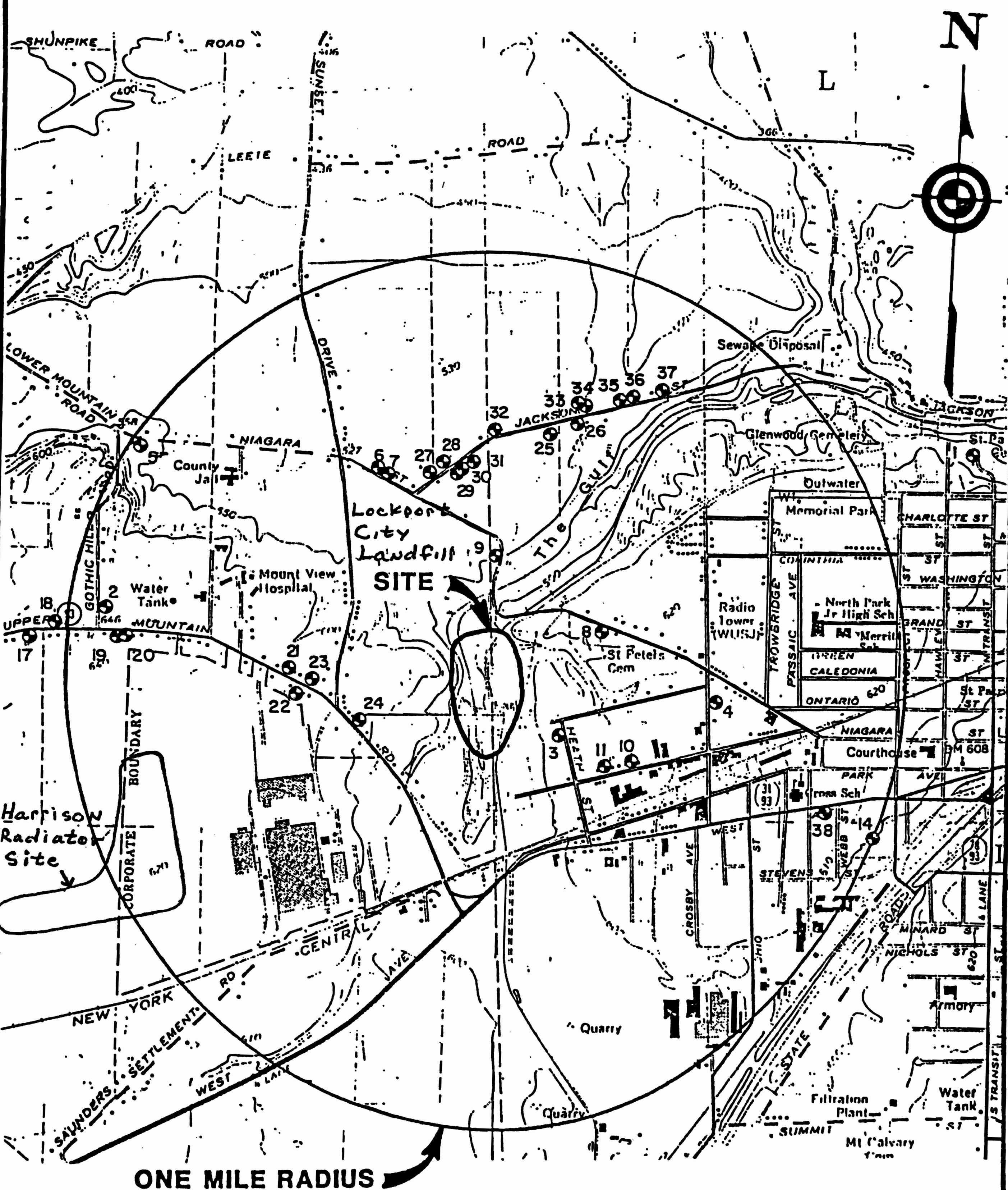
Sincerely yours,

Glenn M May

Glenn M. May, CPG
Engineering Geologist I

Attachments

cc: Mr. Abul Barkat



SOURCE:

LOCKPORT 1965

15 MINUTE QUADRANGLE

RESIDENTIAL WELLS

SCALE

0 1,000' 2,000'

A-4179

URS
CONSULTANTS, INC.

COMMUNITY WELL SURVEY - KNOWN WELL LOCATIONS

LOCKPORT CITY LANDFILL

FIGURE C-1

LOCKPORT LANDFILL RI/FS
COMMUNITY WELL SURVEY
(6/21/91)
RESPONDENTS WITH WELLS

Location Number	Address
1	162 Glenwood Avenue
2	4895 Gothic Hill Road
3	38 Heath Street
4	166 Michigan Street
5	5463 Niagara Street
6	5631 Niagara Street
7	5633 Niagara Street
8	646 Niagara Street
9	998 Niagara Street
10	249 S. Niagara Street
11	285 S. Niagara Street
12*	5291 Saunders Settlement Road
13*	5324 Saunders Settlement Road
14	27 Sunnyside Street
15*	5285 Upper Mt Road
16*	5317 Upper Mt Road
17	5360 Upper Mt Road
18	5377 Upper Mt Road
19	5428 Upper Mt Road
20	5434 Upper Mt Road
21	5515 Upper Mt Road
22	5526 Upper Mt Road
23	5533 Upper Mt Road
24	5621 Upper Mt Road
25	1101 W. Jackson Street
26	1201 W. Jackson Street
27	5733 W. Jackson Street
28	5745 W. Jackson Street
29	5750 W. Jackson Street
30	5762 W. Jackson Street
31	5766 W. Jackson Street
32	5785 W. Jackson Street
33	5853 W. Jackson Street
34	5861 W. Jackson Street
35	5871 W. Jackson Street
36	5873 W. Jackson Street
37	5903 W. Jackson Street
38	280 West Avenue

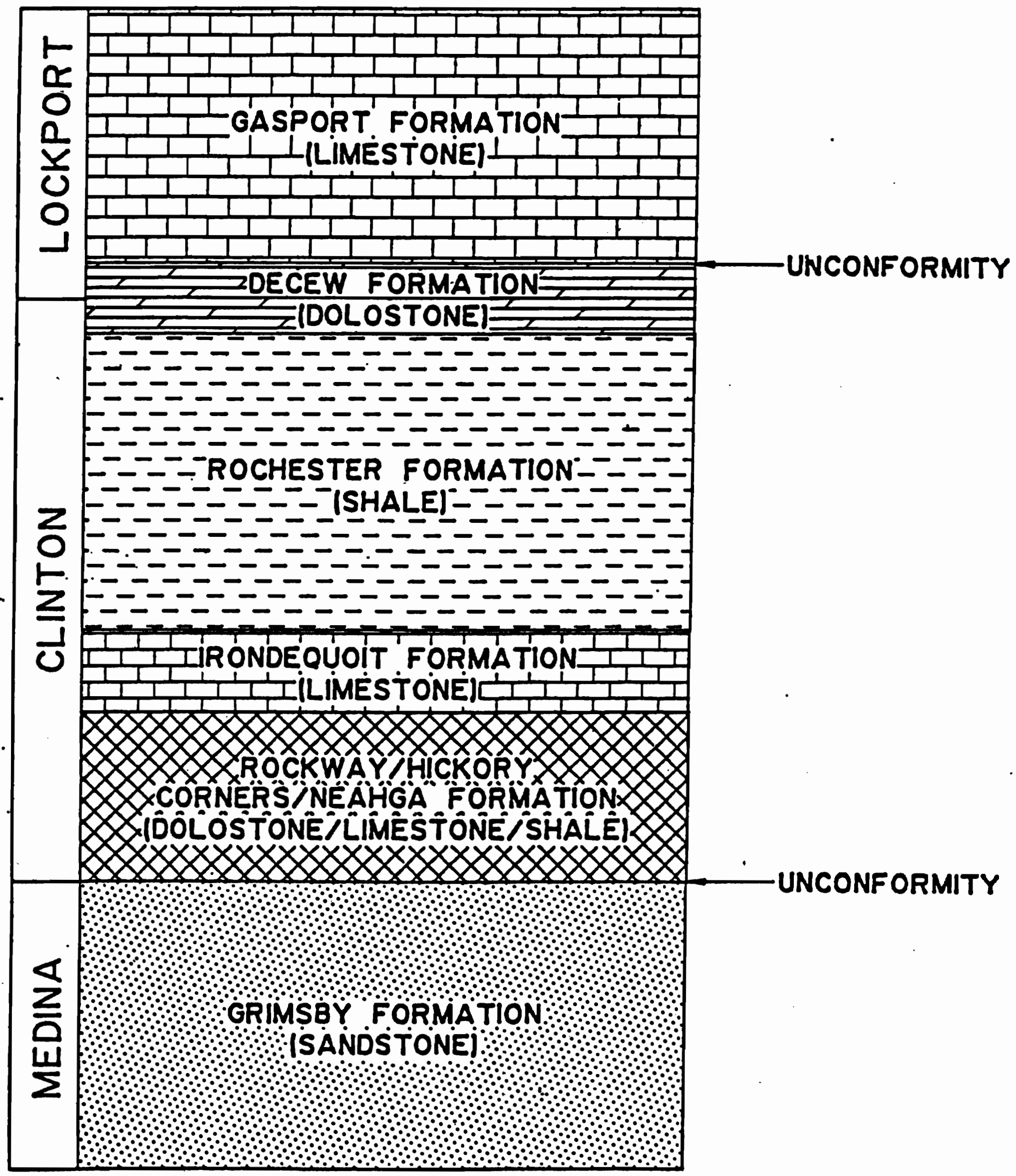
* Off the map shown in Figure C-1

SURVEY.LST/35180B(6/91)

LOCKPORT LANDFILL RI/FS
COMMUNITY WELL SURVEY
(6-21-91)

ELL ESENT (Y/N)		ADDRESS	GROUNDWATER USES	WELL ABANDONED CAPPED,OPEN, PLUGGED	YEAR DRILLED	METHOD	DEPTH OF WELL	LITHOLOGIC UNIT	USING CITY WATER (Y/N)	SUMPPUMP PRESENT (Y/N)	WATER IN BASEMENT (Y/N)
	162	GLENWOOD AVE	NONE	O	1933	DRILLED	60	BEDROCK	Y	Y	Y
	4895	GOTHIC HILL RD	2 WELLS - NOT USED	?	?	DUG	56	?	?	?	?
	38	HEATH ST	NOT USED	?	1949	?	40	?	?	?	?
	166	MICHIGAN ST	ABANDONED	Y	?	?	?	?	?	?	?
	5463	NIAGARA ST	NOT USED	?	?	?	?	?	?	?	?
	5463	NIAGARA ST	NONE	C	?	DRILLED	20'	BEDROCK	Y	N	Y
	5631	NIAGARA ST	NOT USED	?	?	?	?	?	?	?	?
	5633	NIAGARA ST	NOT USED	O	?	DRILLED	?	?	Y	N	?
	646	NIAGARA ST	NOT USED	?	1960	?	23	BEDROCK	?	?	?
	998	NIAGARA ST	DOMESTIC, LIVESTOCK, AGRICULTURE	?	?	?	500	?	?	?	?
Y	249	S. NIAGARA ST	?	?	?	?	?	?	?	?	?
Y	285	S. NIAGARA ST	NOT USED	O	?	?	?	?	Y	Y	Y
Y	5291	SAUNDERS SETTLEMENT RD	NONE	C	1946	?	?	?	Y	Y	N
Y	5324	SAUNDERS SETTLEMENT RD	LIVESTOCK, AGRICULTURE, DRINKING	?	1930	DRILLED	56	BEDROCK	Y	Y	Y
Y	27	SUNNYSIDE ST	?	P	?	DUG	?	?	Y	N	Y
Y	5285	UPPER MT RD	?.	C	1900	DUG	40	?	Y	N	Y
Y	5317	UPPER MT RD	WASHING CARS	O	?	DUG	?	?	Y	N	Y
Y	5360	UPPER MT RD	WATERING PLANTS	?	1930	DUG	50	BEDROCK	Y	N	Y
Y	5377	UPPER MT RD	LAWN WATERING, DRIVEWAY WASHING	O	1900	BOTH	30	?	Y	N	Y
Y	5428	UPPER MT RD	WATERING LAWN AND GARDEN	?	1959	?	25+	?	Y	Y	Y
Y	5434	UPPER MT RD	NONE	C	1955	DRILLED	?	?	Y	Y	Y
Y	5515	UPPER MT RD	NOT USED	?	?	?	?	?	?	?	?
Y	5526	UPPER MT RD	NOT USED	?	?	?	?	?	?	?	?
Y	5533	UPPER MT RD	NOT USED	?	?	?	30?	?	?	?	?
Y	5621	UPPER MT RD	NOT USED	?	?	?	?	?	?	?	?
Y	1101	W. JACKSON ST	DOMESTIC, LIVESTOCK,LAWN	?	?	?	36	BEDROCK	?	?	?
Y	1201	W. JACKSON ST	DOMESTIC, LIVESTOCK, LAWN	?	1970?	?	40	BEDROCK	?	?	?
Y	5733	W. JACKSON ST	2 WELLS - ?IN USE?	?	?	?	?	?	?	?	?
Y	5745	W. JACKSON ST	DOMESTIC, LIVESTOCK, LAWN	?	?	BOTH	125	BEDROCK	?	?	?
Y	5750	W. JACKSON ST	DOMESTIC, LIVESTOCK, LAWN	?	1978?	?	?	?	?	?	?
Y	5762	W. JACKSON ST	DOMESTIC, LIVESTOCK	?	?	?	?	?	?	?	?
Y	5766	W. JACKSON ST	NOT USED	?	?	?	?	?	?	?	?
Y	5785	W. JACKSON ST	LAWN WATERING	?	?	?	?	?	?	?	?
Y	5853	W. JACKSON ST	DOMESTIC, LIVESTOCK, LAWN	?	1960?	?	?	?	?	?	?
Y	5861	W. JACKSON ST	DOMESTIC, LIVESTOCK, LAWN	?	1972	DRILLED	35	BEDROCK	?	?	?
Y	5871	W. JACKSON ST	NOT USED	?	?	DRILLED	30?	?	?	?	?
Y	5873	W. JACKSON ST	?IN USE?	?	?	?	?	?	?	?	?
Y	5903	W. JACKSON ST	LIVESTOCK	?	?	DUG	?	?	?	?	?
Y	280	WEST AVE	DORMANT	O	1800	BOTH	?	?	N	N	Y

TABLE 1 SUMMARY OF COMMUNITY WELLS IN THE VICINITY OF THE HARRISON RADIATOR SITE, LOCKPORT						
LOCATION NUMBER	ADDRESS	GROUNDWATER USES	WELL ABANDONED, CAPPED, OPEN, PLUGGED	WELL DEPTH (FEET)	LITHOLOGIC UNIT	USING CITY WATER
3	38 Heath Street	Not utilized	Unknown	40	Unknown	Unknown
4	166 Michigan Street	Not utilized	Abandoned	Unknown	Unknown	Unknown
8	646 Niagara Street	Not utilized	Unknown	23	Bedrock	Unknown
10	249 S. Niagara Street	Unknown	Unknown	Unknown	Unknown	Unknown
11	285 S. Niagara Street	Not utilized	Open	Unknown	Unknown	Yes
14	27 Sunnyside Street	Not utilized	Plugged	Unknown	Unknown	Yes
21	5515 Upper Mt. Road	Not utilized	Unknown	Unknown	Unknown	Unknown
22	5526 Upper Mt. Road	Not utilized	Unknown	Unknown	Unknown	Unknown
23	5533 Upper Mt. Road	Not utilized	Unknown	30?	Unknown	Unknown
24	5621 Upper Mt. Road	Not utilized	Unknown	Unknown	Unknown	Unknown
38	280 West Avenue	Dormant	Open	Unknown	Unknown	No



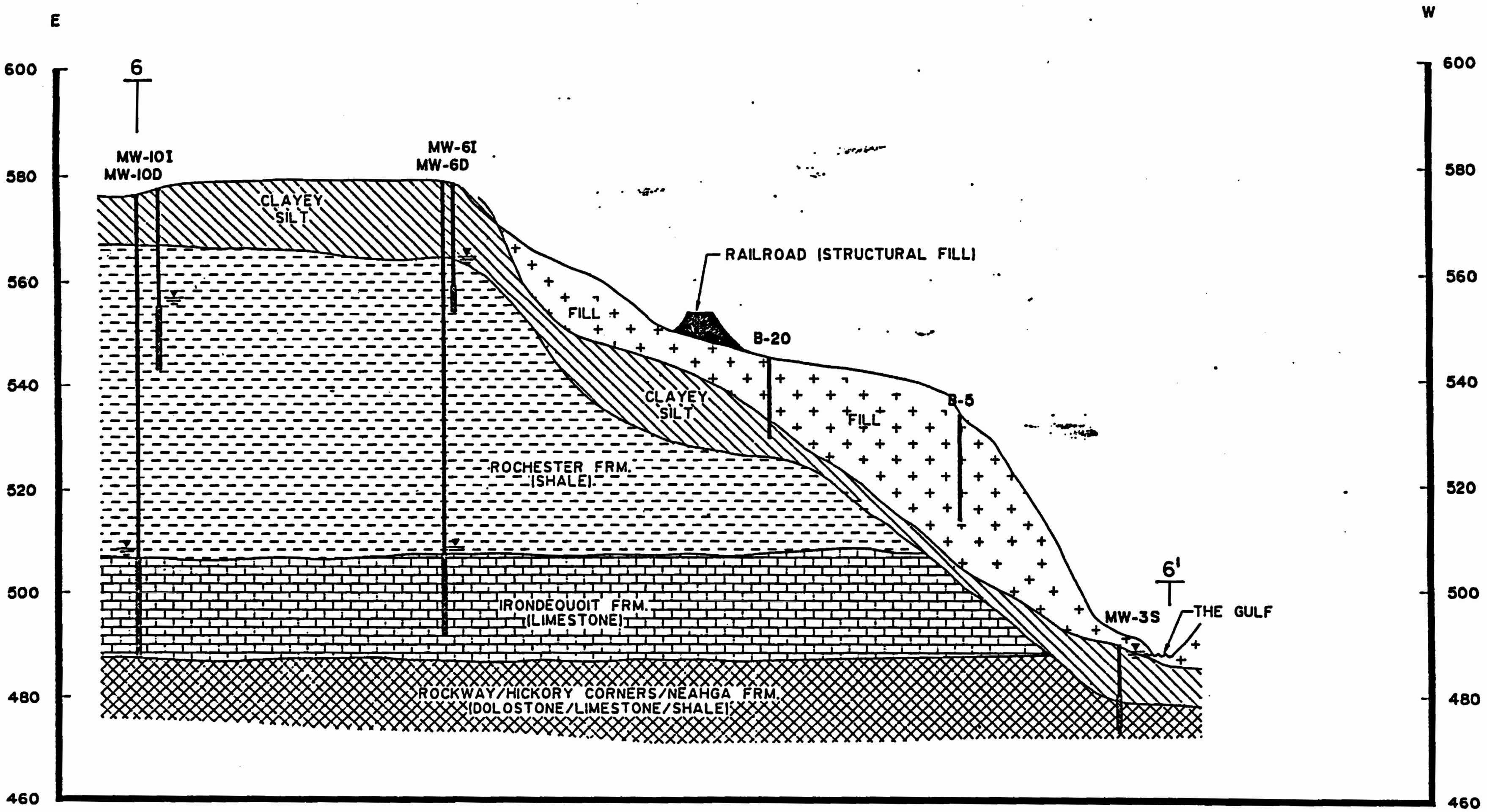
1"=100' 7/8/91

AC-3256/a

URS
CONSULTANTS, INC.

STRATIGRAPHIC COLUMN
OF ROCK UNITS

FIGURE 3-4



SCALE: HORIZ. 1"=100'-0"
VERT. 1"=20'-0"

LEGEND

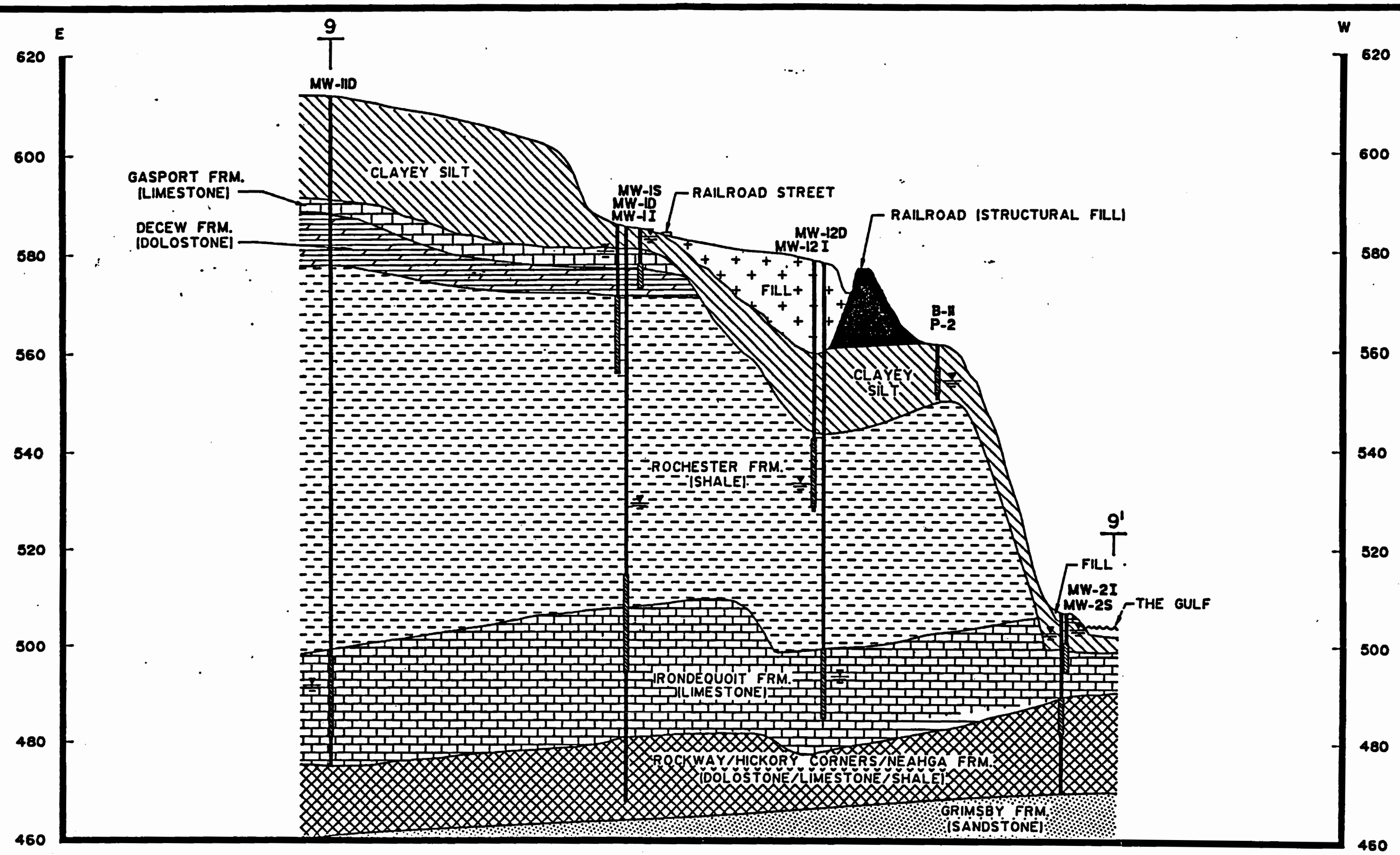
MW-6D — BORING AND MONITORING WELL NUMBER

— GROUNDWATER ELEVATION 4/8/91

— SCREENED INTERVAL OF MONITORING WELL

NOTE:
GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUNTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARD ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.

CROSS SECTION 6-6'	
URS CONSULTANTS, INC.	FIGURE 3-10



SCALE: HORIZ. 1"=200'-0"
VERT. 1"=20'-0"

NOTE:
GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUNTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARD ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.

LEGEND

MW-8D — BORING AND MONITORING WELL NUMBER

— GROUNDWATER ELEVATION 4/8/91

— SCREENED INTERVAL OF MONITORING WELL

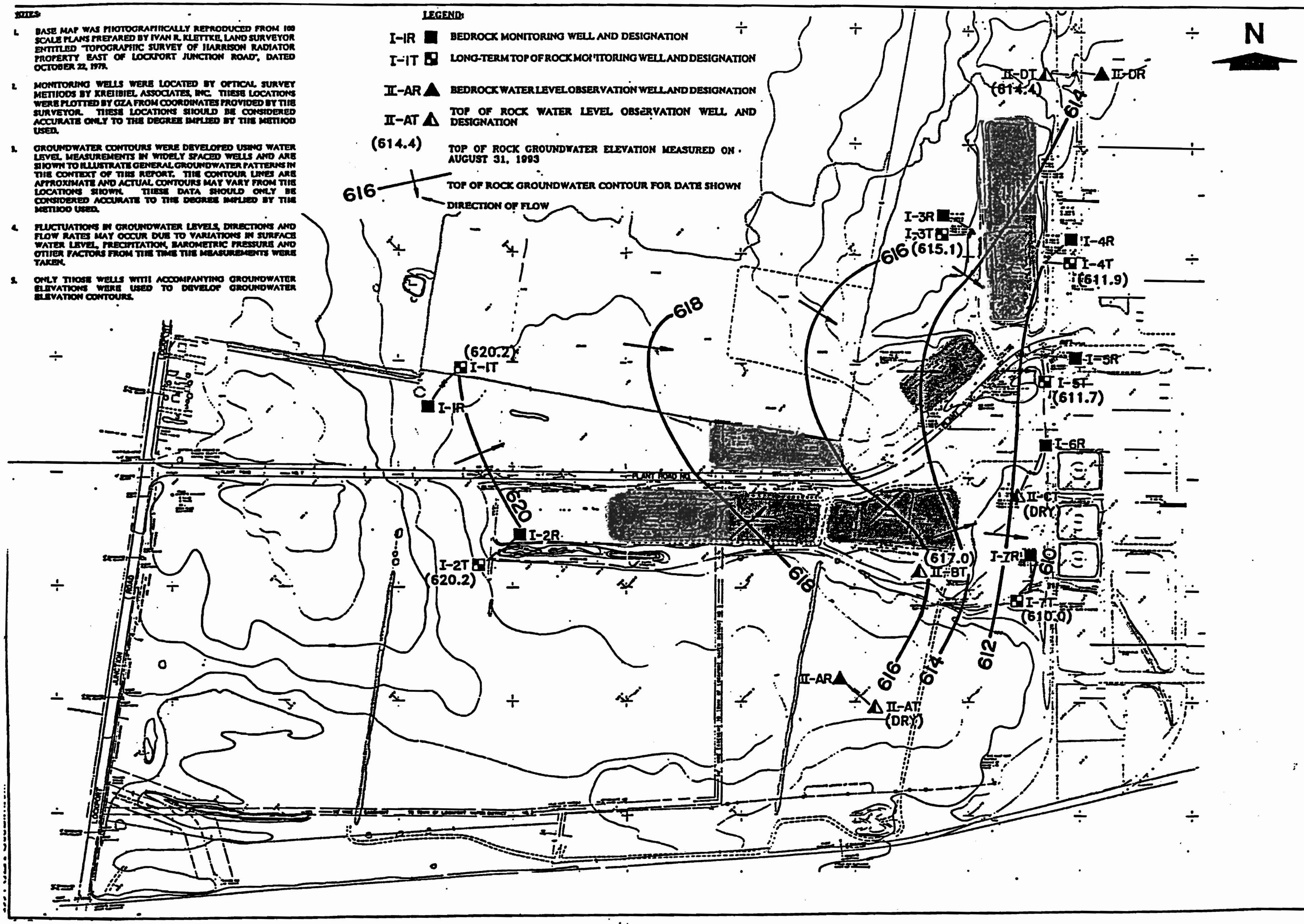
CROSS SECTION 9-9'

URS
CONSULTANTS, INC.

FIGURE 3-13

NOTES:

1. BASE MAP WAS PHOTOGRAPHICALLY REPRODUCED FROM 100 SCALE PLANS PREPARED BY IVAN R. KLETTKE, LAND SURVEYOR ENTITLED "TOPOGRAPHIC SURVEY OF HARRISON RADIATOR PROPERTY EAST OF LOCKPORT JUNCTION ROAD", DATED OCTOBER 22, 1979.
2. MONITORING WELLS WERE LOCATED BY OPTICAL SURVEY METHODS BY KREHBIEL ASSOCIATES, INC. THESE LOCATIONS WERE PLOTTED BY GZA FROM COORDINATES PROVIDED BY THE SURVEYOR. THESE LOCATIONS SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.
3. GROUNDWATER CONTOURS WERE DEVELOPED USING WATER LEVEL MEASUREMENTS IN WIDELY SPACED WELLS AND ARE SHOWN TO ILLUSTRATE GENERAL GROUNDWATER PATTERNS IN THE CONTEXT OF THIS REPORT. THE CONTOUR LINES ARE APPROXIMATE AND ACTUAL CONTOURS MAY VARY FROM THE LOCATIONS SHOWN. THESE DATA SHOULD ONLY BE CONSIDERED ACCURATE TO THE DEGREE IMPLIED BY THE METHOD USED.
4. FLUCTUATIONS IN GROUNDWATER LEVELS, DIRECTIONS AND FLOW RATES MAY OCCUR DUE TO VARIATIONS IN SURFACE WATER LEVEL, PRECIPITATION, BAROMETRIC PRESSURE AND OTHER FACTORS FROM THE TIME THE MEASUREMENTS WERE TAKEN.
5. ONLY THOSE WELLS WITH ACCOMPANYING GROUNDWATER ELEVATIONS WERE USED TO DEVELOP GROUNDWATER ELEVATION CONTOURS.



REV No | DESCRIPTION | BY | DATE

SCALE IN FEET 0 200 400 800

DRAWN BY: DEW DATE: JULY 1994

GZA GeoEnvironmental of New York

HARRISON
DIVISION OF GENERAL MOTORS CORPORATION
LOCKPORT, NEW YORK

TOP OF ROCK GROUNDWATER CONTOUR MAP
AUGUST 31, 1993

PROJECT No. R5805

FIGURE No. 2

NOTES:

1. BASE MAP WAS PHOTOGRAPHICALLY REPRODUCED FROM 100 SCALE PLANS PREPARED BY IVAN R. KLETTKE, LAND SURVEYOR ENTITLED "TOPOGRAPHIC SURVEY OF HARRISON RADIATOR PR) ERTY EAST OF LOCKPORT JUNCTION ROAD", DATED OC 'OBER 22, 1979.
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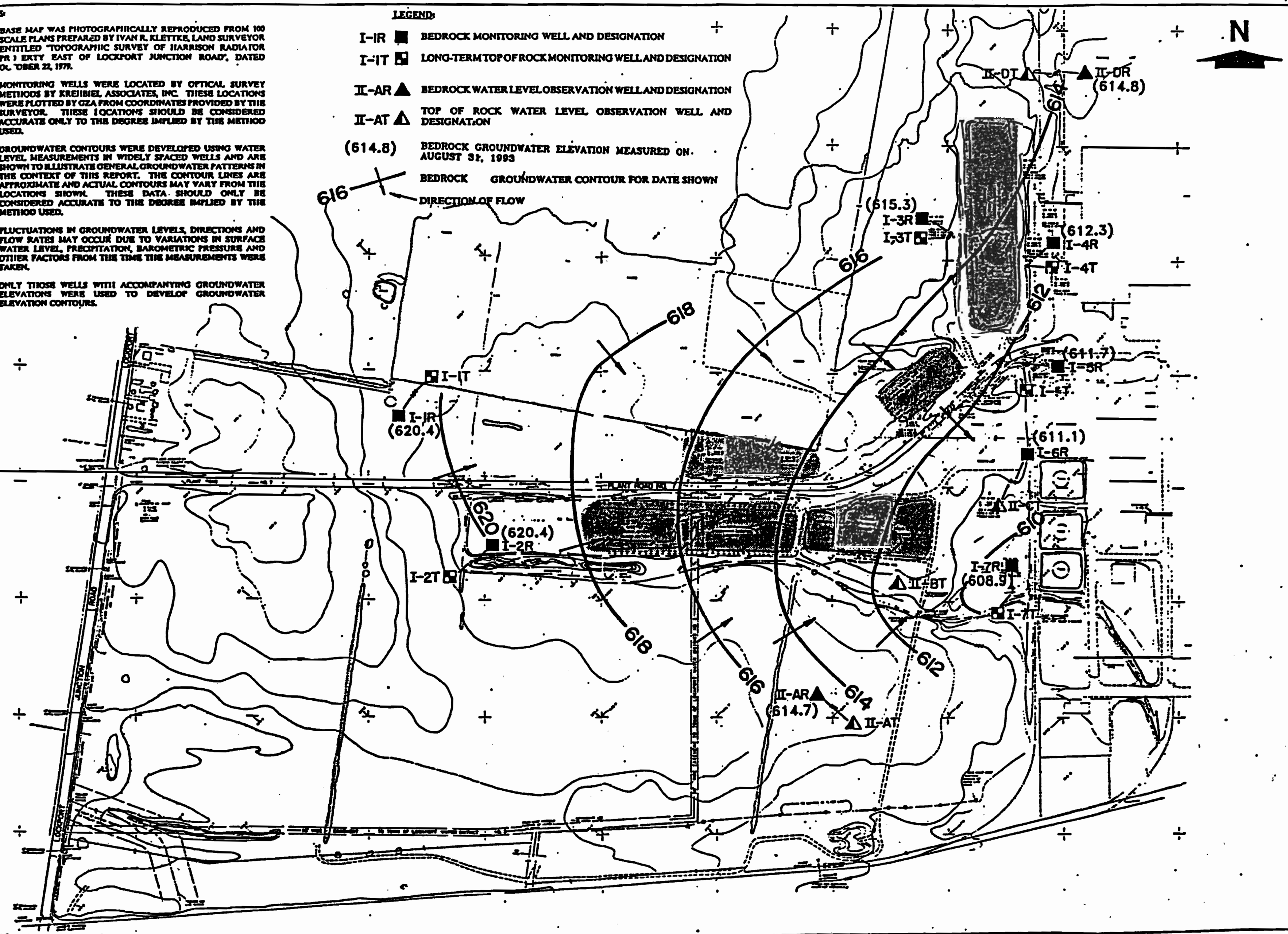
5. ONLY THOSE WELLS WITH ACCOMPANYING GROUNDWATER ELEVATIONS WERE USED TO DEVELOP GROUNDWATER ELEVATION CONTOURS.

LEGEND:

- I-1R ■ BEDROCK MONITORING WELL AND DESIGNATION
- I-1T LONG-TERM TOP OF ROCK MONITORING WELL AND DESIGNATION
- II-AR ▲ BEDROCK WATER LEVEL OBSERVATION WELL AND DESIGNATION
- II-AT △ TOP OF ROCK WATER LEVEL OBSERVATION WELL AND DESIGNATION
- (614.8) BEDROCK GROUNDWATER ELEVATION MEASURED ON AUGUST 31, 1993
- 616 BEDROCK GROUNDWATER CONTOUR FOR DATE SHOWN
- DIRECTION OF FLOW



HARRISON
DIVISION OF GENERAL MOTORS CORPORATION
LOCKPORT, NEW YORK

BEDROCK GROUNDWATER CONTOUR MAP
AUGUST 31, 1993

REV No	DESCRIPTION	BY	DATE

SCALE IN FEET: 0 200 400 800

DRAWN BY: DEW
DATE: JULY 1994

GZA GeoEnvironmental of New York

PROJECT No. R5805

FIGURE No. 3

NOTES:

1. BASE MAP WAS PHOTOGRAPHICALLY REPRODUCED FROM 100 SCALE PLANS PREPARED BY IVAN R. KLETTKE, LAND SURVEYOR ENTITLED "TOPOGRAPHIC SURVEY OF HARRISON RADIATOR PROPERTY EAST OF LOCKPORT JUNCTION ROAD", DATED OCTOBER 22, 1979.
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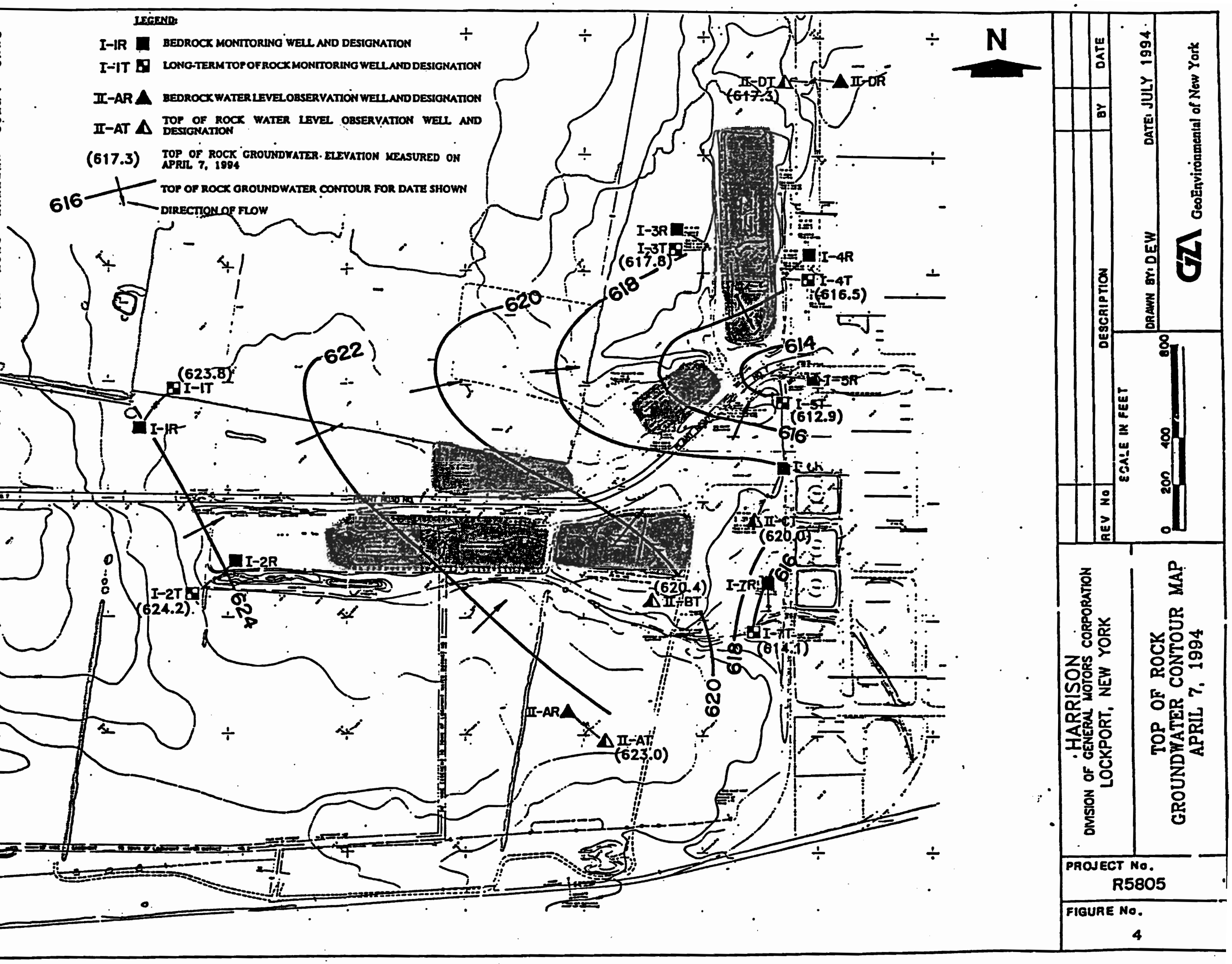

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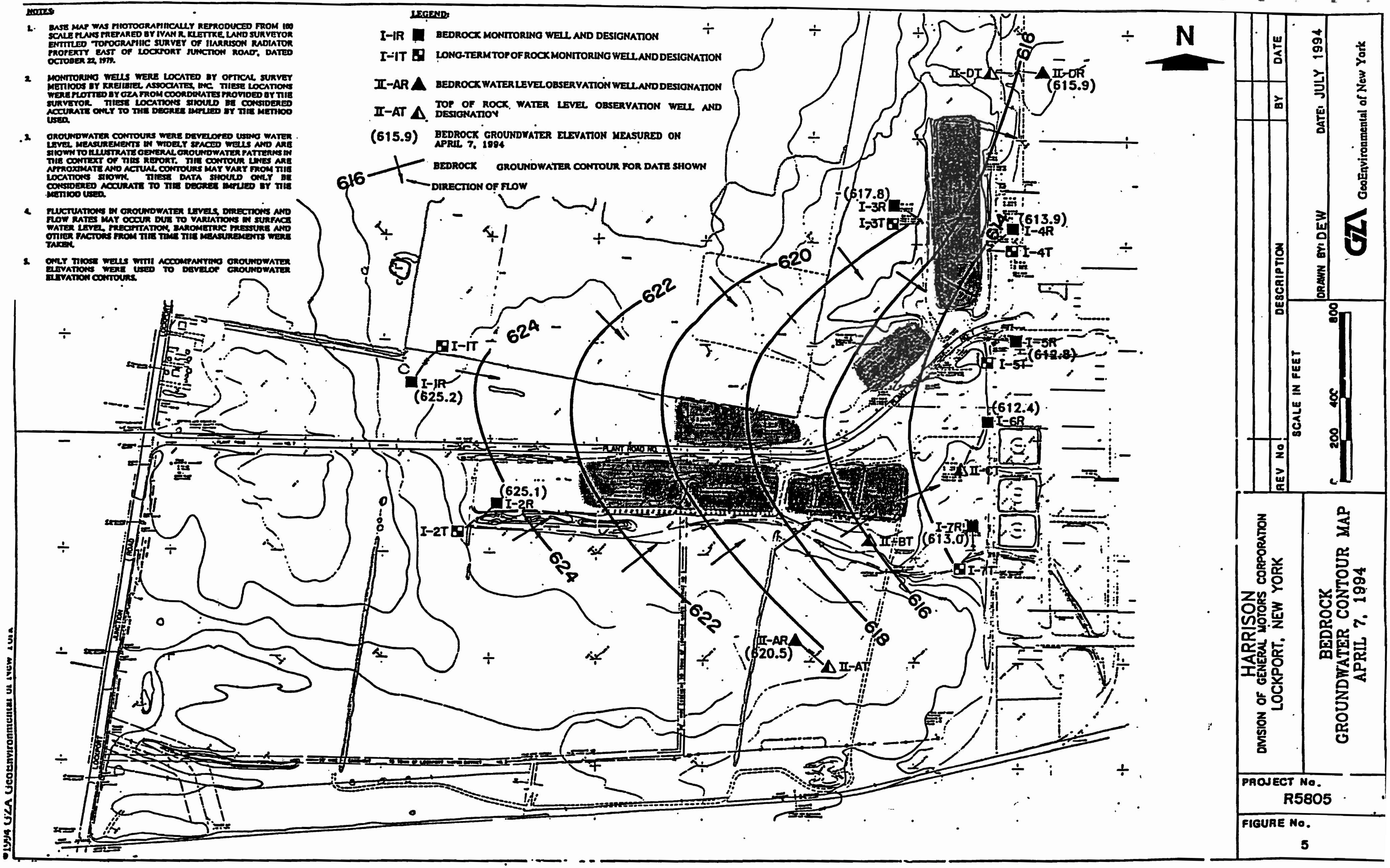
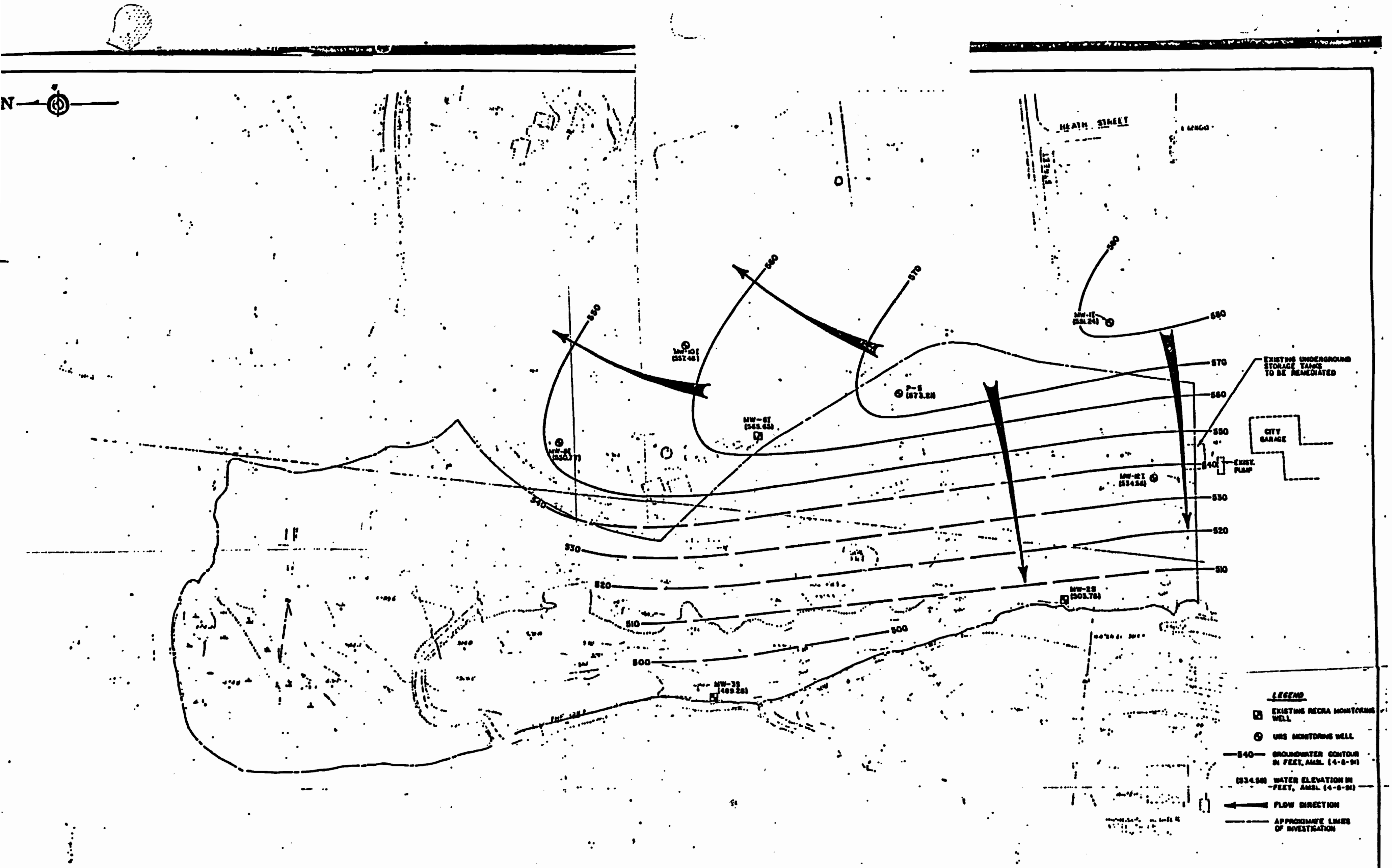




SCALE
0 100 200 FEET

NOTE:
ALL PROPERTY LINES SHOWN ARE TAKEN FROM CITY AND TOWN OF LOCKPORT TAX MAPS AND ARE APPROXIMATE IN THEIR LOCATION. PHYSICAL FEATURES AND CONTOURS WHEN SHOWN ARE TAKEN FROM PHOTOGRAMMETRIC MAPPING PLOTTED BY LOCKWOOD SUPPORT SERVICES, ROCHESTER, N.Y., USING APRIL 1988 AERIAL PHOTOGRAPHY.

DATE	DESCRIPTION	NO	DATE	DESCRIPTION
	COMBINED PHASE I & PHASE II			
	UPDATED TO REFLECT NYSDEC COMMENTS			

REVISIONS

DESIGNED BY: T.A.F.
DRAWN BY: K.L.W.
CHECKED BY:
PROJ. ENGR.:

URS URS Consultants, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

JOB No. 35180

REMEDIAL INVESTIGATION REPORT

LOCKPORT CITY LANDFILL

CITY OF LOCKPORT NIAGARA COUNTY NEW YORK

ROCHESTER FORMATION PIEZOMETRIC SURFACE

Scale: 1"=100' | Date: JULY 1991 | PLATE 6

New York State Department of Environmental Conservation
Division of Environmental Remediation, Region 9
270 Michigan Avenue, Buffalo, New York, 14203-2999
Phone: (716) 851-7220 FAX: (716) 851-7226

John P. Cahill
Commissioner

HARRISON DIV.
GENERAL MOTORS CORP.
RECEIVED
MAY 18 1998
ENVIRONMENTAL ACTIVITIES

May 15, 1998

Mr. Roy D. Knapp
Delphi Harrison Thermal Systems
200 Upper Mountain Road
Lockport, New York 14094

Dear Mr. Knap:

Delphi Thermal; TCE Spill Investigation

A review of program files for the subject site revealed that on August 28, 1997, the Delphi Thermal Corporation (Delphi) collected groundwater samples from nine on-site monitoring wells as part of the company's investigation of a TCE spill. A confirmatory round of samples were subsequently collected by Delphi in October 1997. Our file review also revealed that a report summarizing the results of this sampling, as promised by Delphi by letter dated August 14, 1997, has not been submitted for review. Based upon our experience with sites in the Western New York area wherein quarterly or semi-annual groundwater sampling takes place, sampling reports are generally submitted within three (3) months of the sampling event. Seven (7) months to submit a sampling report, therefore, is unacceptable. By way of this letter we are requesting submittal of such a report by the end of May, 1998.

During the August sampling event the Department collected split samples from four wells for the analysis of TCL volatiles. These results were previously sent to Delphi by letter dated October 9, 1997. Two of the wells sampled (MW-3 and MW-4) are located near the spill area (95 feet and 240 feet, respectively), while the other two wells (MW-11 and MW-12) are located 1230 feet (MW-11) and 1290 feet (MW-12) downgradient from the area of concern.

The split samples collected near the spill area (MW-3 and MW-4) show significant concentrations of trichloroethene (TCE) and its breakdown products dichloroethene (DCE) and vinyl chloride (VC). Wells MW-3 and MW-4 also contain benzene, toluene, ethylbenzene and xylenes (BTEX) above groundwater standards. TCE was not detected in wells MW-11 and MW-12; however, DCE and VC were detected in these wells. While the concentration of these contaminants in well MW-11 is of minimal concern, the concentration of DCE and VC in well MW-12 exceed groundwater standards, suggesting that offsite migration might be occurring. As a result, additional investigation, including the installation of additional monitoring wells, is required.

On April 20, 1998, Department personnel collected two (2) seep samples from the west side of the Gulf for analysis of TCL volatiles (see location on attached figure) for purposes of further evaluating the potential off-site migration of contaminated groundwater from the Delphi facility. This seep covered a large area (approximately 10 feet by 10 feet) in a bedrock outcrop located about 15 feet below the top of the embankment. DCE and VC were not detected in either sample, but TCE at a concentration of 4J $\mu g/l$ was detected in one of the samples (results attached). While these results are not conclusive, they suggest that TCE is entering the Gulf through contaminated groundwater. Additional investigation of the Gulf, therefore, is also required.

In addition to submitting the sampling report, Delphi should also submit a work plan describing additional investigative activities for the Site. This plan should include, at a minimum, the installation of additional monitoring wells to determine both the length and width of the contaminant plume, well sampling, evaluation of seeps along the Gulf, and a detailed evaluation of the natural attenuation mechanism(s).

Should you have any questions, please feel free to contact me at 716-851-7220.

Sincerely yours,

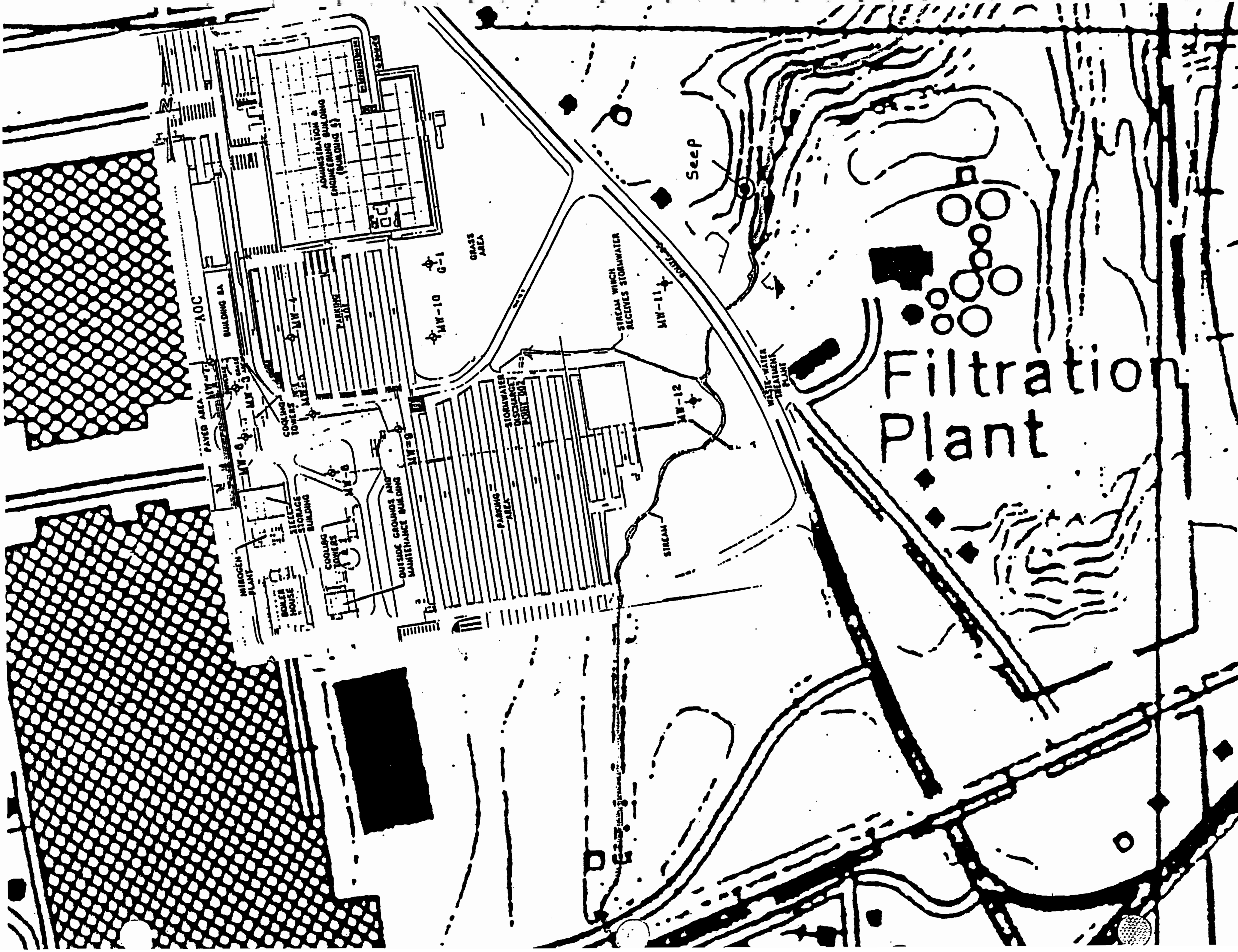
Glenn M May

Glenn M. May, CPG
Engineering Geologist I

GMM:sz

Attachment

cc: Mr. Daniel King, NYSDEC, Division of Environmental Remediation
Joseph Ryan, Esq., NYSDEC, Division of Environmental Enforcement
Mr. Matthew Forcucci, NYS Department of Health, Buffalo


Filtration
Plant
Seep
AOC
GRASS AREA
PARKING LOT
PARKING AREA
STREAM
MW-10
MW-11
MW-12
G-1

ASP 95 - VOLATILES
ANALYSIS DATA SHEET

000008

Client No.

B08101

Lab Name: Recra LabNet Contract: C003783

Lab Code: RECNY Case No.: SH998 SAS No.: ______ SDG No.: 0420

Matrix: (soil/water) WATER Lab Sample ID: A8137401

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: H6402.RR

Level: (low/med) LOW Date Samp/Recv: 04/20/98 04/20/98

% Moisture: not dec. ______ Heated Purge: N Date Analyzed: 04/23/98

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: ______ (uL) Soil Aliquot Volume: ______ (uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND	UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (Total)	10	U
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	4	J
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
108-88-3	Toluene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Total Xylenes	10	U

ASP 95 - VOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

000009

Client No.

B08101

Name: Recra LabNet Contract: C003783

Lab Code: RECNY Case No.: SH998 SAS No.: ______ SDG No.: 0420

Matrix: (soil/water) WATER Lab Sample ID: A8137401

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: H6402.RR

Level: (low/med) LOW Date Samp/Recv: 04/20/98 04/20/98

% Moisture: not dec. ______ Date Analyzed: 04/23/98

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: ______ (uL) Soil Aliquot Volume: ______ (uL)

CONCENTRATION UNITS:
Number TICs found: 0 (ug/L or ug/Kg) UG/L

CAS NO.	Compound Name	RT	Est. Conc.	Q

ASP 95 - VOLATILES
ANALYSIS DATA SHEET

000010

Client No.

B08101 RE

Lab Name: Recra LabNet   Contract: C003783

Lab Code: RECNY   Case No.: SH998   SAS No.: ______   SDG No.: 0420

Matrix: (soil/water) WATER   Lab Sample ID: A8137401RI

Sample wt/vol: 5.00 (g/mL) ML   Lab File ID: H6403.RR

Level: (low/med) LOW   Date Samp/Recv: 04/20/98 04/20/98

% Moisture: not dec. ______ Heated Purge: N   Date Analyzed: 04/24/98

GC Column: DB-624 ID: 0.53 (mm)   Dilution Factor: 1.00

Soil Extract Volume: ______ (uL)   Soil Aliquot Volume: ________ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
[illegible]-35-4	1,1-Dichloroethene	10	U
[illegible]5-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (Total)	10	U
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	4	J
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
108-88-3	Toluene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Total Xylenes	10	U

ASP 95 - VOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

000011

Client No.

B08101 RE

Lab Name: Recra LabNet Contract: C003783

Lab Code: RECNY Case No.: SH998 SAS No.: ______ SDG No.: 0420

Matrix: (soil/water) WATER Lab Sample ID: A8137401RI

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: H6403.RR

Level: (low/med) LOW Date Samp/Recv: 04/20/98 04/20/98

% Moisture: not dec. ______ Date Analyzed: 04/24/98

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: ______ (uL) Soil Aliquot Volume: ________ (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 0

CAS NO.	Compound Name	RT	Est. Conc.	Q

FORM IE - GC/MS VOA TIC

ASP 95 - VOLATILES
ANALYSIS DATA SHEET

000012

Client No.

B08102

Lab Name: Recra LabNet Contract: C003783

Lab Code: RECNY Case No.: SH998 SAS No.: ______ SDG No.: 0420

Matrix: (soil/water) WATER Lab Sample ID: A8137402

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: H6397.RR

Level: (low/med) LOW Date Samp/Recv: 04/20/98 04/20/98

% Moisture: not dec. ______ Heated Purge: N Date Analyzed: 04/23/98

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: ______ (uL) Soil Aliquot Volume: ______ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (Total)	10	U
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
108-88-3	Toluene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Total Xylenes	10	U

ASP 95 - VOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

000013

Client No.

B08102

Lab Name: Recra LabNet   Contract: C003783

Lab Code: RECNY   Case No.: SH998   SAS No.: ______   SDG No.: 0420

Matrix: (soil/water) WATER   Lab Sample ID: A8137402

Sample wt/vol: 5.00 (g/mL) ML   Lab File ID: H6397.RR

Level: (low/med) LOW   Date Samp/Recv: 04/20/98 04/20/98

% Moisture: not dec. ______   Date Analyzed: 04/23/98

GC Column: DB-624   ID: 0.53 (mm)   Dilution Factor: 1.00

Soil Extract Volume: ______ (uL)   Soil Aliquot Volume: ______ (uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NO.	Compound Name	RT	Est. Conc.	Q

FORM IE - GC/MS VOA TIC

ASP 95 - VOLATILES
ANALYSIS DATA SHEET

000014

Client No.

B08102 RE

L-- Name: Recra LabNet Contract: C003783

ab Code: RECNY Case No.: SH998 SAS No.: ______ SDG No.: 0420

Matrix: (soil/water) WATER Lab Sample ID: A8137402RI

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: H6401.RR

evel: (low/med) LOW Date Samp/Recv: 04/20/98 04/20/98

% Moisture: not dec. ______ Heated Purge: N Date Analyzed: 04/23/98

C Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: ______ (uL) Soil Aliquot Volume: ______ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
]-35-4	1,1-Dichloroethene	10	U
-5-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (Total)	10	U
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
108-88-3	Toluene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Total Xylenes	10	U

ASP 95 - VOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

000015

Client No.
B08102 RE

Lab Name: Recra LabNet   Contract: C003783

Lab Code: RECNY   Case No.: SH998   SAS No.: ______   SDG No.: 0420

Matrix: (soil/water) WATER   Lab Sample ID: A8137402RI

Sample wt/vol: 5.00 (g/mL) ML   Lab File ID: H6401.RR

Level: (low/med) LOW   Date Samp/Recv: 04/20/98 04/20/98

% Moisture: not dec. ______   Date Analyzed: 04/23/98

GC Column: DB-624   ID: 0.53 (mm)   Dilution Factor: 1.00

Soil Extract Volume: ______ (uL)   Soil Aliquot Volume: ______ (uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NO.	Compound Name	RT	Est. Conc.	Q

FORM IE - GC/MS VOA TIC

New York State Department of Environmental Conservation
Division of Environmental Remediation, Region 9
270 Michigan Avenue, Buffalo, New York, 14203-2999
Phone: (716) 851-7220 FAX: (716) 851-7226

John P. Cahill
Commissioner

HARRISON DIV.
GENERAL MOTORS CORP.
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ENVIRONMENTAL ACTIVITIES

October 21, 1998

Ms. Catherine A. Ver
Delphi Harrison Thermal Systems
200 Upper Mountain Road
Lockport, New York 14094

Dear Ms. Ver:

Meeting Minutes

This letter is in response to GZA's September 8, 1998 letter summarizing the August 3, 1998 meeting between Delphi Thermal and the Department, and your September 9, 1998 letter concerning the listing of the Delphi Thermal Site in the Registry. Regarding site listing, conversations with the Department's Albany staff indicate that a formal decision concerning the listing of the Delphi Thermal Site has not yet been made. These conversations also confirmed that a Fact Sheet describing the site can be sent with the site listing notification letter. To this end, the Department will draft the Fact Sheet and coordinate the mailings. A copy of the draft Fact Sheet will be sent to you for review.

Regarding GZA's letter, Department responses and comments are summarized by bullet as follows:

Bullet 1, Page 1: While the distribution of contaminant concentrations throughout the site suggest that natural attenuation is occurring, additional data is required (e.g., the additional parameters discussed in bullet 3 on page 2) to substantiate this; and if substantiated, to fully evaluate the natural attenuation process occurring at the Delphi Thermal site. Also, while no further private well assessment is required at this time, I cannot guarantee that such an assessment will not be required by other reviewers during the RI/FS process. As requested at the meeting, Delphi should determine whether the houses downgradient of the contaminant plume along Route 93 have basements. The absence of basements would significantly reduce/eliminate potential adverse health impacts for these residents from any contaminants that may be migrating off-site.

Bullet 3, Page 2: The additional parameters proposed for evaluating the natural attenuation process are acceptable. The Department suggests, however, that magnesium, sodium, potassium and alkalinity be added to the parameter list to facilitate the evaluation of site groundwater through graphical methods (e.g., piper plots, stiff diagrams). Such graphs have been successful in delineating multiple source areas at sites (e.g., increases in chloride concentration from the breakdown of

TCE versus increased chloride content from the solubilization of road salt). Road salt impacts are possible at the Delphi Thermal site and may need to be evaluated.

<u>Bullet 4, Page 2:</u> At least three copies of the report should be submitted - one for the NYSDEC Buffalo office, one for the NYSDEC Albany office and one for the NYSDOH. Elimination of piezometer G-1 from the monitoring program is acceptable.

<u>Bullet 5, Page 2:</u> It is correct to state that much of the work required for a Remedial Investigation (RI) has been completed. This information, however, must be incorporated into an RI Report that conforms to EPA guidance. The FS for the Delphi Thermal site must include a detailed screening of remedial alternatives and must also conform to EPA guidance. Inclusion of a discussion related to the difficulty in remediating fractured bedrock can be included, but should not be the focus of the FS.

<u>Bullet 1, Page 3:</u> Implementation of a long term operation and maintenance and/or monitoring program at the site would likely require formal agreement between Delphi and the Department. The agreement would likely be an Order on Consent or similar document, irrespective of whether the work is undertaken via the Interim Remedial Measure (IRM) or Remedial Design/Remedial Action (RD/RA) process.

Should you have any questions or comments concerning the above, please feel free to contact me at 716-851-7220.

Sincerely yours,

Glenn M May

Glenn M. May, CPG
Engineering Geologist I

GM:lj

cc: Mr. Daniel King, Regional Hazardous Waste Remediation Engineer
Mr. Matthew Forcucci, New York State Department of Health

(a:ver.gm)

New York State Department of Environmental Conservation
Division of Environmental Remediation, Region 9
270 Michigan Avenue, Buffalo, New York, 14203-2999
Phone: (716) 851-7220 • **FAX:** (716) 851-7226
Website: www.dec.state.ny.us

John P. Cahill
Commissioner

August 12, 1999

Ms. Catherine A. Ver
Delphi Harrison Thermal Systems
200 Upper Mountain Road
Lockport, New York 14094

Dear Ms. Ver:

Delphi Thermal; Inactive Site No. 932113

This letter is a follow-up to our August 9, 1999 telephone conversation regarding the subject site and the upcoming groundwater sampling event. Since the Department has yet to issue specific guidance concerning the use of natural attenuation as a remedial option, we recommend that these groundwater samples be analyzed for the same set of parameters as the December 1998 groundwater samples. This list of parameters can be reevaluated as further guidance becomes available.

In a related matter, please find attached two articles from Soil & Groundwater Cleanup concerning the use of natural attenuation as a remedial option. Also, find attached the cover pages of two EPA guidance documents regarding natural attenuation. The Department is currently evaluating these latter documents to determine if they are consistent with program policies and procedures. In the interim, however, the Remedial Investigation work plan should be consistent with this guidance.

Should you have any questions or comments concerning the above, please feel free to contact me at 716-851-7220.

Sincerely yours,

Glenn M May

Glenn M. May, CPG
Engineering Geologist I

GM:lj

Attachments

cc: Mr. Daniel King, Division of Environmental Remediation
Mr. Matthew Forcucci, New York State Department of Health

a:Delph-16

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AUG 16 1999
DELPHI AUTOMOTIVE
ENVIRONMENTAL

New York State Department of Environmental Conservation
Division of Environmental Remediation, Region 9
270 Michigan Avenue, Buffalo, New York, 14203-2999
Phone: (716) 851-7220 • **FAX:** (716) 851-7226
Website: www.dec.state.ny.us

Environmental Conservation 30 YEARS
John P. Cahill
Commissioner

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March 10, 2000

Ms. Catherine A. Ver
Delphi Harrison Thermal Systems
200 Upper mountain Road
Lockport, New York 14094

Dear Ms. Ver:

Focused RI/FS Work Plan
Delphi Harrison Thermal Systems Site,
Registry Number 932113

The New York State Departments of Health (DOH) and Environmental Conservation (DEC) have completed review of the RI/FS Work Plan prepared by GZA for the subject site as submitted to the Departments on January 12, 2000. Correctly stated in Section 1.10 of the work plan, the objective of a Remedial Investigation (RI) is to characterize the nature and extent of contamination identified at a site. We do not believe that the field activities completed to date, nor the field activities proposed during the RI, will accomplish that objective. While Delphi Thermal has characterized the nature of the contamination through various investigative efforts over the last six years, the Departments do not believe that the extent of the groundwater contaminant plume has been adequately determined. GZA must include specific investigative activities to delineate the dimensions of this plume in the work plan.

Although trichloroethene (TCE) contaminated soils have been excavated from the site, a significant source of groundwater contamination appears to remain within the bedrock. The extremely high concentrations of TCE (near or above the solubility limit) in wells MW-1 and MW-7 suggest DNAPL presence within the bedrock near the original source area. The presence of DNAPL in well MW-5 may indicate that DNAPL at the site is mobile, having migrated to this well from the source area. As the top of bedrock trends in elevation from west (higher near the former storage tank) to east (lower toward edge of property near Route 93), it appears that contaminant source migration, and its associated dissolved phase contamination, is a legitimate concern at this site. As dichloroethene (DCE) and vinyl chloride (VC) are already present well above groundwater standards in at least one of the westernmost monitoring wells (MW-12), the potential for relatively significant groundwater contaminant migration from the site exists.

The work plan proposes to focus the Feasibility Study (FS) on two remedial alternatives; natural attenuation and groundwater extraction. GZA cites technical impracticability of removing DNAPL from fractured bedrock as the justification for this focus. This approach is common and reasonable; however, it appears that GZA is already demonstrating a propensity toward the natural attenuation approach. While the distribution of contaminant concentrations throughout the site suggests that natural attenuation is occurring, the RI will need to prove conclusively that such an attenuation mechanism is occurring. If substantiated, GZA must fully evaluate the natural attenuation process occurring at the Delphi Thermal site. We require such evaluation to support the selection of natural attenuation over other applicable alternatives in the FS screening process. In addition, natural attenuation remedies are not necessarily appropriate for sites with a remaining contaminant source (i.e., DNAPL). As a result, the remedial alternatives considered in the focused FS should include efforts to reduce the mass of the contaminant source further. We suggest that the focused FS include, at a minimum, the evaluation of in-situ chemical oxidation. While relatively new in their application, two such oxidants - potassium permanganate and sodium permanganate, may reduce/eliminate the mass of contaminant contributing to groundwater contamination.

We summarize specific comments regarding the RI/FS work plan as follows:

<u>Section 1.10, Purpose and Objective:</u>

<u>RI, 1st Bullet:</u> The data do not support the statement that contaminant concentrations are "near" the Class GA water standards near the property line. Concentrations of DCE and VC in well MW-12 are significantly greater (almost two orders of magnitude greater during the October 1997 sampling event) than the Class GA water standards.

<u>RI, 2nd Bullet:</u> The work plan states that "the on-site contamination is limited to TCE, tetrachloroethene (PCE) and their degradation products." Besides these compounds, however, BTEX has been detected in groundwater at an isolated area of the site and 2-butanone was detected in some soil samples during early investigation activities. Also, previous analyses for other contaminants (i.e., semivolatiles, PCBs, pesticides and metals) have not been completed. Therefore, GZA cannot make this statement.

<u>RI, 4th Bullet:</u> The work plan states that "there are no significant exposure scenarios from the source of the contamination to the property line." As the original contaminant source area is immediately adjacent to Building 8A, are there any health concerns to be considered such as indoor air quality, sump water, etc? Also, depending upon building construction, might there be residual product under the limits of the building? GZA should include such issues in the scope of work.

RI, 6th Bullet: While scientists widely recognize that the complete removal of DNAPL from the subsurface environment is nearly impossible, DNAPL left in place will continue to act as a source of groundwater contamination. The presence of DNAPL in monitoring well MW-5, therefore, needs to be further evaluated. Such evaluation should include thickness, extent and composition. In addition, the source of this DNAPL has not been satisfactorily determined.

FS, 2nd Bullet: As discussed above, GZA should include in-situ chemical oxidation as a potentially applicable technology for the destruction of DNAPL.

Section 1.20, Project Description, History and Location, 2nd Bullet, Page 4: From the groundwater chemistry data provided by MW-3D, deep bedrock groundwater has not been impacted at this location. However, does other information support an assessment that the former storage tank has not affected deep bedrock groundwater? Specifically, did fractures observed in bedrock cores indicate the lack of vertical fracturing? Do groundwater elevations within MW-3D and MW-3S indicate an upward gradient from the deep to the shallow bedrock? The answers to these questions may dictate the need for additional deep bedrock monitoring wells.

Section 2.10, Task 1, Work Plans: The work plan states that GZA will develop a Field Activities Plan for work completed after October 1999. As stated earlier, specific investigative activities to further evaluate the groundwater contaminant plume, DNAPL in well MW-5, and the natural attenuation process must be included in the RI/FS work plan before its approval.

Utilization of the previously approved Sampling and Analysis Plan (SAP) and Health and Safety Plan (HASP) is acceptable if these plans cover the additional field activities proposed during the RI. If not, an addendum to these plans will be required, and should be incorporated into the revised RI/FS work plan. We will require copies of the previously approved SAP and HASP for distribution to the other reviewers, for attachment to the Order on Consent when finalized, and for the document repository.

Regarding the Citizen Participation Plan, please be reminded that the development and execution of the Citizen Participation Plan (CP), with Department oversight, is the responsibility of the Potentially Responsible Party (PRP). Besides developing the fact sheets, Delphi Thermal will also be responsible for mailing. The Department will assist Delphi Thermal in the preparation of the fact sheets, will coordinate internal Department review, and will provide Delphi Thermal with an initial mailing list. Delphi Thermal will be responsible for updating that list as appropriate. Also note that the Department reserves the right to amend the CP Plan to reflect public interest and issues. We may request additional CP activities, including fact sheets, public notices, public availability sessions, and public meetings.

<u>Section 2.20, Task 2, Focused Remedial Investigation:</u>

<u>General:</u> To further delineate the extent (e.g., width and length) of the groundwater contaminant plume, we will require additional monitoring wells. Regarding downgradient wells, previous discussions between the Department and Delphi Thermal have focused on spatial constraints. It appears from Figure 1, however, that an additional well or wells could be installed on Delphi's Waste Water Treatment Plant property. This location is critical because DCE and VC were detected above groundwater standards in well MW-12, which is immediately upgradient of this property. In addition, GZA should evaluate and sample seeps along the Gulf.

<u>Public and Private Well Assessment:</u> Delphi proposes to examine public records to locate and inventory private basements and sumps along Route 93. The mailing or hand delivery of a questionnaire may prove an expedient and reliable way to supplement such a records search.

<u>Section 2.40, Task 4, Focused Feasibility Study:</u> Besides the two alternatives discussed, DNAPL removal/destruction from well MW-5 should be considered for the reasons discussed above (i.e., continuing source of groundwater contamination). While we recognize that residual DNAPL may remain in the subsurface environment based upon the remedial alternative utilized, natural biological activity could further reduce this residual DNAPL, thus reducing the time required for long-term groundwater monitoring.

<u>Section 2.50, Task 5, FFS Report:</u> The Focused FS Report should be complete and be a "stand alone" document. Despite previous screening and evaluations included in previous reports, the FFS should function as a complete Feasibility Study on its own, and not be "Part 2" of an FS that picks up from parts of another report. In addition, in-situ chemical oxidation should be included and considered in the FFS.

Should you have any comments or questions, please feel free to contact me at 716-851-7220.

Sincerely yours,

Glenn M May

Glenn M. May, CPG.
Engineering Geologist I

cc: Mr. Daniel King, NYSDEC
Mr. Brian Sadowski, NYSDEC
Mr. Jeff Konsella, NYSDEC
Mr. Matthew Forcucci, NYSDOH

DELPHI
Automotive Systems

June 20, 2000

Mr. Glenn M. May
New York State Department of Environmental Conservation
270 Michigan Avenue
Buffalo, New York 14203 -2999

Dear Mr. May:

Delphi Harrison Thermal Systems is submitting our response to your March 10, 2000 letter on the Focused Remedial Investigation (FRI) and Focused Feasibility Study (FFS) Work Plan for NYSDEC Inactive Hazardous Waste Registry Site #932113 located at the Lockport Site.

I would like to propose an onsite meeting with NYSDEC, Delphi Thermal, and GZA GeoEnvironmental personnel to be held after July 17, 2000. The Delphi Thermal facility will be closed on July 1 with normal production scheduled to resume after July 16. I will contact you during the week of June 26 to set the meeting date and time.

Please call me at (716) 439 - 2942 if you have any questions.

Sincerely,

Catherine A. Ver

Catherine A. Ver
Sr. Environmental Engineer

Harrison Thermal Systems
World Headquarters
200 Upper Mountain Road Lockport, New York 14094 USA

GZA
GeoEnvironmental
of New York

Engineers and Scientists

June 19, 2000
File No. 55039.20

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JUN 19 2000
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Ms. Cathy Ver
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200 Upper Mountain Road
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364 Nagel Drive
Buffalo
New York 14225
716-685-2300
FAX 716-685-3629
http://www.gza.net

Re: Focused Remedial Investigation and
Focused Feasibility Study Work Plan
Response to NYSDEC Comments
Delphi Harrison Thermal Systems West Lockport Complex
NYSDEC Registry Site # 932113

Dear Ms. Ver:

This letter is in response to comments made by the New York State Department of Environmental Conservation (NYSDEC) in its letter to Delphi Thermal (dated March 10, 2000) regarding the Focused Remedial Investigation (FRI) and Focused Feasibility Study (FFS) Work Plan prepared by GZA GeoEnvironmental of New York (GZA), dated January 12, 2000.

In general, NYSDEC comments relate to the following key items:

- Delineation of the extent (width and length) of the trichloroethylene (TCE) (and TCE degradation constituents) groundwater plume at the Site.
- DNAPL evaluation and remediation.
- FFS evaluation related to consideration of in-situ chemical oxidation as a possible remedial technology for use at this site.

A Subsidiary of GZA
GeoEnvironmental
Technologies, Inc.

We have addressed these items as follows:

- Two additional monitoring wells will be added on the plant side of Route 93 to complete the task of delineating the extent of the groundwater plume. The round of FRI sampling that will include the two wells should allow us to assess the full nature and extent of the contamination at issue.
- The available data indicate that the observed DNAPL is not migrating and that it is not technically feasible to use in-situ chemical oxidation to address this contaminant source.
- Although in-situ chemical oxidation is not technically feasible for the treatment of DNAPL (in fractured bedrock), it will be considered in the FFS evaluation for the dissolved phase contamination detected at the Site.

With respect to the specific questions/comments posed by the NYSDEC, we have set forth in the following discussion specific responses for NYSDEC's consideration. In this regard, note that several of the questions/comments relate to topics previously discussed with NYSDEC during various meetings attended by NYSDEC, Delphi Thermal and GZA. GZA has included information from those discussions in our responses as appropriate.

It should also be noted that the FRI/FFS work plan and consent order are being negotiated after much work has been completed. Delphi Thermal has performed this work on a voluntary basis in consultation with the NYSDEC since the detection of the TCE release in 1994. The field work and the reports that have been completed and submitted to NYSDEC have included a significant number of tasks normally associated with the RI/FS process.

<u>*Section 1.10. Purpose and Objective:*</u>

<u>RI 1st Bullet</u>: The data do not support the statement that contaminant concentrations are "near" the Class GA water standards near the property line. Concentrations of DCE and VC in well MW-12 are significantly greater (almost two orders of magnitude greater during the October 1997 sampling event) than the Class GA water standards.

Detected concentrations at the downgradient wells MW-11 and MW-12 are set forth in the following Table:

MW-11			MW-12		
Date	Total 1,2 DCE (ug/l)	VC (ug/l)	Date	Total 1,2 DCE (ug/l)	VC (ug/l)
8/28/97	5	4	8/28/97	130	190
10/10/97	3	1	10/10/97	160	170
12/1/98	13	5	12/1/98	47	88
10/5/99	10	2	10/5/99	27	32

With respect to the information in the Table, note the following:

1) ug/l is equivalent to ppb.
2) PCE (tetrachloroethene) and TCE were not detected.
3) The NYSDEC groundwater standard is 5 ug/l for both cis-1,2 dichloroethene (DCE) and trans-1,2 DCE. The DCE detected at the Site is primarily cis-1,2 DCE.
4) The NYSDEC groundwater standard for vinyl chloride is 2 ug/l.

As indicated in the Table, the concentrations of DCE and VC at monitoring wells MW-11 and MW-12 are at or near (generally within about one order of magnitude) the NYSDEC groundwater standard (6 NYCRR §703.5) for the last two rounds completed. Additionally, it appears that the constituent concentrations at MW-12 are on a general decreasing trend.

Attenuation is expected to continue to occur in a downgradient direction (to the east) between wells MW-11 and MW-12 and the properties located across Route 93. These wells are located about 300 feet (MW-12) and 170 feet (MW-11) from the nearest buildings/structures located across Route 93.

<u>RI, 2nd Bullet</u>: The work plan states that "the on-site contamination is limited to TCE, tetrachloroethene (PCE) and their degradation products." Besides these compounds, however, BTEX has been detected in groundwater at an isolated area of the site and 2-butanone was detected in some soil samples during early investigation activities. Also, previous analyses for other contaminants (i.e. semivolatiles, PCBs, pesticides and metals) have not been completed. Therefore, GZA cannot make this statement.

Delphi Thermal's investigation was prompted by its detection of a release of TCE in the area of Building 8 (the Area of Concern or AOC) and so the constituents of concern for this Registry Site have been identified as TCE and its degradation products (the "project constituents"). Therefore, as previously agreed with NYSDEC, it is not necessary to undertake any additional testing for contaminants other than the project constituents. However, GZA will modify its statement to "the on-site contamination associated with the TCE release is limited to TCE and its degradation products."

BTEX was detected in samples collected from monitoring well MW- 3S at about 8 mg/l total BTEX. No BTEX was detected in downgradient monitoring wells MW-4 and MW-5 or other (sidegradient) wells that were sampled in the vicinity. An underground gasoline storage tank was formerly located next to Building 8, near the former TCE tank (see GZA's Phase III Extent of Contamination Studies Report, dated February 1997). Delphi Thermal is not aware of any petroleum releases or any other petroleum spills from this tank, which the facility believes was removed in the early 1980s. No other petroleum sources of contamination exist in this area and we therefore cannot identify the source of the BTEX.

2-butanone (MEK) was detected at one auger probe (AP) sample collected above the water table (AP-1, 4-5 feet below ground surface). MEK was not detected at the same location at or below the water table (AP-2, 7-8 feet below ground surface). Additionally, MEK is a common laboratory contaminant and its presence is therefore suspect.

GZA and Delphi Thermal previously reviewed the BTEX and MEK findings with NYSDEC and the consensus was that the presence of these compounds did not require further action. However, GZA will include a brief discussion of BTEX and 2-butanone detections in the FRI report.

<u>RI, 4th Bullet</u>: The work plan states that "there are no significant exposure scenarios from the source of the contamination to the property line." As the original contaminant source area is immediately adjacent to Building 8A, are there any health concerns to be considered such as indoor air quality, sump water, etc? Also, depending upon building construction, might there be residual product under the limits of the building? GZA should include such issues in the scope of work.

GZA completed an evaluation of TCE impacted soil inside of Building 8 (see GZA Phase III Extent of Contamination Report dated September 1996). GZA tested 13 soil samples (four inside Building 8 and nine outside Building 8 in the AOC) from the unsaturated soil zone for the presence of TCE. Two samples (both located outside Building 8) exceeded the NYSDEC cleanup guidance criteria for TCE of 0.7 mg/kg. No product was observed in test holes completed inside the building.

No groundwater collection sumps are located in Buildings 8 (manufacturing building) or the contiguous 8A (office building). A concrete lined underground utility chase is located south of Building 8 (running north-south) in the AOC. The utility chase is constructed on top of bedrock. A concrete lined dewatering sump is located in the chase adjacent to Building 8. Groundwater from the AOC is not anticipated to enter the chase dewatering sump. Therefore, health concerns in Buildings 8 or 8A are not expected. However, GZA will include an evaluation/discussion of Buildings 8 and 8A in the exposure assessment section of the FRI report.

Delphi Thermal utilizes an excavation permit program at the facility. Excavation work is monitored and assessed for potential hazards prior to issuing a permit. This would include air monitoring and proper personnel protective equipment consideration prior to work. This program would limit the potential for exposure scenarios related to excavation work in the AOC.

<u>RI, 6th Bullet</u> [Actually FS, 1st Bullet]: While scientists widely recognize that the complete removal of DNAPL from the subsurface environment is nearly impossible, DNAPL left in place will continue to act as a source of groundwater contamination. The presence of DNAPL in monitoring well MW-5, therefore, needs to be further evaluated. Such evaluation should include thickness, extent and composition. In addition, the source of this DNAPL has not been satisfactorily determined.

The presence of DNAPL in the subsurface will provide an ongoing source of groundwater contamination. However, the studies completed indicate that the contamination is naturally attenuating. Studies to identify the extent of DNAPL are very risky because intrusive activities in DNAPL areas can cause mobilization/migration/spread of DNAPL. GZA attempted to measure the layer of DNAPL in monitoring well MW-5 (using an interface probe) on September 13, and October 10, 1997 and found that the layer was too thin to be measured. Based on visual observation during well purging and sampling, it is anticipated that the DNAPL is less than 1/8 inch thick. The layer DNAPL was not observed at other locations. Concentrations in wells located sidegradient (MW-8) and downgradient (MW-9 and MW-10) of MW-5 do not indicate the presence of DNAPL.

The DNAPL likely reached its current location during and/or shortly after the TCE release occurred. The DNAPL is not expected to move significantly further unless it is disturbed by intrusive activities. Subsurface activities such as remedial or monitoring well installation (rock coring with fluids) or other remedial activities (injection of agents such as oxidizers) could result in the disruption and mobilization of the DNAPL.

Due to the lack of evidence supporting ongoing DNAPL migration, there is no additional DNAPL investigation planned. This decision reflects our prior conversations with NYSDEC in which it concurred with our conclusion.

FS, 2nd Bullet: As discussed above, GZA should include in-situ chemical oxidation as a potentially applicable technology for the destruction of DNAPL.

In-situ chemical oxidation is considered an innovative technology. There have been relatively few full scale applications using Fenton's Reagent (hydrogen peroxide with a catalyst), and potassium or sodium permanganate for in-situ groundwater treatment.

According to the vendors of these technologies, DNAPL remediation in a fractured bedrock environment is not considered practical. At best, some percentage of the total mass would be consumed/treated. Given the heterogeneities of the rock, we would anticipate less than 50% of the DNAPL mass would be treated.

GZA discussed the potential applicability for in-situ chemical oxidation of DNAPL with NYSDEC personnel including those from the NYSDEC Division of Environmental Remediation (Region 9 and Albany). It is generally agreed that it is not yet technically feasible to completely eliminate the presence of DNAPL using in-situ chemical oxidation processes. Available literature obtained by GZA at a recent USEPA and Groundwater Remediation Technologies Analysis Center conference ("Advances In Innovative Groundwater Remediation Technologies", June 6, 2000) supports the inherent limitations and difficulty associated with remediating DNAPL in fractured bedrock using chemical oxidation processes.

The use of in-situ chemical oxidation is not considered technically feasible for DNAPL remediation at this site due to the presence of fractured bedrock. However, it may be applicable for remediation of dissolved phase contamination. Therefore, GZA will include a discussion/evaluation of in-situ chemical oxidation (for dissolved phase contamination and not for DNAPL) in its technology screening/review in the FS.

<u>Section 1.20 Project Description, History and Location 2nd Bullet, Page 4</u>: From the groundwater chemistry data provided by MW-3D, deep bedrock groundwater has not been impacted at this location. However, does other information support an assessment that the former storage tank has not affected deep bedrock groundwater? Specifically, did fractures observed in bedrock cores indicate that lack of vertical fracturing? Do groundwater elevations within MW-3D and MW-3S indicate an upward gradient from the deep to the shallow bedrock? The answers to these questions may dictate the need for additional deep bedrock monitoring wells.

The majority of fractures noted at the site were horizontal or low angle (i.e., lack of vertical fractures). Some minor vertical fractures were noted, but they are not suspected to be continuous (which is typical for this formation). Water levels in MW-3D are deeper than in MW-3S and contamination was not detected in monitoring well MW-3D. This supports a lack of communication between the upper and lower bedrock. NYSDEC representatives observed the rock core samples collected from monitoring well MW-3D.

As previously agreed upon with NYSDEC, one deep well downgradient of the AOC was installed (MW-3D) to assess deep groundwater. Based on the information obtained from the sampling of this well, no additional deep groundwater monitoring wells are planned.

<u>Section 2.10 Task 1, Work Plans</u>: The work plan states that GZA will develop a Field Activities Plan for work completed after October 1999. As stated earlier, specific investigative activities to further evaluate the groundwater contaminant plume, DNAPL in well MW-5, and the natural attenuation process must be included in the RI/FS work plan before its approval.

Several groundwater sampling rounds using commonly accepted natural attenuation parameters have been previously completed at this site. The data indicate that natural attenuation is occurring. Two additional sample rounds, which will include target compound VOC analysis and natural attenuation parameters on selected wells (MW-11, MW-12, MW-10 and MW-4), will be completed as part of the FRI following the installation of two monitoring wells near MW-11 and MW-12. These monitoring wells (MW-13 and MW-14) will be installed in the same manner as the wells installed previously. The proposed well locations are shown on the attached Figure. The selected locations reflect the fact that access is limited near Route 93 due to the presence of utilities and the highway right of way.

It is anticipated that monitoring well MW-13 will provide additional information regarding the downgradient edge of the plume. Monitoring well MW-14 will provide information regarding the southern edge of the plume. Existing well MW-11 generally defines the north edge of the plume.

GZA will assess the need for possible additional monitoring wells following a review of the proposed rounds of ground water monitoring that includes monitoring wells MW-13 and MW-14. GZA and Delphi Thermal will discuss the need for any additional work with NYSDEC following our review.

For the reasons previously described, no additional DNAPL delineation is planned.

Utilization of the previously approved Sampling and Analysis Plan (SAP) and Health and Safety Plan (HASP) is acceptable if these plans cover the additional field activities proposed during the RI. If not, an addendum to these plans will be required, and should be incorporated into the revised RI/FS work plan. We will require copies of the previously approved SAP and HASP for distribution to the other reviewers, for attachment to the Order on Consent when finalized, and for the document repository

GZA has previously submitted these documents to NYSDEC in connection with previous investigations at the site. GZA will amend the existing plans as appropriate and include these amended documents in the form of attachments to the revised FRI/FFS work plan.

Regarding the Citizen Participation Plan, please be reminded that the development and execution of the Citizen Participation Plan (CP), with Department oversight, is the responsibility of the Potentially Responsible Party (PRP). Besides developing the fact sheets, Delphi Thermal will also be responsible for mailing. The Department will assist Delphi Thermal in the preparation of the fact sheet, will coordinate internal Department review, and will provide Delphi Thermal with an initial mailing list. Delphi Thermal will be responsible for updating that list as appropriate. Also note that the Department reserves the right to amend the CP Plan to reflect public interest and issues. We may request additional CP activities, including fact sheets, public notices, public availability sessions, and public meetings.

Delphi Thermal will develop and mail the fact sheets as needed. Delphi Thermal will provide a copy of each fact sheet for prior review by the NYSDEC. It is anticipated that the NYSDEC will provide Delphi Thermal an electronic copy of the mailing list. The list may be modified as agreed between NYSDEC and Delphi Thermal.

GZA will develop the CP Plan after it has a copy of the final mailing list. The CP Plan will be submitted with the revised FRI/FFS work plan for NYSDEC approval. It is anticipated that any modifications to the CP Plan (based on public interest) should be discussed and agreed to between NYSDEC and Delphi Thermal prior to implementation.

<u>*Section 2.20, Task 2, Focused Remedial Investigations;*</u>

<u>General</u>: To further delineate the extent (e.g., width and length) of the groundwater contaminant plume, we will require additional monitoring wells. Regarding downgradient wells, previous discussions between the Department and Delphi Thermal have focused on spatial constraints. It appears for Figure 1, however, that an additional well or wells could be installed on Delphi's Waste Water Treatment Plant property. This location is critical because DCE and VC were detected above groundwater standards in well MW-12, which is immediately upgradient of this property. In additional, GZA should evaluate and sample seeps along the Gulf.

GZA has visited the Gulf area to make observations and collect seep samples. GZA did not observe any flowing seeps in the area downgradient of monitoring wells MW-11 or MW-12. The bedrock face exposed in the Gulf was noted to be moist but no apparent free water seeps were observed. Access to the rock face in the Gulf is limited and difficult.

As previously described, two additional proposed monitoring wells (MW-13 and MW-14) will be installed to further delineate the plume. These wells will be located between existing monitoring wells MW-11 and MW-12 and near Route 93. A figure showing the proposed location for these wells is attached.

It is anticipated that groundwater flow (near the Gulf) in the area of the Delphi Thermal Wastewater Treatment Plant (Treatment Plant) is to the northwest toward the Gulf. (See the attached Figure, which shows the conceptual groundwater flow direction in the area of the Gulf.) Therefore, monitoring wells placed in the area of the Treatment Plant would not be expected to provide any additional insights on the plume that originates on the manufacturing plant side of Route 93.

<u>Public and Private Well Assessment</u>: Delphi proposes to examine public records to locate and inventory private basements and sumps along Route 93. The mailing or hand delivery of a questionnaire may prove an expedient and reliable way to supplement such a records search.

GZA will use a phased approach to collect information regarding the presence of basements and sumps downgradient of the site. GZA will first complete an assessment of the basements and sumps by examining public records. If the RI investigation indicates potential exposure issues for residences for which there is not publicly available information on the presence of basements or sumps, GZA will prepare a questionnaire (regarding the presence of sumps and basements) for the potentially affected property owners to complete. The questionnaire will be submitted to Delphi Thermal and NYSDEC for review and approval.

<u>*Section 2.40, Task 4, Focused Feasibility Study:*</u> *Besides the two alternatives discussed, DNAPL removal/destruction from well MW-5 should be considered for the reasons discussed above (i.e., continuing source of groundwater contamination). While we recognize that residual DNAPL may remain in the subsurface environmental based upon the remedial alternative utilized, natural biological activity could further reduce this residual DNAPL, thus reducing the time required for long-term groundwater monitoring.*

Groundwater concentrations at the Site are not likely to decrease significantly from their current levels until the mass of DNAPL is practically eliminated. This issue has been discussed with NYSDEC and it was agreed that groundwater restoration in the presence of DNAPL is considered impractical, because of technical limitations associated with attempts to remove subsurface DNAPL in fractured bedrock. The technical limitations associated with DNAPL destruction at this site will be discussed in the context of the FFS. The currently proven methods for remediating DNAPL contaminated sites like Delphi Thermal consist of natural attenuation and groundwater extraction.

<u>*Section 2.50, Task 5, FFS Report:*</u> *The Focused FS Report should be complete and be a "stand alone" document. Despite previous screening and evaluations included in previous reports, the FFS should function as a complete Feasibility Study on its own, and not be "Part 2" of an a FS that picks up from parts of another report. In addition, in-situ chemical oxidation should be included and considered in the FFS.*

As requested, the FFS Report will be completed as a stand-alone document. A reference section will be included regarding earlier reports.

As previously described herein, GZA will include consideration of in-situ chemical oxidation for dissolved phase contamination as a potential remedial technology in the FFS.

<u>*The NYSDEC comment letter included the following statement:*</u> *"GZA cites technical impracticability of removing DNAPL from fractured bedrock as the justification for this focus (two remedial alternatives, natural attenuation and groundwater extraction). This approach is common and reasonable; however, it appears that GZA is already demonstrating a propensity toward the natural attenuation approach."*

GZA's February 1997 report included screening of remedial technologies and development and analysis of alternatives. No promising proven remedial technologies have been developed since 1997, except that in-situ chemical oxidation could possibly be used to treat dissolved phase contamination at the site. Previous discussions between Delphi Thermal, GZA and NYSDEC reflect a consensus that existing data supports the natural attenuation approach.

Following NYSDEC's review of this submittal, GZA suggests that Delphi Thermal schedule a meeting with NYSDEC to discuss this project and items included in this letter.

Please let us know of convenient dates and times after you have discussed the proposed meeting with NYSDEC.

Please call if you have any questions regarding this submittal.

Very truly yours,

GZA GEOENVIRONMENTAL OF NEW YORK

Gary J. Klawinski
Project Manager

Raymond F. Laport, P.E.
Project Reviewer

Ernest R. Hanna, P.E.
Associate Principal

Attachments: Figure 1 Site Plan/Proposed Monitoring Well Location Plan

New York State Department of Environmental Conservation
Division of Environmental Remediation, Region 9
270 Michigan Avenue, Buffalo, New York 14203-2999
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John P. Cahill
Commissioner

September 18, 2000

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Ms. Catherine A. Ver
Delphi Harrison Thermal Systems
200 Upper mountain Road
Lockport, New York 14094

Dear Ms. Ver:

Focused RI/FS Work Plan, Delphi Responses to NYSDEC Comments, Delphi Harrison Thermal Systems Site, Registry Number 932113

The New York State Departments of Health (DOH) and Environmental Conservation (DEC) are in receipt of your June 20, 2000 letter containing responses to the Department's March 10, 2000 letter regarding the Focused RI/FS Work Plan for the subject site. While most of GZA's responses are acceptable to the Departments, a few remaining issues must still be resolved. These issues are summarized as follows:

- Delphi proposes to install two additional monitoring wells along Route 93 to determine the extent of the groundwater contaminant plume. The groundwater analytical data collected to date, however, indicate that the width of the contaminant plume has not yet been determined. Two additional monitoring wells, placed in the proper locations, should be sufficient to make this determination. As such, the Department suggest one well in the grass area east of Building 6 and one well in the parking lot southeast of existing well MW-9 (see attached figure). If Delphi desires, proposed monitoring well MW-14 could be moved to one of these sidegradient locations.

- It is stated that the DNAPL in monitoring well MW-5 "likely reached its current location during and/or shortly after the TCE release occurred." This statement implies that the DNAPL is related to the former aboveground storage tank, and that a sizeable quantity of DNAPL could be present in the subsurface environment (based upon the distance from the former tank to well MW-5). The Departments, however, do not believe that the DNAPL in well MW-5 is related to the former storage tank. Analytical results from the DNAPL indicate that it contains both TCE and PCE at significant concentrations. Groundwater from wells located near the former tank, however, do not contain PCE, suggesting that the DNAPL is not related to the former aboveground storage tank. Is there another potential source for this DNAPL?

  Since DNAPL has only been encountered in one on-site well, and considering the fact that PCE concentrations in groundwater are non-detect in the two farthest downgradient wells (MW-11 and

MW-12), the Departments will not require additional DNAPL investigation at this time. Please note that should site conditions change (e.g., DNAPL detected in other wells; detectable concentrations of PCE in downgradient wells MW-11 and MW-12), additional DNAPL investigation will be required.

- GZA proposes to sample only select wells for compounds of concern and natural attenuation parameters. In order to fully assess contaminant trends and natural attenuation indicators, all wells should be included in the proposed sampling round. This also includes well MW-3D to confirm that conditions in the deep bedrock have not changed since the well was sampled in 1996.

As stated in our March 10th letter, "utilization of the previously approved Sampling and Analysis Plan (SAP) and Health and Safety Plan (HASP) is acceptable if these plans cover the additional field activities proposed during the RI." Because the additional field activities proposed are covered by these plans, utilization of the previously approved SAP and HASP is acceptable. However, since the SAP and HASP will become part of the approved RI/FS work plan, the Department will require copies of these plans for distribution to the other reviewers, for attachment to the Order on Consent when finalized, and for the document repository. These documents should be submitted with the revised RI/FS work plan. The revised work plan should also contain a schedule indicating when the proposed field activities will be conducted and when submittal of milestone reports will occur.

While the Departments typically require an approved work plan and executed Order on Consent before the completion of field work, this site is atypical as a significant amount of investigation has already been completed under a previously approved work plan. Since the proposed additional field activities are consistent with the work already completed at the site, we will not require prior approval of the RI/FS work plan if Delphi wishes to complete these activities this field season, so long as the additional field activities discussed in this letter are acceptable to Delphi. Should you have any comments or questions regarding the RI/FS, please feel free to contact me at 716-851-7220. Information concerning the Citizen Participation activities should be directed to Mr. Podd at the same number. Mr. Podd should be contacted directly to obtain an electronic copy of the mailing list.

Sincerely yours,

Glenn M May

Glenn M. May, CPG.
Engineering Geologist I

Attachment

cc: Mr. Daniel King, NYSDEC, Region 9 with attachment
Mr. Jeff Konsella, NYSDEC, Albany with attachment
Mr. Matthew Forcucci, NYSDOH, Buffalo with attachment
Mr. Michael Podd, NYSDEC, Region 9 w/o attachment

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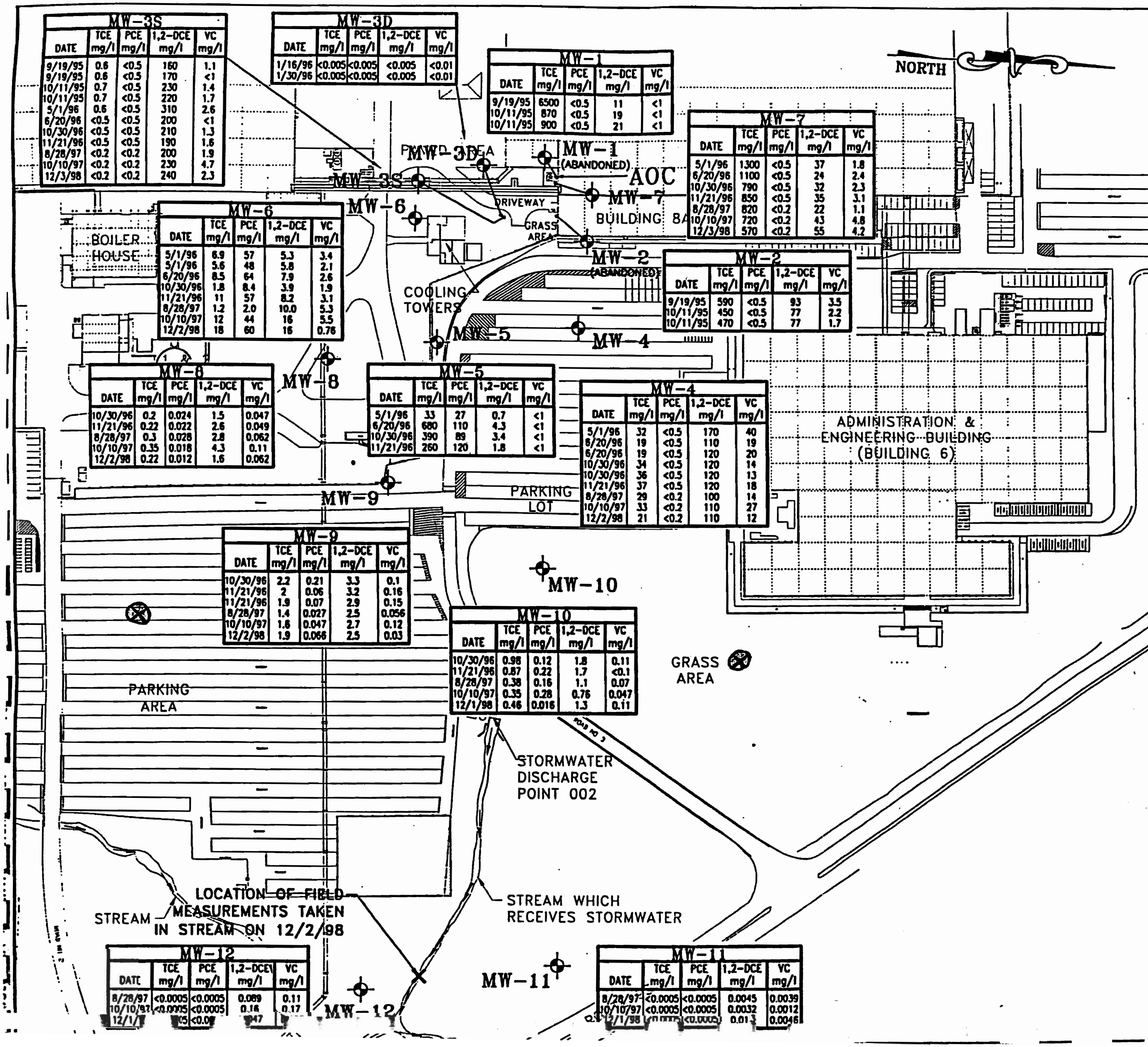

MW-3S

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
9/19/95	0.6	<0.5	160	1.1
9/19/95	0.6	<0.5	170	<1
10/11/95	0.7	<0.5	230	1.4
10/11/95	0.7	<0.5	220	1.7
5/1/96	0.6	<0.5	310	2.6
6/20/96	<0.5	<0.5	200	<1
10/30/96	<0.5	<0.5	210	1.3
11/21/96	<0.5	<0.5	190	1.6
8/28/97	<0.2	<0.2	200	1.9
10/10/97	<0.2	<0.2	230	4.7
12/3/98	<0.2	<0.2	240	2.3

MW-3D

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
1/16/96	<0.005	<0.005	<0.005	<0.01
1/30/96	<0.005	<0.005	<0.005	<0.01

MW-1

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
9/19/95	6500	<0.5	11	<1
10/11/95	870	<0.5	19	<1
10/11/95	900	<0.5	21	<1

MW-7

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
5/1/96	1300	<0.5	37	1.8
6/20/96	1100	<0.5	24	2.4
10/30/96	790	<0.5	32	2.3
11/21/96	850	<0.5	35	3.1
8/28/97	820	<0.2	22	1.1
10/10/97	720	<0.2	43	4.8
12/3/98	570	<0.2	55	4.2

MW-6

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
5/1/96	6.9	57	5.3	3.4
5/1/96	5.6	48	5.8	2.1
6/20/96	8.5	64	7.9	2.6
10/30/96	1.8	8.4	3.9	1.9
11/21/96	11	57	8.2	3.1
8/28/97	1.2	2.0	10.0	5.3
10/10/97	12	44	16	5.5
12/2/98	18	60	16	0.76

MW-2

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
9/19/95	590	<0.5	93	3.5
10/11/95	450	<0.5	77	2.2
10/11/95	470	<0.5	77	1.7

MW-8

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
10/30/96	0.2	0.024	1.5	0.047
11/21/96	0.22	0.022	2.6	0.049
8/28/97	0.3	0.028	2.8	0.062
10/10/97	0.35	0.018	4.3	0.11
12/2/98	0.22	0.012	1.6	0.062

MW-5

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
5/1/96	33	27	0.7	<1
6/20/96	680	110	4.3	<1
10/30/96	390	89	3.4	<1
11/21/96	260	120	1.8	<1

MW-4

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
5/1/96	32	<0.5	170	40
6/20/96	19	<0.5	110	19
6/20/96	19	<0.5	120	20
10/30/96	34	<0.5	120	14
10/30/96	36	<0.5	120	13
11/21/96	37	<0.5	120	18
8/28/97	29	<0.2	100	14
10/10/97	33	<0.2	110	27
12/2/98	21	<0.2	110	12

MW-9

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
10/30/96	2.2	0.21	3.3	0.1
11/21/96	2	0.06	3.2	0.16
11/21/96	1.9	0.07	2.9	0.15
8/28/97	1.4	0.027	2.5	0.056
10/10/97	1.6	0.047	2.7	0.12
12/2/98	1.9	0.066	2.5	0.03

MW-10

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
10/30/96	0.98	0.12	1.8	0.11
11/21/96	0.87	0.22	1.7	<0.1
8/28/97	0.38	0.16	1.1	0.07
10/10/97	0.35	0.28	0.76	0.047
12/1/98	0.46	0.016	1.3	0.11

MW-12

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
8/28/97	<0.0005	<0.0005	0.089	0.11
10/10/97	<0.0005	<0.0005	0.16	0.17
12/1/[illegible]	[illegible]05	<0.0[illegible]	[illegible]047	[illegible]

MW-11

DATE	TCE mg/l	PCE mg/l	1,2-DCE mg/l	VC mg/l
8/28/97	<0.0005	<0.0005	0.0045	0.0039
10/10/97	<0.0005	<0.0005	0.0032	0.0012
12/1/98	[illegible]	<0.0005	0.013	0.0046

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NOTE:

1. BASE MAP ADAPTED FROM FILE PROVIDED BY DELPHI THERMAL SYSTEMS.
2. ANALYTICAL TESTING WAS [illegible] BY FREE-COL LABORATOR[illegible]
3. UNITS ARE LISTED IN MILL[illegible] LITER. (< - INDICATES C[illegible] NOT DETECTED ABOVE THE DETECTION LIMIT)

LEGEND:

MW-8 APPROXIMATE LOC[illegible] DESIGNATION OF M[illegible] WELL INSTALLED B[illegible]

AOC DENOTES AREA OF [illegible]

TCE = TRICHLOROETHENE

PCE = TETRACHLOROETHE[illegible]

1,2-DCE = TRANS & CIS 1,2-DICHLOROETHE[illegible]

VC = VINYL CHLORIDE

⊗ Proposed additi[illegible] Well.

New York State Department of Environmental Conservation
Division of Environmental Remediation, Region 9
270 Michigan Avenue, Buffalo, New York 14203-2999
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September 25, 2000

Ms. Catherine A. Ver
Delphi Harrison Thermal Systems
200 Upper mountain Road
Lockport, New York 14094

Dear Ms. Ver:

October 1999 Groundwater Sampling Report,
Delphi Thermal Site, Registry No. 932113

The New York State Departments of Health (DOH) and Environmental Conservation (DEC) have completed review of the Supplemental Phase III Extent of Contamination Studies Data Report submitted by Delphi Harrison Thermal Systems (Delphi) on August 29, 2000. This report presents the analytical results for groundwater samples collected from on-site wells and further evaluates natural attenuation parameters for the site.

The results for trichloroethene (TCE) and its breakdown products are consistent with previous analytical results for the site; groundwater samples collected from well MW-7 at the area of concern (AOC) contain the highest concentrations of TCE, while samples collected from wells downgradient of the AOC (MW-3 and MW-4) show significant concentrations of TCE breakdown products (dichloroethene (DCE) and vinyl chloride (VC)). These results also indicate that TCE was not detected in the most downgradient wells (MW-11 and MW-12), although DCE and VC were detected. The relatively high concentrations of chloride (138 to 1220 μg/l) compared to the 20.2 μg/l background concentration appear to be direct evidence of the reductive dechlorination process.

We note in Table 3 that the concentrations of calcium, magnesium and sodium in monitoring well MW-10 are significantly lower than detected in this well during December 1998, and also significantly lower than the dissolved concentrations for these compounds. The dissolved concentrations are consistent with the previous sampling event, suggesting a possible reporting error for the non-dissolved concentrations.

Should you have any questions, please feel free to contact me at 716-851-7220.

Sincerely yours,

Glenn M May

Glenn M. May, CPG.
Engineering Geologist I

cc: Mr. Daniel King, NYSDEC, Region 9
Mr. Jeff Konsella, NYSDEC, Albany
Mr. Matthew Forcucci, NYSDOH, Buffalo

DELPHI
Automotive Systems

November 16, 2000

Mr. Glenn M. May
New York State Department of Environmental Conservation
270 Michigan Avenue
Buffalo, New York 14203 -2999

Dear Mr. May:

Delphi Harrison Thermal Systems (Delphi Thermal) is submitting our response to your letters dated September 18 and September 25, 2000 concerning the NYSDEC Inactive Hazardous Waste Registry Site #932113 located at the Lockport Site.

As we discussed yesterday, the well locations have been modified and are shown in the attached drawing.

Please call me at (716) 439 - 2942 if you have any questions. Please note that Delphi Thermal will be closed for the Thanksgiving Day holiday, November 23 -24 and that I will be out of the office from November 17 through November 26, returning on November 27, 2000.

Sincerely,

Catherine A. Ver

Catherine A. Ver
Sr. Environmental Engineer

Harrison Thermal Systems
World Headquarters
200 Upper Mountain Road Lockport, New York 14094 USA

GZA
GeoEnvironmental
of New York

Engineers and
Scientists

November 16, 2000
File No. 55039.20

RECEIVED
NOV 16 2000
DELPHI AUTOMOTIVE
ENVIRONMENTAL

Ms. Cathy Ver
Delphi Harrison Thermal Systems
World Headquarters
200 Upper Mountain Road
Lockport, New York 14094-1896

GZA

364 Nagel Drive
Buffalo
New York 14225
716-685-2300
FAX 716-685-3629
http://www.gza.net

Re: Focused Remedial Investigation and
Focused Feasibility Study Work Plan
Response to NYSDEC Letters Dated September 18 and 25, 2000
Delphi Harrison Thermal Systems West Lockport Complex
NYSDEC Registry Site # 932113

Dear Ms. Ver:

This letter is in response to comments made by the New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH) in their letters to Delphi Thermal, dated September 18, 2000 (commenting on the results of the October 1999 groundwater sampling) and dated September 25, 2000 (commenting on the Focused Remedial Investigation and Focused Feasibility Study Work Plan) (the "Departments' Letters").

We have addressed the Departments' comments (shown below in italics) in the discussion that follows by reference to the issues raised in their letters.

<u>NYSDEC Letter Dated September 18, 2000</u>

Delphi proposes to install two monitoring wells along Route 93 to determine the extent of the groundwater contamination plume. The groundwater analytical data collected to date, however, indicated that the width of the contaminant plume has not yet been determined. Two additional monitoring wells, placed in the proper locations, should be sufficient to make this determination. As such, the Departments suggest one well in the grass area east of Building 6 and one well in the parking lot southeast of the existing well MW-9 (see attached figure). If Delphi desires, proposed monitoring well MW-14 could be moved to one of these sidegradient locations.

A Subsidiary of GZA
GeoEnvironmental
Technologies, Inc.

As discussed with the Departments, GZA is providing information related to the alternate agreed upon locations (conversation between Cathy Ver and Glenn May on November 15, 2000) for monitoring wells MW-14 and MW-15 to those noted by the Departments in their September 18, 2000 letter to Delphi Thermal. The reasons for the alternate locations are described below. The location for monitoring well MW-13 will remain unchanged (as shown on the attached figure). It should be noted that monitoring well MW-13 is anticipated to provide additional information regarding the groundwater concentration at the downgradient edge of the plume (at the Delphi Thermal property line).

Monitoring wells MW-14 and MW-15 are anticipated to provide additional information regarding the width (north and south) of the plume. Proposed locations are described below.

GZA

Monitoring Well MW-14

The Departments' proposed location of MW-14 is in a parking lot area that is heavily used. Snow removal in this parking lot is likely to damage the upper part of the well and the potential exists for access to the well to be blocked by vehicles. The alternate proposed location for MW-14 is in a grass area. It is anticipated that the alternate location will provide sufficient information regarding the width of the plume to the south.

Monitoring Well MW-15

The Departments' proposed location of MW-15 is the area of a memorial grove (stone marker). Delphi Thermal requests that the area of the memorial grove be avoided. Underground utilities are located near facility Road No. 3. The alternate proposed location for MW-15 is in a grass area directly east of the Departments' proposed location. GZA anticipates that the alternate location will provide sufficient information regarding the width of the plume to the north.

Delphi Thermal would like to avoid the use of flush mount protective casings (often used at locations in parking lots/paved areas) because they generally do not provide as good a surface seal as stick-up protective casings. It should be noted that the wells included in the project monitoring program are constructed with stick-up type protective casings. The alternate locations for monitoring wells MW-14 and MW-15 can be completed using stick-up protective casings (preferred by Delphi Thermal).

GZA proposes to sample only select wells for compounds of concern and natural attenuation parameters. In order to fully assess contaminant trends and natural attenuation indicators, all wells should be included in the proposed sample round. This also includes well MW-3D to confirm that conditions in the deep bedrock have not changed since the well was sampled in 1996.

Two full rounds of natural attenuation parameter testing have been completed to date (December 1998 and October 1999). With the exception of the data noted below for monitoring well MW-10 (December 1998 round), the data between the rounds has been consistent. As noted in GZA's reports regarding the natural attenuation parameters, the data support that natural attenuation is occurring at the site.

In addition to the natural attenuation parameter testing, GZA has completed four full rounds (August 1997, October 1997, December 1998 and October 1999) of sampling and analytical testing for compounds of concern from the existing shallow bedrock groundwater monitoring wells at the site.

GZA proposes to complete the Spring 2001 sampling event on wells located in the downgradient area of the plume (existing wells MW-11and MW-12, and new wells MW-13, MW-14 and MW-15) and selected wells in the main part of the plume (MW- 10 and MW-4). As noted by the Departments, the areas of the plume that require additional study are the downgradient edge and the south and north extents. Sampling of these seven monitoring wells for both natural attenuation and compounds of concern testing would provide adequate information to assess contaminant trends in the main part of the plume and evaluate the downgradient part of the plume.

As requested, sampling of deep bedrock monitoring well MW-3D will be included in the next sample round. If contamination is not detected in this well, future sampling of this well should not be required.

GZA suggests that several natural attenuation parameters be eliminated from future sampling rounds for the following reasons:

Dissolved Inorganics: The groundwater results from the December 1998 and October 1999 sample rounds indicate similar total and dissolved inorganics (calcium, iron, magnesium, manganese, sodium and potassium) concentrations. This is likely due to sampling the monitoring wells using low flow sampling techniques which yield low turbidity, thus minimizing the total inorganic sediment interference. Therefore, the dissolved inorganics testing should be eliminated from future sampling events.

Calcium: The parameter calcium provides little information regarding natural attenuation at the site. Therefore, calcium should be eliminated from future sampling events.

Since the proposed additional field activities are consistent with the work already completed at the site, we will not require prior approval of the RI/FS work plan if Delphi wishes to complete these activities this field season, so long as the additional field activities discussed in this letter are acceptable to Delphi.

Under the current schedule, the three new wells (MW-13, MW-14 and MW-15) will be installed concurrent with the next groundwater sampling event in the Spring of 2001. This decision was based in part on the fact that current colder weather (including freezing temperatures) could potentially increase the well installation costs and make work difficult (i.e., snow/ice removal, freezing rock coring drilling lines).

NYSDEC Letter Dated September 25, 2000

We note in Table 3 that the concentrations of calcium, magnesium and sodium in monitoring well MW-10 are significantly lower than detected in this well during December 1998, and also significantly lower than dissolved concentrations for these compounds. The dissolved concentrations are consistent with the previous sampling event, suggesting a possible reporting error for the non-dissolved concentrations.

GZA has reviewed the data described above. Our review included checking the data presented in Table 3 with the laboratory data sheets and the laboratory. There was no reporting error found. GZA agrees that the December 1998 data from monitoring well MW-10 for calcium, total magnesium and total sodium appear lower than expected. GZA will sample this well for these (total and dissolved) parameters (excluding calcium as noted above) as part of the next sample round planned for the Spring 2001. GZA will compare the new data to the historic data and make a determination as to whether the December 1998 data is usable or anomalous.

Please let us know if and when the Departments have approved the proposed changes in the work plan that are described in this letter. Once Delphi Thermal has received approval, we will proceed with the preparation of a revised work plan and time schedule.

Very truly yours,

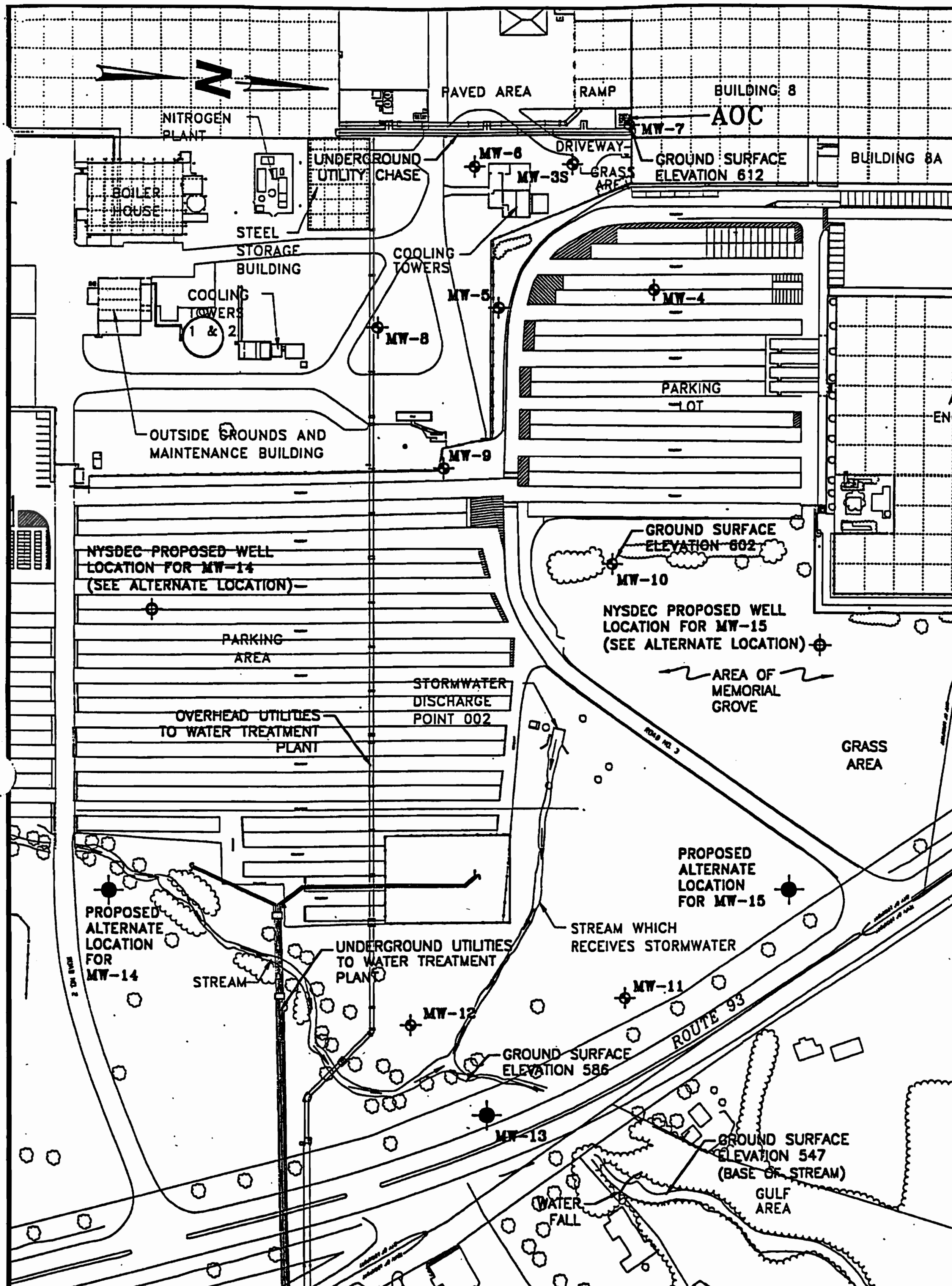
GZA GEOENVIRONMENTAL OF NEW YORK

Gary J. Klawinski
Project Manager

Raymond F. Laport, P.E.
Project Reviewer

Ernest R. Hanna, P.E.
Associate Principal

Attachments: Figure 1 Site Plan/Proposed Monitoring Well Location Plan
NYSDEC Letters Dated September 18 and 25, 2000



DRAWN BY: BWS

DATE: OCTOBER 2000

GZA GeoEnvironmental of New York

SCALE IN FEET

0 100 200 400

DELPHI HARRISON THERMAL SYSTEMS
LOCKPORT, NEW YORK
FOCUSED REMEDIAL INVESTIGATION/FEASABILITY STUDY

PROPOSED MONITORING WELL LOCATION PLAN

PROJECT No.
55039.2

FIGURE No.
1

LEGEND:

MW-13 APPROXIMATE LOCATION AND DESIGNATION OF PROPOSED MONITORING WELL

MW-3S APPROXIMATE LOCATION AND DESIGNATION OF MONITORING WELL INSTALLED BY GZA

AOC DENOTES AREA OF CONCERN

NOTES:

1. BASE MAP ADAPTED FROM AN AUTOCADFILE PROVIDED BY DELPHI HARRISONTHERMAL SYSTEMS.
2. WATER LEVEL READINGS HAVE BEEN MADE IN WELLS AT TIMES AND UNDER CONDITIONS STATED IN THE TEXT. IT MUST BE NOTED THAT FLUCTUATIONS IN THE GROUNDWATER ELEVATIONS MAY OCCUR DUE TO VARIATIONS IN RAINFALL, BAROMETRIC PRESSURE AND OTHER FACTORS.
3. WATER LEVEL FOR MW-11 WAS MEASURED ON OCTOBER 4, 1999.

New York State Department of Environmental Conservation
Division of Environmental Remediation, Region 9
270 Michigan Avenue, Buffalo, New York 14203-2999
Phone: (716) 851-7220 • **FAX:** (716) 851-7226
Website: www.dec.state.ny.us

RECEIVED
APR 18 2001

John P. Cahill
Commissioner

RECEIVED
FEB 5 2001
DELPHI AUTOMOTIVE
ENVIRONMENTAL

February 2, 2001

Ms. Catherine A. Ver
Delphi Harrison Thermal Systems
200 Upper mountain Road
Lockport, New York 14094

Focused RI/FS Work Plan,
Delphi Responses to NYSDEC Comments,
Delphi Harrison Thermal Systems Site,
Registry Number 932113

Dear Ms. Ver:

The New York State Departments of Health (DOH) and Environmental Conservation (DEC) have reviewed GZA's responses that were contained in your November 16, 2000 letter and find them to be acceptable. Incorporation of these and previous GZA responses into the January 2000 Focused RI/FS Work Plan will result in an acceptable document. For your convenience in preparing the final work plan, the following items should be included:

- A revision to the January 2000 Focused RI/FS Work Plan that incorporates Department comments transmitted to Delphi by letters dated March 10 and September 18, 2000; and Delphi's responses transmitted to the Department by letters dated June 20 and November 16, 2000.

- The Sampling and Analysis Plan dated August 1995, which was accepted as part of the Focused RI/FS Work Plan by letter dated March 10, 2000. Among other items this plan includes well installation protocols, soil and groundwater sampling protocols, laboratory quality controls procedures, and a site specific health and safety plan.

- A project schedule that includes dates for implementation of field work and submittal of milestone reports.

- A Citizen Participation Plan.

Seven copies of the final Focused RI/FS Work Plan will be required for distribution.

Should you have any comments or questions regarding this letter or the RI/FS process, please feel free to contact me at 716-851-7220. Information concerning the Citizen Participation activities should be directed to Mr. Podd at the same number. Mr. Podd should be contacted directly to obtain an electronic copy of the mailing list.

Sincerely yours,

Glenn M May

Glenn M. May, CPG.
Engineering Geologist I

cc: Mr. Daniel King, NYSDEC, Region 9
Mr. Jeff Konsella, NYSDEC, Albany
Mr. Matthew Forcucci, NYSDOH, Buffalo
Mr. Michael Podd, NYSDEC, Region 9
Ms. Maura Desmond, NYSDEC, Buffalo Field Unit

New York State Department of Environmental Conservation
Division of Environmental Remediation, Region 9
270 Michigan Avenue, Buffalo, New York 14203-2999
Phone: (716) 851-7220 • **FAX:** (716) 851-7226
Website: www.dec.state.ny.us

Erin M. Crotty
Commissioner

June 5, 2001

Mr. Rick Eisemann
Delphi Energy and Chassis Systems
P.O. Box 92700
Rochester, New York 14692

Dear Mr. Eisemann:

Focused RI/FS Work Plan;
Delphi Harrison Thermal Systems Site;
Registry Number 932113

The New York State Departments of Health (DOH) and Environmental Conservation (DEC) have reviewed the April 2001 Focused RI/FS Work Plan and find it to be acceptable with the exception that the Health and Safety Plan does not contain a Community Air Monitoring Plan. Such a plan is required at all inactive hazardous waste sites during intrusive activities and is implemented to protect residents living near a site. I have attached a copy of DOH's Generic Community Air Monitoring Plan that should be utilized during the upcoming site investigation. Revision of the Focused RI/FS Work Plan to incorporate the Community Air Monitoring Plan will not be required. Instead, this plan will be appended to said work plan and incorporated into the Order on Consent.

Should you have any comments or questions regarding the Community Air Monitoring Plan or the RI/FS process, please feel free to contact me at 716/851-7220.

Sincerely yours,

Glenn M May

Glenn M. May, CPG
Engineering Geologist I

Attachment
cc: Mr. Daniel King, NYSDEC, Region 9
Mr. Jeff Konsella, NYSDEC, Albany
Mr. Matthew Forcucci, NYSDOH, Buffalo
Ms. Maura Desmond, NYSDEC, Buffalo Field Unit

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

All 15-minute readings must be recorded and be available for State (DEC and DOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls

New York State Department of Health
Generic Community Air Monitoring Plan

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical-specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for volatile organic compounds (VOCs) and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate NYSDEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

All readings must be recorded and be available for State (DEC and DOH) personnel to review.

DELPHI
Automotive Systems

June 20, 2001

Mr. Glenn May
New York State Department of Environmental Conservation
Division of Environmental Remediation, Region 9
270 Michigan Avenue
Buffalo, New York 14203-2999

Re: Work Plan Attachments
Focused Remedial Investigation and Focused Feasibility Study Work Plan
Delphi Harrison Thermal Systems West Lockport Complex
NYSDEC Registry Site # 932113

Dear Mr. May:

Delphi Harrison Thermal Systems (Delphi) is pleased to provide the enclosed attachments to the Focused Remedial Investigation (FRI) and Focused Feasibility Study (FFS) Work Plan for the above referenced site at Delphi's West Lockport Complex. The attachments are hard copies of electronic files already reviewed by the Department. Verbal approval of these documents was given to GZA on June 19, 2001. The following items are enclosed:

- <u>Revised Project Schedule (FRI/FFS Work Plan Figure 2)</u>: Per your request, Figure 2 is revised to identify durations of project tasks rather than calendar dates. This revised schedule supercedes the schedule included in the FRI/FFS Work Plan.

- <u>Community Air Monitoring Plan (CAMP)</u>: As requested in your letter dated June 5, 2001, a site-specific CAMP is included. The CAMP includes revised Table 1 (Air Monitoring Action Levels) from the Health and Safety Plan (FRI/FFS Work Plan Attachment D). Please note that the generation of dust/particulates is not expected during the proposed intrusive work (i.e., test boring/monitoring well installation). Therefore, dust/particulate monitoring is not planned. However, GZA GeoEnvironmental of New York will have a particulate monitor available, if needed. With the exception of these guidelines, the CAMP follows the NYSDOH suggested guidance.

Please attach the above items to the FRI/FFS Work Plan. You may contact me at (716) 647-4766 if you have any questions regarding this submittal.

Sincerely,

Richard C. Eisenman

Richard C. Eisenman
Senior Environmental Engineer

Enclosure: Revised Figure 2 (Project Schedule)
Community Air Monitoring Plan

cc: Ms. Maura Desmond (NYSDEC, Buffalo Field Unit)
Mr. Daniel King (NYSDEC, Region 9)
Mr. Jeff Konsella (NYSDEC, Albany)
Mr. Matthew Forcucci (NYSDOH, Buffalo)
Mr. Barry Kogut (Bond, Schoeneck & King)
Mr. Gary Klawinski (GZA GeoEnvironmental of New York)
Mr. James Walle (Delphi Automotive Systems, Troy MI)
Ms. Catherine Ver (Delphi)

FIGURE 2 (REVISED)
PROJECT SCHEDULE
FOCUSED REMEDIAL INVESTIGATION AND
FOCUSED FEASIBILITY STUDY
DELPHI HARRISON THERMAL SYSTEMS
WEST LOCKPORT COMPLEX
LOCKPORT, NEW YORK

ID	Task Name	Duration (Work Days)
1	**Monitoring Well Installation ***	**10 days**
2	Well Installation	5 days
3	Well Development	5 days
4	**Supplemental Groundwater Sampling Round 1****	**31 days**
5	Field Work	5 days
6	Lab Analysis	21 days
7	Data Report	5 days
8	**Supplemental Groundwater Sampling Round 2****	**31 days**
9	Field Work	5 days
10	Lab Analysis	21 days
11	Data Report	5 days
12	**Focused Remedial Investigation (FRI) Report *****	**120 days**
13	**Focused Feasibility Study (FFS) Report ******	**150 days**

* The start date for Monitoring Well Installation work will be within fifteen work days following the signing date of the Consent Order; unless the fifteenth day falls between the dates of July 2 – 6, 2001 (Delphi Thermal facility shut-down), whereby the well installation start date will be July 9, 2001.

** The start date for Supplemental Groundwater Sampling Round 1 will be within ten to twenty work days following the end of Monitoring Well Installation/Development work. The start date for Supplemental Groundwater Sampling Round 2 will be within fifty to sixty-five work days following the end of Supplemental Groundwater Sampling Round 1 field work.

*** GZA will need about four work weeks, following receipt of analytical data from the last sample round (Supplemental Groundwater Sampling Round 2), to complete a draft FRI Report. The referenced duration assumes overlap of this task with other FRI/FFS tasks. The referenced duration assumes that the completion of the supplemental groundwater monitoring set forth in the FRI/FFS Work Plan will allow GZA to complete the characterization of the TCE-related contamination at the Site. The duration for submittal of the FRI Report is an estimate, because it will depend upon the result of GZA's evaluation of the need for further groundwater monitoring (see page 8 of the FRI/FFS Work Plan).

**** The referenced duration assumes overlap of this task with other FRI/FFS tasks. The FFS Report shall be submitted within thirty (30) days after Delphi's receipt of NYSDEC's written approval of the FRI Report (or revised FRI Report, whichever one applies). The duration for submittal of the FFS Report is an estimate, because it is dependent on: (a) the time required by NYSDEC to review and approve the FRI Report and (b) whether there is a need for revisions to be made to the initial draft of the FRI Report.

COMMUNITY AIR MONITORING PLAN

ATTACHMENT TO THE HEALTH AND SAFETY PLAN
APPENDIX D - FOCUSED REMEDIAL INVESTIGATION AND FOCUSED FEASIBILITY STUDY WORK PLAN
DELPHI HARRISON THERMAL SYSTEMS
WEST LOCKPORT COMPLEX
LOCKPORT, NEW YORK
DATED APRIL 2001

1.00 INTRODUCTION

In addition to real-time time air monitoring and personal exposure monitoring requirements (specified in HASP Section 5.0), community air monitoring will be conducted at the Delphi Harrison Thermal Systems Site (Site) during field activities to be performed in accordance with the Focused Remedial Investigation/Focused Feasibility Study (FRI/FFS) Work Plan. Table 1 (Revised) summarizes these three types of environmental monitoring, as well as appropriate response actions applicable to the Site. Additional details regarding community air monitoring are presented below.

2.00 COMMUNITY AIR MONITORING

Real-time air monitoring for volatile compounds at the perimeter of the work area will be conducted as follows. Volatile organic compounds will be monitored at the downwind perimeter of the work area at a minimum of once per hour. If total organic vapor levels exceed 5 ppm above background, work activities must be halted and monitoring continued under the provisions of a Vapor Emission Response Plan. Readings shall be recorded and will be available for State (NYSDEC and NYSDOH) personnel to review.

Intrusive work with potential to generate dust/particulates at the Site is expected to include test boring/monitoring well installation. Considering that the subsurface soils encountered during previous work at the Site are moist to wet and rock coring is done with water, GZA does not expect the generation of dust/particulates during our work. Therefore, GZA does not plan to conduct dust/particulate monitoring as part of the NYSDOH Community Air Monitoring Plan requirements. With the exception of the dust/particulate monitoring requirements, the Community Air Monitoring Plan requirements included below follow the NYSDOH suggested guidance.

2.10 Vapor Emission Response Plan

If the ambient air concentration of organic vapors exceeds 5 ppm above background at the perimeter of the work area, activities will be halted and monitoring increased to every 15 minutes. If the organic vapor level decreases below 5 ppm above background, work activities can resume. If the organic vapor levels are greater than 5 ppm over background but less than 10 ppm over background at the perimeter of the work area, activities can resume provided that the organic vapor level 200 feet downwind of the work area or half the distance to the nearest residential or commercial structure, whichever is less, is below 5 ppm over background.

If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown. When work shutdown occurs, downwind air monitoring as directed by the Safety Officer will be implemented.

2.20 Major Vapor Emissions

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

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

If efforts to abate the emission source are unsuccessful and levels above 5 ppm above background persist for more than 30 minutes in the 20-Foot Zone, then the Major Vapor Emission Response Plan shall automatically be placed into effect (See Section 2.30).

2.30 Major Vapor Emissions Response Plan

Upon activation, the following activities will be undertaken:

- Notification of Emergency Response Contacts (including NYSDEC and NYSDOH) and as listed in Section 11.20 of this HASP will go into effect, as specified.

- Local police authorities will immediately be contacted by the Safety Officer and advised of the situation.

- Frequent air monitoring will be conducted at 30-minute intervals within the 20-Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the Safety Officer.

TABLE 1 (REVISED)
ACTION LEVELS
DELPHI HARRISON THERMAL SYSTEMS WEST LOCKPORT COMPLEX SITE

	Monitoring Type	Concentration	Instrument	Monitoring Location	Monitoring Frequency	Required Action
Real time Monitoring	Total VOCs	< 1 ppm sustained above background	PID (10.2 eV)	EZ	at least every 15 minutes	Continue monitoring.
Real time Monitoring	Total VOCs	> 1 ppm sustained above background	PID (10.2 eV)	EZ	continuous	Test for specific compounds with detector tubes (vinyl chloride and trichloroethylene). Set new action level after consulting with SSO.
Community Air Monitoring (intrusive activities only)	Total VOCs	< 5 ppm sustained above background	PID (10.2 eV)	Downwind of EZ	at least every one hour	Continue monitoring of EZ (potential source) and downwind perimeter of the EZ (work zone).
Community Air Monitoring (intrusive activities only)	Total VOCs	> 5 ppm sustained above background (downwind > 5 ppm above upwind)	PID (10.2 eV)	Upwind and Downwind of EZ	at least every 15 minutes	Stop work. Increase monitoring to every 15 minutes. If organic vapor levels are > 5 ppm over background but less than 10 ppm over background at the perimeter of the work area, then work can resume provided the organic vapor level 200 feet downwind of the work area or half the distance to the nearest structure is < 5 ppm. If the level is > 5 ppm 200 feet downwind, follow procedures outlined in Major Vapor Emissions section of this HASP attachment.
Community Air Monitoring (intrusive activities only)	Total VOCs	> 25 ppm sustained above background	PID (10.2 eV)	Downwind of EZ	continuous	Stop work. Follow air monitoring procedures outlined in Major Vapor Emissions section of this HASP attachment.
Real time Monitoring	Combustible Gas	<10% LEL	CGI	EZ	at least every 15 minutes	Eliminate all ignition sources.
Real time Monitoring	Combustible Gas	>10% LEL	CGI	EZ	continuous	Eliminate all ignition sources. Stop work and contact SSO. Evaluate cause of gas. Verify LEL readings have abated prior to resumption of activities.
Particulate Monitoring	Not Planned					Not Planned

NOTES: EZ = Exclusion Zone (work zone); LEL = Lower Explosive Limit; VOCs = Volatile Organic Compounds; SSO = Site Safety Officer

DELPHI

Automotive Systems

RECEIVED
JUL 11 2001
GZA-BUFFALO

July 9, 2001

Mr. Peter Buechi, Region 9
Division of Environmental Remediation
New York State Department of Environmental Conservation
270 Michigan Avenue
Buffalo, New York 14203

Re: Order On Consent # B9-0553-99-06
Delphi Harrison Thermal Systems West Lockport Complex
NYSDEC Registry Site # 932113

Dear Mr. Buechi:

As required by the Consent Order referenced above, Delphi Harrison Thermal Systems (Delphi) is providing notification of the commencement of fieldwork to be conducted pursuant to the order. Installation of monitoring wells is expected to begin on July 24, 2001.

You may contact me at (716) 647-4766 if you have any questions.

Sincerely,

Richard C. Eisenman

Richard C. Eisenman
Senior Environmental Engineer

cc: Mr. Glenn May (NYSDEC, Region 9)
Ms. Maura Desmond (NYSDEC, Buffalo Field Unit)
Mr. Barry Kogut (Bond, Schoeneck & King)
Mr. Gary Klawinski (GZA GeoEnvironmental of New York)
Mr. James Walle (Delphi Automotive Systems, Troy MI)
Ms. Catherine Ver (Delphi)

New York State Department of Environmental Conservation
Division of Environmental Remediation, Region 9
270 Michigan Avenue, Buffalo, New York 14203-2999
Phone: (716) 851-7220 • **FAX:** (716) 851-7226
Website: www.dec.state.ny.us

Erin M. Crotty
Commissioner

February 8, 2002

Mr. Richard Eisemann
Delphi Energy and Chassis Systems
P.O. Box 92700
Rochester, New York 14692

Dear Mr. Eisemann:

Supplemental Groundwater Sampling Report
October 2001 Sample Round
Delphi Thermal Site, Registry No. 932113

The New York State Departments of Health and Environmental Conservation have completed review of the subject report submitted by Delphi Harrison Thermal Systems (Delphi) in December 2001. This report presents the analytical results of groundwater samples collected from selected on-site wells and further evaluates natural attenuation parameters for the site. This work was completed as part of the Remedial Investigation (RI) being conducted at the site. Since the submittal of the Supplemental Groundwater Sampling Report completes the RI field activities, Delphi should have its consultant proceed with the completion of the RI Report.

The analytical results from the October 2001 sample round are consistent with previous analytical results for the site; concentrations of trichloroethene (TCE) and its breakdown products dichloroethene (DCE) and vinyl chloride (VC) decrease with increasing distance from the source area. While TCE was not detected in the most downgradient wells (MW-11, MW-12, MW-13, MW-14 and MW-15), low concentrations of DCE and VC were detected in some of these wells, thereby remaining a source of potential future off-site migration of TCE breakdown products. Low concentrations of tetrachloroethene (PCE) were also detected in downgradient well MW-15. Given these results, it is premature to conclude that further off-site monitoring is not needed. Rather, the potential for future off-site impacts should be discussed in the RI Report and evaluated in detail in the Feasibility Study (FS) Report.

Should you have any questions, please feel free to contact me at 716/851-7220.

Sincerely yours,

Glenn M. May

Glenn M. May, CPG
Engineering Geologist I

GMM/tml

cc: Mr. Daniel King, NYSDEC, Region 9
Mr. Jeff Konsella, NYSDEC, Albany
Mr. Matthew Forcucci, NYSDOH, Buffalo

APPENDIX B

TEST BORING AND MONITORING WELL LOGS

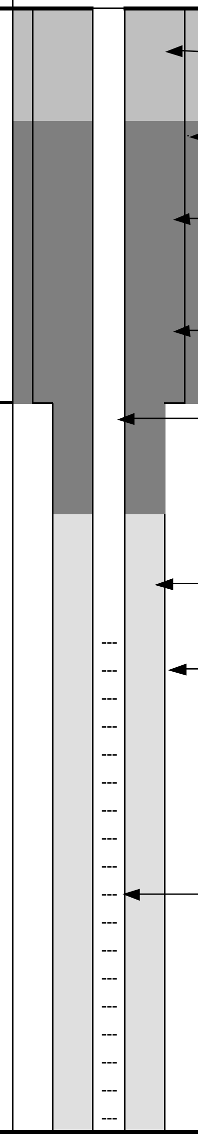
Delphi Harrison Thermal Systems
Focused Remedial Investigation
West Lockport Complex
Lockport, NY

CONTRACTOR	Earth Dimensions, Inc.	BORING LOCATION	See Location Plan
DRILLER	S. Gingrich	GROUND SURFACE ELEVATION	611.9 DATUM NGVD
START DATE	08/31/1995 END DATE 09/01/1995	GZA GEOENVIRONMENTAL REPRESENTATIVE	G. Klawinski

WATER LEVEL DATA				
DATE	TIME	WATER	CASING	NOTES
08/31/1995	4:15	6.5	7.5	

TYPE OF DRILL RIG	Diedrich D-50
CASING SIZE AND DIAMETER	6-1/4" HSA
OVERBURDEN SAMPLING METHOD	2"OD X 24" Split Spoon Sampler
ROCK DRILLING METHOD	HQ Size Rock Core

DEPTH	SAMPLE BLOWS (/6")	SAMPLE NO.	SAMPLE DEPTH (FT)	SAMPLE N-VALUE /RQD %	SAMPLE RECOVERY (%)	SAMPLE DESCRIPTION	EQUIPMENT DESCRIPTION	OVM (ppm)
	4					Loose, Gray, F/C SAND and		
1	4	S-1	0 - 2	8	30	GRAVEL, Damp (Fill).	Concrete surface seal	ND
	4						to 2.0 ft.	
2	4							
	3	S-2	2 - 4	5	30		4 " Steel Casing to	ND
3	3						7 feet.	
	2							
4	3						Cement and bent. grout	
	5	S-3	4 - 6	6	30		from 2 to 7 feet.	12
5	4					... grades to wet		
	2							
6	1						Bentonite Pellets	
	6	S-4	6 - 8	NA	5		from 5.0 to 9.0 ft.	150
7	2					Split spoon and auger refusal @ 7.0'		
	$100^{+}/0$					BEDROCK	2 inch PVC flush	
8		C-1	7 - 11.9	57	100	LOCKPORT DOLOMITE FORMATION	coupled riser pipe	
						Gray, hard,very slight to	to 11.3 feet.	
9						moderate weathering, fine		
						grained horizontal and low angle		
10						fractures.		
							Morie Sand #N00	
11							from 9 to 26.3 feet	
12							Nominal 3.75" diameter	
		C-2	11.9 - 17	88	100		rock hole 7 to 26.3 feet.	
13								
14								
15								
16							2 inch PVC Screen	
							SCH. 40, 10 slot,	
17							from 11.3 to 26.3 feet.	
		C-3	17 - 22.2	96	100			
18								
19								
20								



Note: See notes on Page 2

DEPTH	SAMPLE BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)	SAMPLE DESCRIPTION	EQUIPMENT DESCRIPTION		OVM (ppm)

21							---		

22							---		
		C-4	22.2 - 26.3	96	100		---		
23							---		

24							---		

25							---		

26							---		
27						Bottom of Boring 26.3 Feet			
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									
41									
42									

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) HNu PI - 101organic vapor meter used to screen soil samples.
Meter was calibrated to the equivalent of 54 ppm benzene in air.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

GZA GEOENVIRONMENTAL OF NEW YORK

Delphi Harrison Thermal Systems
Focused Remedial Investigation
West Lockport Complex
Lockport, NY

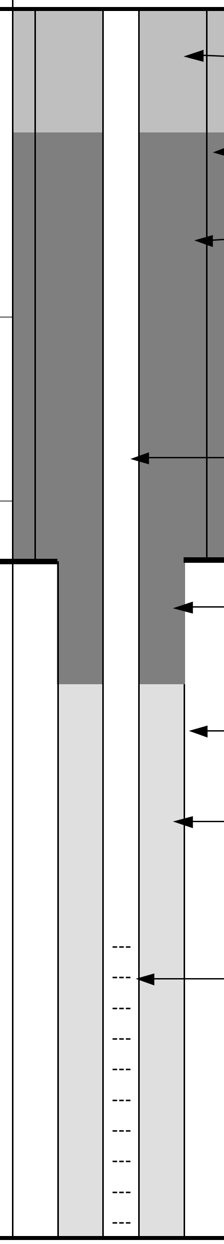
BORING No. MW-2
SHEET 1 OF 2
FILE No. 55039.2
CHECKED BY SHB

CONTRACTOR	Earth Dimensions, Inc.	BORING LOCATION	See Location Plan
DRILLER	S. Gingrich	GROUND SURFACE ELEVATION	613.1 DATUM NGVD
START DATE	08/31/1995 END DATE 09/04/1995	GZA GEOENVIRONMENTAL REPRESENTATIVE	G. Klawinski

WATER LEVEL DATA				
DATE	TIME	WATER	CASING	NOTES
08/31/1995	1:30	Dry	8.9	
08/31/1995	1:45	Dry	8.9	

TYPE OF DRILL RIG	Diedrich D-50
CASING SIZE AND DIAMETER	6-1/4" HSA
OVERBURDEN SAMPLING METHOD	2"OD X 24" Split Spoon Sampler
ROCK DRILLING METHOD	HQ Size Rock Core

DEPTH	SAMPLE BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)	SAMPLE DESCRIPTION	EQUIPMENT DESCRIPTION	OVM (ppm)
	5					Very stiff, brown, SILT & CLAY,		
1	10	S-1	0 - 2	20	75	little f/c Sand, damp.	Concrete surface seal	ND
	10						to 2.0 ft.	
2	8							
	6	S-2	2 - 4	14	50	...grades to stiff	4" Steel Casing to	ND
3	7						8.9 feet	
	7							
4	8						Cement and bent. grout	
	2	S-3	4 - 6	6	80	...grades to medium	from 2 to 8.9 feet.	ND
5	3							
	3					Medium stiff, brown Clayey SILT,		
6	4					some f/c Sand, moist.		
	1	S-4	6 - 8	16	100			ND
7	3					...grades to very stiff, moist to wet		
	13						2 inch PVC flush	
8	16						coupled riser pipe	
	49	S-5	8 - 8.9	NA	70	Weathered bedrock and f/c SAND	to 15.0 feet.	ND
9	50/0.4					Auger refusal at 8.9 feet		
10		C-1	8.9 - 13.9	54	100	BEDROCK	Bentonite Pellets	
						LOCKPORT DOLOMITE FORMATION	from 7.0 to 11.0 ft.	
11						Gray, hard,very slight to		
						moderate weathering, fine		
12						grained horizontal and low angle	Nominal 3.75" diameter	
						fractures.	rock hole 8.9 to 26.3	
13							feet.	
							Morie Sand #N00	
14							from 11 to 30 feet	
		C-2	13.9 - 19.2	92	100			
15								
16							2 inch PVC Screen	
							SCH. 40, 10 slot,	
17							from 15.0 to 30.0 feet.	
18								
19								
		C-3	19.2 - 25.1	92	100			
20								



DEPTH	SAMPLE BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)	SAMPLE DESCRIPTION	EQUIPMENT DESCRIPTION		OVM (ppm)
21							---		
22							---		
23							---		
24							---		
25							---		
		C-4	25.1 - 30.0	100	100		---		
26							---		
27							---		
28							---		
29							---		
30							---		
						Bottom of Boring 30.0 Feet			
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									
41									

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) HNu PI - 101organic vapor meter used to screen soil samples.
Meter was calibrated to the equivalent of 54 ppm benzene in air.

General Notes: 1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Delphi Harrison Thermal Systems
Focused Remedial Investigation
West Lockport Complex
Lockport, NY

CONTRACTOR	Earth Dimensions, Inc.	BORING LOCATION	See Location Plan
DRILLER	S. Gingrich	GROUND SURFACE ELEVATION	611.9 DATUM NGVD
START DATE	08/31/1995 END DATE 09/04/1995	GZA GEOENVIRONMENTAL REPRESENTATIVE	G. Klawinski

WATER LEVEL DATA

DATE	TIME	WATER	CASING	NOTES
08/31/1995	11:50	Dry	8.9	
08/31/1995	1:45	Dry	8.9	

TYPE OF DRILL RIG	Diedrich D-50
CASING SIZE AND DIAMETER	6-1/4" HSA
OVERBURDEN SAMPLING METHOD	2"OD X 24" Split Spoon Sampler
ROCK DRILLING METHOD	HQ Size Rock Core

DEPTH	BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)	SAMPLE DESCRIPTION	EQUIPMENT DESCRIPTION	OVM (ppm)
	7					Hard, brown, SILT & CLAY,		
1	16	S-1	0 - 2	39	75	little f/c Sand, damp.	Concrete surface seal	ND
	23						to 2.0 ft.	
2	26							
	5	S-2	2 - 4	19	75	...grades to Stiff, CLAY & SILT		ND
3	10						4" steel casing to	
	9						8.9 feet.	
4	11						Cement and bent. grout	
	22	S-3	4 - 4.6	NA	100	...rock fragments in split spoon	from 2 to 8.9 feet.	ND
5	50/0.1							
6								
	5	S-4	6 - 8	35	65	Hard, brown Clayey SILT,		40
7	17					some f/c Sand, moist.		
	18						2 inch PVC flush	
8	26						coupled riser pipe	
	20	S-5	8 - 8.8	NA	20	... grades with intermixed rock frags.	to 12.7 feet.	50
9	100/0.3					Auger refusal at 8.9 feet		
10		C-1	8.8 - 13.8	88	92	BEDROCK	Bentonite Pellets	
						LOCKPORT DOLOMITE FORMATION	from 6.5 to 10.5 ft.	
11						Gray, hard,very slight to		
						moderate weathering, fine		
12						grained horizontal and low angle	Nominal 3.75" diameter	
						fractures.	rock hole to 27.7 feet.	
13								
							Morie Sand #N00	
14							from 10.5 to 27.7 feet	
		C-2	13.8 - 19.0	100	100			
15								
16							2 inch PVC Screen	
							SCH. 40, 10 slot,	
17							from 12.7 to 27.7 feet.	
18								
19								
		C-3	19.0 - 22.5	100	100			
20								

DEPTH	SAMPLE BLOWS (/6")	SAMPLE NO.	SAMPLE DEPTH (FT)	SAMPLE N-VALUE /RQD %	SAMPLE RECOVERY (%)	SAMPLE DESCRIPTION	EQUIPMENT DESCRIPTION		OVM (ppm)
21							---		
22							---		
23		C-4	22.5 - 27.7	100	100		---		
24							---		
25							---		
26							---		
27							---		
28						Bottom of Boring 27.7 feet			
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) HNu PI - 101organic vapor meter used to screen soil samples. Meter was calibrated to the equivalent of 54 ppm benzene in air.

General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Delphi Harrison Thermal Systems
Focused Remedial Investigation
West Lockport Complex
Lockport, NY

CONTRACTOR	Earth Dimensions, Inc.	BORING LOCATION	See Location Plan
DRILLER	S. Gingrich	GROUND SURFACE ELEVATION	612.0 DATUM NGVD
START DATE	12/18/1995 END DATE 01/03/1996	GZA GEOENVIRONMENTAL REPRESENTATIVE	B. Klettke/G. Klawinski

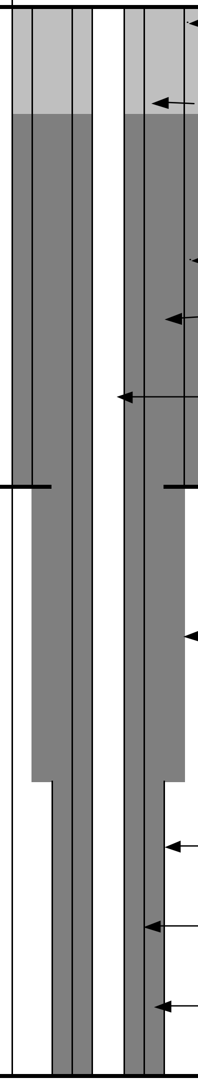
WATER LEVEL DATA

DATE	TIME	WATER	CASING	NOTES
08/31/1995	11:50	Dry	8.9	
08/31/1995	1:45	Dry	8.9	

TYPE OF DRILL RIG	Mobile B-81
CASING SIZE AND DIAMETER	8-1/4" HSA
OVERBURDEN SAMPLING METHOD	2"OD X 24" Split Spoon Sampler
ROCK DRILLING METHOD	NQ Size Rock Core (29' to 38')
	HQ Size Rock Core (38' to 70.3')

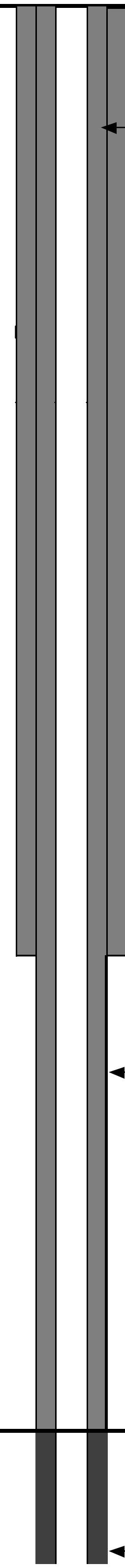
DEPTH	BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)	SAMPLE DESCRIPTION
0–4						Augerted 0' - 4' without sampling.
4	3	S-1	4 - 6	12	80	Stiff, brown Clayey SILT, little fine to coarse Sand, moist to wet
5	3					
	9					
6	12					
	8	S-2	6 - 8	25	65	
7	7					
	18					
8	26					
	6	S-3	8 - 9.1	63/0.8'	70	
9	34					Auger refusal at 9.1 feet
	29					
10						Drilled from 9.1' to 14.5' with a 7-7/8" diameter roller bit. (No samples collected)
15						Drilled from 14.5' to 28' with a 5-7/8" diameter roller bit. (No samples collected)
20						

EQUIPMENT DESCRIPTION



6" diam. Steel casing (3' above ground to 2' below ground)
Concrete surface seal to 2.0 ft.
Nominal 12" diam. hole to 9.1'
6" diam. PVC casing Sch. 80 2.0' to 14.5'
Cement and bent. grout from 2 to 14.5 feet.
2 inch PVC, Sch. 40 coupled riser pipe 2.6" above ground to 59.8' below ground
Nominal 7-7/8" diameter hole from 9.1" to 14.5'
Nominal 5-7/8" diameter hole from 14.5' to 38.0'
4" diam. PVC casing Sch. 80 to 38.0'
Cement/bentonite grout seal around 4" diam. casing to 38.0'

OVM (ppm)

DEPTH	SAMPLE BLOWS (/6")	SAMPLE NO.	SAMPLE DEPTH (FT)	SAMPLE N-VALUE /RQD %	SAMPLE RECOVERY (%)	SAMPLE DESCRIPTION	EQUIPMENT DESCRIPTION		OVM (ppm)
21									
22								Cement/bentonite grout seal around 2" diam. PVC well riser to 47.0'	
23									
24						No loss of water observed during drilling from 9.1' to 28'.			
25									
26									
27									
28									
		C-1	28.0 - 38.0	98	100	Lockport Dolomite Formation Gray, hard, very slight to moderate weathering, fine grained horizontal and low angle fractures			
29									
30									
31						No water loss observed during coring from 28' to 38'			
32									
33									
34									
35									
36									
37									
38									
		C-2	38.0 - 41.4	100	100	No water loss observed during coring from 38' to 70.3'			
39									
40									
41								Nominal 3-3/4" diameter hole from 38.0' to 70.3'	
		C-3	41.1 - 46.3	98	100				
42									
43									
44									
45									
46									
		C-4	46.3 - 51.5	90	100				
47									
48									
49								Bentonite Pellet Seal	

DEPTH	SAMPLE BLOWS (/6")	SAMPLE NO.	SAMPLE DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)	SAMPLE DESCRIPTION	EQUIPMENT DESCRIPTION		OVM (ppm)
50								47.0' to 57.0'	
51						Transition zone from the Lockport Formation to the Rochester Shale Formation		Nominal 3-3/4" diameter hole from 38.0' to 70.3'	
52		C-5	51.5 - 56.5	98	99				
53									
54									
55									
56									
57		C-6	56.5 - 61.4	94	98				
58									
59									
60								Sandpack (Sidney size No. 1240) 57.0' to 70.3'	
61									
62		C-7	61.4 - 66.6	96	96	Rochester Shale Formation			
63									
64								2" PVC Screen Sch. 40 No. 10 Slot from 59.8' to 69.8'	
65									
66									
67		C-8	66.6 - 70.3	92	100				
68									
69									
70						Bottom of Boring @ 70.3'			
71									

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) HNu PI - 101organic vapor meter used to screen soil samples. Meter was calibrated to the equivalent of 54 ppm benzene in air.

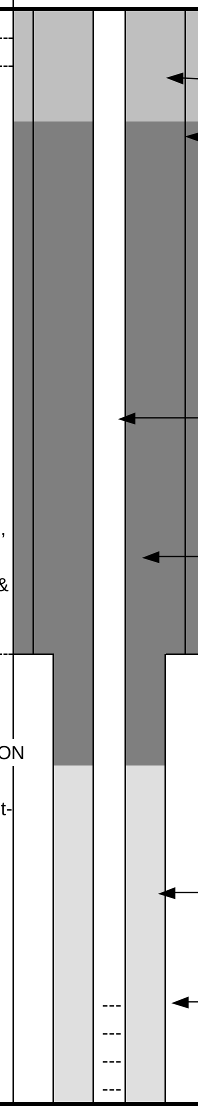
General Notes:
1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Delphi Harrison Thermal Systems
Focused Remedial Investigation
West Lockport Complex
Lockport, NY

CONTRACTOR	Earth Dimensions, Inc.	BORING LOCATION	See Location Plan
DRILLER	S. Gingrich	GROUND SURFACE ELEVATION	610.8 DATUM NGVD
START DATE	04/05/1996 END DATE 04/08/1996	GZA GEOENVIRONMENTAL REPRESENTATIVE	T. Seider

WATER LEVEL DATA				
DATE	TIME	WATER	CASING	NOTES
04/05/1996	12:10	Dry	11.5	60 min. stab.
04/05/1996	15:25	Dry	11.5	
04/08/1996	8:30	7.0	11.5	

TYPE OF DRILL RIG	Mobile B-61
CASING SIZE AND DIAMETER	6-1/4" HSA
OVERBURDEN SAMPLING METHOD	2" O.D. x 24" Split Spoon Sampler
ROCK DRILLING METHOD	HQ Size Rock Core

DEPTH	SAMPLE BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)	SAMPLE DESCRIPTION	WELL INSTALLATION DIAGRAM	WELL INSTALLATION DESCRIPTION	OVM (ppm)
	15	S-1	0 - 2	12	50	ASPHALT CONCRETE		Top of Riser Elev.=	ND
1	8					GRAVEL Subbase		613.07'	
	4					Stiff, dark brown to black, SILT &		Concrete surface seal	
2	6					CLAY, little fine to medium Sand,		to 2.0 ft.	
	4	S-2	2 - 4	14	15	moist		4 " Steel Casing to	ND
3	4					...Grades reddish brown		11.6 feet.	
	10							Cement/bentonite grout	
4	14							from 2 to 11.6 feet.	
	4	S-3	4 - 6	14	60	Stiff, reddish brown, CLAY &			ND
5	6					SILT, trace fine to medium Sand,		10" nominal diameter	
	8					moist		borehole to 11.6'.	
6	11								
	5	S-4	6 - 8	14	45				ND
7	6								
	8							2 inch PVC flush	
8	9							coupled riser pipe	
	3	S-5T	8 - 10	11	60			to 17.5 feet.	2
9	4					Stiff, dark brown to black, Clayey			
	7					SILT, trace Sand, trace Organics,			
10	9	S-5B				moist (9.5'-10.0')		Bentonite Pellets	3
	3	S-6	10 - 11.6	41	30	Hard, dark brown and tan CLAY &		from 9.2 to 13.6 ft.	30
11	13					SILT, Rock fragments @ 11.5'			
	28								
12	50/0.1'	C-1	11.6 - 17.0	83	100	Auger refusal @ 11.6'			
13						BEDROCK			
						LOCKPORT DOLOMITE FORMATION			
14						Gray, hard, slight to moderate			
						weathering, fine-grained, horizont-			
15						al and low angle fractures			
16								Sidley Sand #1240	
								from 13.6 to 32.5 feet	
17									
		C-2	17.0 - 22.2	98	98				
18								Nominal 3.75" diameter	
								rock hole 11.5 to 32.5	
19								feet.	

Note: See notes on Page 2

DEPTH	SAMPLE BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)	SAMPLE DESCRIPTION	WELL INSTALLATION DIAGRAM	WELL INSTALLATION DESCRIPTION	OVM (ppm)
20									
21									
22								2 inch PVC Screen SCH. 40, 10 slot, from 17.5 to 32.5 feet.	
		C-3	22.2 - 27.4	100	100				
23									
24									
25									
26									
27									
		C-4	27.4 - 32.5	96	100				
28									
29									
30									
31									
32									
33						Bottom of Boring 32.5 Feet			
34									
35									
36									
37									
38									
39									
40									

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) HNu PI - 101 organic vapor meter used to screen soil samples. Meter was calibrated to the equivalent of 57 ppm benzene in air.
2) Collected 4 oz. analytical sample of soil from 10.0'-11.5'.

General Notes:
1) Stratification lines represent approximate boundary between soil types; transitions may be gradual.
2) Water level readings have been made at times and under conditions stated; fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Delphi Harrison Thermal Systems
Focused Remedial Investigation
West Lockport Complex
Lockport, NY

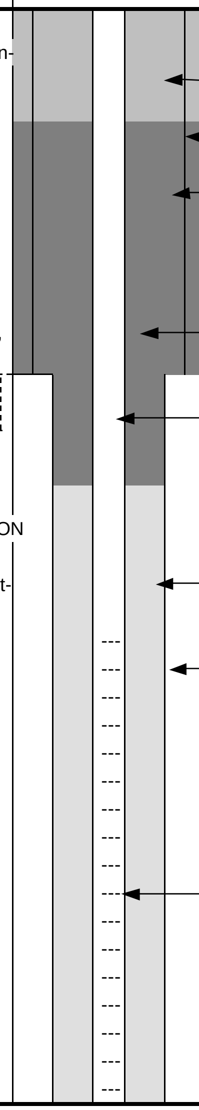
BORING No. MW-5
SHEET 1 OF 2
FILE No. 55039.2
CHECKED BY SHB

CONTRACTOR	Earth Dimensions, Inc.	BORING LOCATION	See Location Plan
DRILLER	S. Gingrich	GROUND SURFACE ELEVATION	607.0 DATUM NGVD
START DATE	04/05/1996 END DATE 04/08/1996	GZA GEOENVIRONMENTAL REPRESENTATIVE	T. Seider

WATER LEVEL DATA

DATE	TIME	WATER	CASING	NOTES
04/05/1996	12:50	Dry	6.2	20 min. stab.
04/08/1996	8:30	3.0	6.2	

TYPE OF DRILL RIG	Mobile B-61
CASING SIZE AND DIAMETER	6-1/4" HSA
OVERBURDEN SAMPLING METHOD	2" O.D. x 24" Split Spoon Sampler
ROCK DRILLING METHOD	HQ Size Rock Core

DEPTH	SAMPLE BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)	SAMPLE DESCRIPTION	WELL INSTALLATION DIAGRAM	WELL INSTALLATION DESCRIPTION	OVM (ppm)
	1	S-1	0 - 2	8	60	Stiff, brown, SILT & CLAY, little		Top of Riser Elev.=	ND
1	4					fine to medium Sand, trace Organ-		609.05'	
	4					ics, moist		Concrete surface seal	
2	8							to 2.0 ft.	
	7	S-2	2 - 4	14	65	Stiff, reddish-brown, CLAY &		4 " Steel Casing to	ND
3	6					SILT, trace fine to coarse Sand,		6.2 feet.	
	8					trace fine Gravel, moist		Cement/bentonite grout	
4	7							from 2 to 6.2 feet.	
	2	S-3	4 - 6	7	90	…Grades medium stiff, moist to		Nominal 10" diameter	ND
5	3					wet		borehole to 6.2'.	
	4								
6	7					Dark brown to black Clayey SILT,		Bentonite Pellets	
	50/0.3'	S-4	6 - 6.3		90	little Organics, moist (6.0'-6.2')		from 3.5 to 8.4 ft.	ND
7		C-1	6.2 - 11.3	84	98	Reddish-brown CLAY & SILT,			
						moist to wet (6.2'-6.3')		2 inch PVC flush	
8						Auger refusal @ 6.2'		coupled riser pipe	
								to 11.6 feet.	
9						BEDROCK			
						LOCKPORT DOLOMITE FORMATION			
10						Gray, hard, slight to moderate			
						weathering, fine-grained, horizont-		Sidley Sand #1240	
11						al and low angle fractures		from 8.4 to 26.6 feet	
		C-2	11.3 - 16.4	100	100				
12								Nominal 3.75" diameter	
								rock hole 6.5 to 26.6	
13								feet.	
14									
15									
16								2 inch PVC Screen	
		C-3	16.4 - 21.5	96	100			SCH. 40, 10 slot,	
17								from 11.6 to 26.6 feet.	
18									
19									

DEPTH	SAMPLE BLOWS (/6")	SAMPLE NO.	SAMPLE DEPTH (FT)	SAMPLE N-VALUE /RQD %	SAMPLE RECOVERY (%)	SAMPLE DESCRIPTION	WELL INSTALLATION DIAGRAM	WELL INSTALLATION DESCRIPTION	OVM (ppm)
20							---		

21							---		

22		C-4	21.5 - 26.6	98	100		---		

23							---		

24							---		

25							---		

26							---		
27									
						Bottom of Boring 26.6 Feet			
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) HNu PI - 101 organic vapor meter used to screen soil samples.
Meter was calibrated to the equivalent of 57 ppm benzene in air.

General Notes:
1) Stratification lines represent approximate boundary between soil types; transitions may be gradual.
2) Water level readings have been made at times and under conditions stated; fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

GZA GEOENVIRONMENTAL OF NEW YORK

Delphi Harrison Thermal Systems
Focused Remedial Investigation
West Lockport Complex
Lockport, NY

BORING No. MW-6
SHEET 1 OF 1
FILE No. 55039.2
CHECKED BY SHB

CONTRACTOR	Earth Dimensions, Inc.	BORING LOCATION	See Location Plan
DRILLER	S. Gingrich	GROUND SURFACE ELEVATION	609.1 DATUM NGVD
START DATE 04/09/1996	END DATE 04/12/1996	GZA GEOENVIRONMENTAL REPRESENTATIVE	B. Klettke

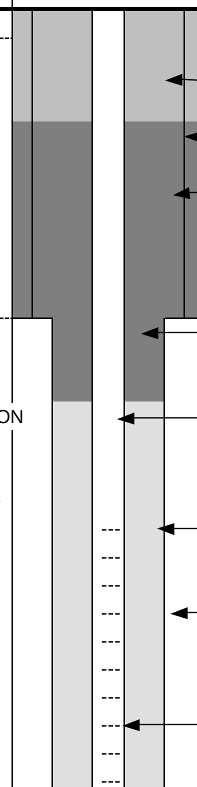
WATER LEVEL DATA

DATE	TIME	WATER	CASING	NOTES
04/09/1996	10:50	Dry	5.3	
04/09/1996	11:32	Dry	5.3	
04/12/1996	11:30	7.4	Open hole to 13.9'	

TYPE OF DRILL RIG	Mobile B-61
CASING SIZE AND DIAMETER	6-1/4" HSA
OVERBURDEN SAMPLING METHOD	2" O.D. x 24" Split Spoon Sampler
ROCK DRILLING METHOD	HQ Size Rock Core

DEPTH	SAMPLE BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)	SAMPLE DESCRIPTION	WELL INSTALLATION DESCRIPTION	OVM (ppm)
	3	S-1	0 - 2	14	75	Dark brown TOPSOIL (0.0'-0.5')	Top of Riser Elev.=	0
1	7					Stiff, brown, CLAY & SILT, trace	611.21'	
	7					fine to coarse Sand, moist	Concrete surface seal	
2	6						to 2.0 ft.	
	5	S-2	2 - 4	9	80		4 " Steel Casing to	0
3	4					...Grades wet @ 3.0'	5.3 feet.	
	5						Cement/bentonite grout	
4	54						from 2 to 5.3 feet.	
	30	S-3	4 - 4.7	100/0.2'	90	Fractured rock fragments from	10" Nominal diameter	
5	100/0.2'					4.5' to 4.7'	borehole to 5.3'.	
		C-1	5.3 - 10.3	60	100	Auger refusal @ 5.3'		
6						Clay seam from 5.9' to 6.0'	Bentonite Pellets	
							from 4.0 to 7.0 ft.	
7						BEDROCK		
						LOCKPORT DOLOMITE FORMATION	2 inch PVC flush	
8						Gray, hard,very slight to	coupled riser pipe	
						moderate weathering, fine	to 8.9 feet.	
9						grained, horizontal and low angle		
						fractures.	Sidley Sand #1240	
10							from 7 to 13.9 feet	
		C-2	10.3 - 13.9	96	96			
11							Nominal 3.75" diameter	
							rock hole 5.3 to 13.9	
12							feet.	
13							2 inch PVC Screen	
							SCH. 40, 10 slot,	
14							from 8.9 to 13.9 feet.	
						Bottom of Boring @ 13.9'		
15								
16								

WELL INSTALLATION DIAGRAM



S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) HNu PI - 101 organic vapor meter used to screen soil samples.
Meter was calibrated to the equivalent of 57 ppm benzene in air.
2) Collected 4 oz. analytical sample of soil from 3.8'-4.5'.

General Notes: 1) Stratification lines represent approximate boundary between soil types; transitions may be gradual.
2) Water level readings have been made at times and under conditions stated; fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

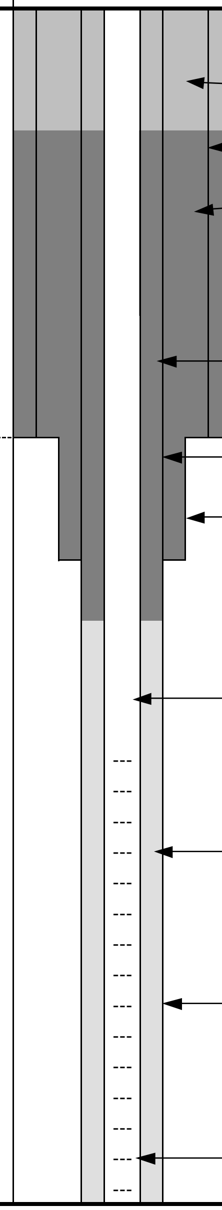
CONTRACTOR	Earth Dimensions, Inc.	BORING LOCATION	See Location Plan
DRILLER	S. Gingrich	GROUND SURFACE ELEVATION	612.3 DATUM NGVD
START DATE	04/06/1996 END DATE 04/15/1996	GZA GEOENVIRONMENTAL REPRESENTATIVE	B. Klettke

WATER LEVEL DATA				
DATE	TIME	WATER	CASING	NOTES
04/09/1996	13:40	6.9	7.0	15 min. stab.

TYPE OF DRILL RIG	Mobile B-61
CASING SIZE AND DIAMETER	8-1/4" HSA
OVERBURDEN SAMPLING METHOD	None
ROCK DRILLING METHOD	HQ Size Rock Core

DEPTH	SAMPLE BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)	SAMPLE DESCRIPTION	WELL INSTALLATION DESCRIPTION	OVM (ppm)
						Driller augered to auger refusal	Top of Riser Elev.=	
1						at 7.0' without sampling.	613.86'	
							Concrete surface seal	
2							to 2.0 ft.	
							6 " Steel Casing to	
3							7 feet.	
							Cement/bentonite grout	
4							from 2 to 9 feet.	60
5							10" Nominal diameter	
							borehole to 7.0'	
6							Bentonite Pellets	
							from 5.0 to 9.9 ft.	
7						Auger refusal @ 7.0'		
		C-1	7.0 - 9.0	20	40	BEDROCK	4" Steel Casing to	
8						LOCKPORT DOLOMITE FORMATION	9 feet.	
						Gray, hard,very slight to	5-3/4" Nominal	
9						slight weathering, fine grained,	diameter borehole 7.0'	
		C-2	9.0 - 14.0	74	100	horizontal and low angle fractures.	to 9.0'	
10								
11								
							2 inch PVC flush	
12							coupled riser pipe	
							to 12.2 feet.	
13								
14							Sidley Sand #1240	
		C-3	14.0 - 19.2	89	94		from 9.9 to 27.2 feet	
15								
16								
							Nominal 3.75" diameter	
17							rock hole 9 to 27.2 feet.	
18								
							2 inch PVC Screen	
19							SCH. 40, 10 slot,	
		C-4	19.2 - 24.1	100	100		from 12.2 to 27.2 feet.	

WELL INSTALLATION DIAGRAM



DEPTH	SAMPLE BLOWS (/6")	SAMPLE NO.	SAMPLE DEPTH (FT)	SAMPLE N-VALUE /RQD %	SAMPLE RECOVERY (%)	SAMPLE DESCRIPTION	WELL INSTALLATION DIAGRAM	WELL INSTALLATION DESCRIPTION	OVM (ppm)
20									
21									
22									
23									
24									
		C-5	24.1 - 27.2	97	100				
25									
26									
27									
						Bottom of Boring @ 27.2 Feet			
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									

S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) HNu PI - 101 organic vapor meter used to screen soil samples. Meter was calibrated to the equivalent of 57 ppm benzene in air.
2) OVM reading shown taken on auger spoils.

General Notes:
1) Stratification lines represent approximate boundary between soil types; transitions may be gradual.
2) Water level readings have been made at times and under conditions stated; fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

GZA GEOENVIRONMENTAL OF NEW YORK

Delphi Harrison Thermal Systems
Focused Remedial Investigation
West Lockport Complex
Lockport, NY

BORING No. MW-8
SHEET 1 OF 1
FILE No. 55039.2
CHECKED BY SHB

CONTRACTOR	Earth Dimensions, Inc.	BORING LOCATION	See Location Plan
DRILLER	S. Gingrich	GROUND SURFACE ELEVATION	606.6 DATUM NGVD
START DATE	10/15/1996 END DAT 10/17/1996	GZA GEOENVIRONMENTAL REPRESENTATIVE	T. Seider

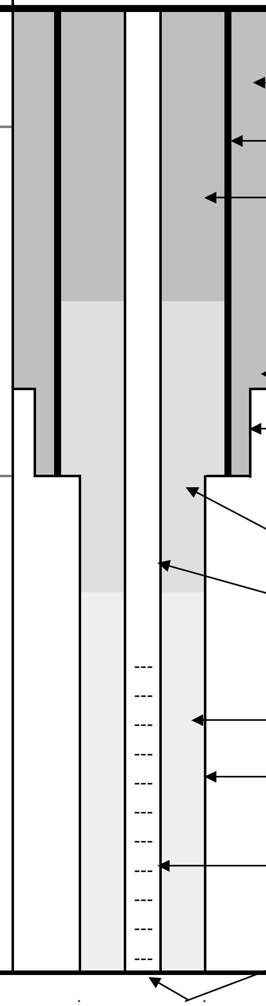
WATER LEVEL DATA

DATE	TIME	WATER	CASING	NOTES

TYPE OF DRILL RIG	Dedrich D-50
CASING SIZE AND DIAMETER	6-1/4" HSA
OVERBURDEN SAMPLING METHOD	2" O.D. x 24" Split Spoon Sampler
ROCK DRILLING METHOD	HQ Size Rock Core

DEPTH	SAMPLE BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)	SAMPLE DESCRIPTION	WELL INSTALLATION DESCRIPTION	OVM (ppm)
	8	S-1	0 - 2	57	50	Grey, Very dense, f-c SAND,	Top of Riser Elev.=	2
1	23					some f-c Gravel, littler clayey silt,		
	34					moist, (parking area gravel).	Concrete surface seal	
2	8						to 2.0 ft.	
	5	S-2	2 - 4	13	55	Redish brown, Stiff, SILT & CLAY,	4 " Steel Casing to	ND
3	6					some f-c Sand, moist.	8.1 feet.	
	7						Cement/bentonite grout	
4	7						to 5 feet.	
	3	S-3	4 - 6	9	65	Redish brown, Stiff, CLAY & SILT,		1
5	5					little f-m Sand, moist to wet.	Nominal 10" diameter	
	4						borehole to 6.8 feet.	
6	4							
	3	S-4	6 - 6.8	-	5	same	Cement/bentonite grout,	1
7	75/4"						2 to 8.1 feet.	
						Split Spoon and Auger refusal @	Nominal 3-7/8" diameter	
8						6.8', Roller bit to 8.1'	roller bit hole,	
		C-1	8.1 - 13.3	86.5	100		6.8 to 8.1 feet.	
9								
							Bentonite Chips,	
10							5 to 10 ft.	
							2 inch PVC flush	
11							coupled riser pipe	
						LOCKPORT DOLOMITE FORMATION	to 11.3 feet.	
12								
							Sidley Sand #1240,	
13							10 to 16.3 feet	
		C-2	13.3 - 16.3	89.0	98.3		Nominal 3.75" diameter	
14							rock hole, 8.1 to 16.3	
							feet.	
15							2 inch PVC Screen	
							SCH. 40, 10 slot,	
16							from 11.3 to 16.3 feet.	
							PVC end cap at 16.3 ft.	
17						Bottom of Boring 16.3 Feet		

WELL INSTALLATION DIAGRAM



S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) HNu PI - 101 organic vapor meter used to screen soil samples. Meter was calibrated to the equivalent of 58 ppm benzene in air.
2) Approx. 40 gallons of core water gradually lost during C-,1 starting at approx. 10.5 feet. Core water changed color from the usual grey to borwn at approx. 10.2 feet for approx. 10 seconds, then turned back to grey.
3) Approx. 40 gallons of core water gradually lost during C-2.
4) Approx. 120 gallons of water pumped from the boring, after drilling to 16.3 feet and prior to installing the well.

General Notes: 1) Stratification lines represent approximate boundary between soil types; transitions may be gradual.
2) Water level readings have been made at times and under conditions stated; fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

GZA GEOENVIRONMENTAL OF NEW YORK

Delphi Harrison Thermal Systems
Focused Remedial Investigation
West Lockport Complex
Lockport, NY

BORING No. MW-9
SHEET 1 OF 1
FILE No. 55039.2
CHECKED BY SHB

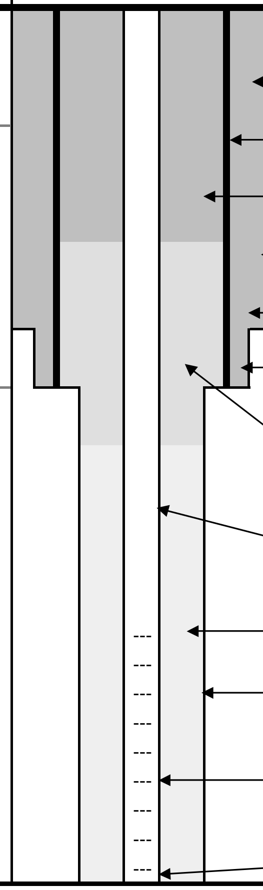
CONTRACTOR	Earth Dimensions, Inc.	BORING LOCATION	See Location Plan		
DRILLER	S. Gingrich	GROUND SURFACE ELEVATION	602.7	DATUM	NGVD
START DATE	10/14/1996 END DAT 10/16/1996	GZA GEOENVIRONMENTAL REPRESENTATIVE	T. Seider		

WATER LEVEL DATA				
DATE	TIME	WATER	CASING	NOTES

TYPE OF DRILL RIG	Dedrich D-50
CASING SIZE AND DIAMETER	6-1/4" HSA
OVERBURDEN SAMPLING METHOD	2" O.D. x 24" Split Spoon Sampler
ROCK DRILLING METHOD	HQ Size Rock Core

DEPTH	SAMPLE BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)	SAMPLE DESCRIPTION	OVM (ppm)
	29	S-1	0 - 2	10	5	Asphalt Pavement	NT
1	6						
	4						
2	5						
	4	S-2	2 - 4	10	60	Redish brown, Stiff, Clayey Silt,	ND
3	3					some f-m Sand, moist to wet.	
	7						
4	7						
	4	S-3T	4 - 4.8	---	80	grades and f-c Sand, wet.	ND
5	12					grades tan and redish brown with	
	30/4"	S-3B	4.8 - 5.5			intermixed rock fragments.	ND
6						Split Spoon and Auger refusal @	
						5.6', Roller bit to 6.3'	
7		C-1	6.5 - 11.5	70.4	91.0		
						LOCKPORT DOLOMITE FORMATION	
8							
9							
10							
11							
12		C-2	11.5 - 15.0	67.7	97.0		
13							
14							
15							
						Bottom of Boring 15.0 Feet	
16							
17							

WELL INSTALLATION DIAGRAM



WELL INSTALLATION DESCRIPTION

- Concrete surface seal to 2.0 ft.
- 4 " Steel Casing to 6.3 feet.
- Cement/bentonite grout to 4 feet.
- Nominal 10" diameter borehole to 5.6 feet.
- Cement/bentonite grout, 2 to 6.3 feet.
- Nominal 3-7/8" diameter roller bit hole, 5.6 to 6.3 feet.
- Bentonite Chips, 4 to 7.5 ft.
- 2 inch PVC flush coupled riser pipe to 10 feet.
- Sidley Sand #1240, 7.5 to 15 feet
- Nominal 3.75" diameter rock hole, 6.5 to 15 feet.
- 2 inch PVC Screen SCH. 40, 10 slot, from 10 to 15 feet.
- PVC end cap at 15 feet

S - Split Spoon Sample
C - Rock Core Sample

NOTES:
1) HNu PI - 101 organic vapor meter used to screen soil samples. Meter was calibrated to the equivalent of 58 ppm benzene in air.
2) Approx. 30 gallons of core water gradually lost during C-,1 Brownish core water noted during approx. the firs 6 inches of C-1. The core water changed back to the usual grey for the remainder of the core.
3) Approx. 15 gallons of core water gradually lost during C-2.
4) Sample 1 consisted of asphalt stuck in the split spoon tip.

General Notes:
1) Stratification lines represent approximate boundary between soil types; transitions may be gradual.
2) Water level readings have been made at times and under conditions stated; fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

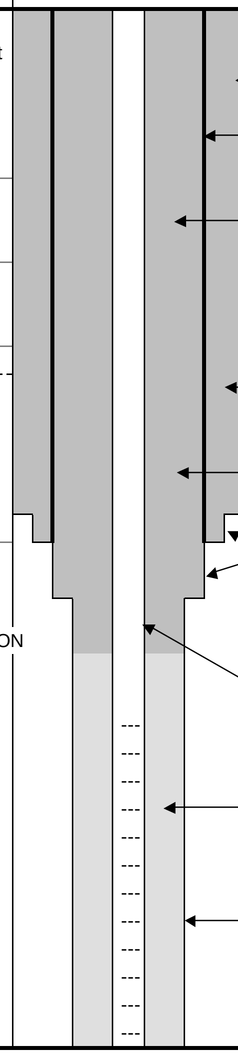
Delphi Harrison Thermal Systems
Focused Remedial Investigation
West Lockport Complex
Lockport, NY

CONTRACTOR	Earth Dimensions, Inc.	BORING LOCATION	See Location Plan
DRILLER	S. Gingrich	GROUND SURFACE ELEVATION	602.3 DATUM NGVD
START DATE	10/14/1996 END DATE 10/16/1996	GZA GEOENVIRONMENTAL REPRESENTATIVE	T. Seider

WATER LEVEL DATA

DATE	TIME	WATER	CASING	NOTES

TYPE OF DRILL RIG	Dedrich D-50
CASING SIZE AND DIAMETER	6-1/4" HSA
OVERBURDEN SAMPLING METHOD	2" O.D. x 24" Split Spoon Sampler
ROCK DRILLING METHOD	HQ Size Rock Core



DEPTH	SAMPLE BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)	SAMPLE DESCRIPTION	WELL INSTALLATION DESCRIPTION	OVM (ppm)
	2	S-1	0 - 2	6	80	Dark brown, medium, SILT &	Top of Riser Elev.=	3
1	3					CLAY, some f-c Sand, moist, root		
	3					fragments.	Concrete surface seal	
2	4						to 2.0 ft.	
	4	S-2T	2 - 4	16	90	grades very stiff.	4 " Steel Casing to	ND
3	9						9.7 feet.	
	7					Redish brown, very stiff, CLAY &		
4	9	S-2B				SILT, little f-c Sand, trace f-c	Cement/bentonite grout	ND
	6	S-3T	4 - 4.9	-	90	Gravel, moist.	to 7.5 feet.	ND
5	70/5"	S-3B				same		ND
						rock fragments	Nominal 10" diameter	
6						(see note 2)	borehole to 9.3 feet.	
	2	S-4	6 - 8	6	80	Redish brown, medium, CLAY &		ND
7	3					SILT, little f-c Sand, moist to wet.	Cement/bentonite grout,	
	3						2 to 9.3 feet.	
8	6							
	8	S-5	8 - 9.2	-	100	grades little f-c Gravel.	Bentonite Chips,	ND
9	11					Split Spoon and Auger refusal @	7.5 to 11.5 ft.	
	50/2"					9.3 feet, roller bit to 9.7, set		
10						casing, roller bit to 10.8 feet.	Nominal 3-7/8" diameter	
							roller bit hole, 9.3 to 9.7,	
11		C-1	11 - 16	37	98.1	BEDROCK	and 9.7 to 10.8 feet.	
						LOCKPORT DOLOMITE FORMATION		
12								
							2 inch PVC flush	
13							coupled riser pipe	
							to 12.5 feet.	
14								
							Sidley Sand #1240,	
15							11.5 to 21.3 feet	
16								
		C-2	16.2 - 21.3	63.7	102		Nominal 3.75" diameter	
17							rock hole, 10.8 to 21.3	
							feet.	
18								

Note: See notes on Page 2

DEPTH	SAMPLE BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)	SAMPLE DESCRIPTION	WELL INSTALLATION DIAGRAM	WELL INSTALLATION DESCRIPTION	OVM (ppm)
19							---	2 inch PVC Screen SCH. 40, 10 slot, from 12.5 to 21.3 feet.	
20							---		
21							---	PVC end cap at 21.3 feet	
22						Bottom of Boring 21.3 Feet			
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									

S - Split Spoon Sample
C - Rock Core Sample

NOTES:
1) HNu PI - 101 organic vapor meter used to screen soil samples. Meter was calibrated to the equivalent of 57 ppm benzene in air.
2) Split spoon refusal at 4.9 feet, auger to 6 feet through a rock substance, augers grinding from 4.9 to 6 feet.
3) While roller bitting through cement plug in the casing, the driller over drilled to 10.8 feet.
4) No water loss noted during C-1.
5) Approx. 30 gallons of core water gradually lost during C-2.

General Notes:
1) Stratification lines represent approximate boundary between soil types; transitions may be gradual.
2) Water level readings have been made at times and under conditions stated; fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

Delphi Harrison Thermal Systems
Focused Remedial Investigation
West Lockport Complex
Lockport, NY

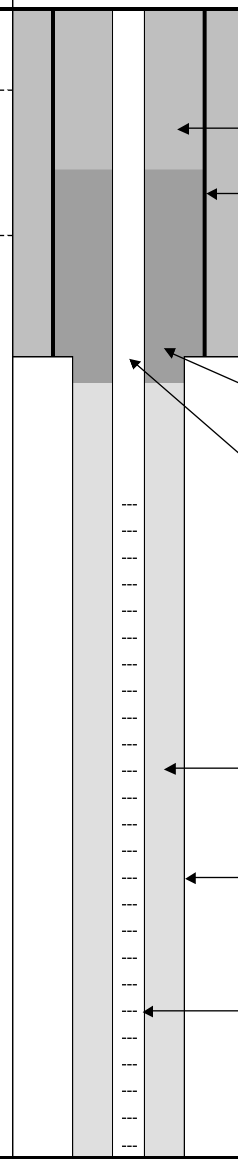
CONTRACTOR	Earth Dimensions, Inc.	BORING LOCATION	See Location Plan
DRILLER	S. Gingrich	GROUND SURFACE ELEVATION	588.7 DATUM NGVD
START DATE	08/13/1997 END DATE 08/15/1997	GZA GEOENVIRONMENTAL REPRESENTATIVE	T. Seider

WATER LEVEL DATA				
DATE	TIME	WATER	CASING	NOTES
08/14/1997	3:50	4.6'	none	after C-2
08/15/1997	7:20	5.3'	none	prior to drilling

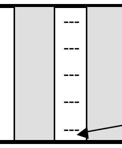
TYPE OF DRILL RIG	Dedrich D-50
CASING SIZE AND DIAMETER	6-1/4" HSA
OVERBURDEN SAMPLING METHOD	2" O.D. x 24" Split Spoon Sampler
ROCK DRILLING METHOD	HQ Size Rock Core

DEPTH	SAMPLE BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)	SAMPLE DESCRIPTION	WELL INSTALLATION DESCRIPTION	OVM (ppm)
	2	S-1T	0 - 2	19	85	Dark and light brown, very stiff,	Top of Riser Elev.=590.1	ND
1	7					SILT & CLAY, little f-m Sand,	Concrete surface seal	
	12					damp, root fragments. (TOPSOIL)	to 1.0 ft.	
2	28	S-1B				Grayish brown, medium dense f-c		
	16	S-2	2 - 4	40	10	SAND, little Clayey Silt, little f-c	Cement/bentonite grout	ND
3	19					Gravel, damp.		
	21					grades and clayey Silt.	4 " Steel Casing to	
4	17					Rock fragments at 4.2 feet.	6.5 feet.	
	50/3"	S-3	4 - 4.3	>100	50			ND
5						Spoon refusal at 4.2 feet.	Cement/bentonite grout	
						Auger refusal at 6.5 feet	from 1 to 6.5 feet.	
6							Nominal 10" diameter	
							borehole to 6.5 feet.	
7		C-1	6.5 - 10	10	96	BEDROCK		
						LOCKPORT DOLOMITE FORMATION	Bentonite Pellets	
8							3.0 to 7.0 ft.	
						Gray, hard, very slight to moderate		
9						weathering, fine grained, horizontal	2 inch PVC flush	
						to low angle fractures.	coupled riser pipe	
10							to 7.0 feet.	
		C-2	10 - 15.1	59	100			
11								
12								
13								
14								
							Sidley Sand #1240,	
15							7.0 to 24.1 feet	
		C-3	15.1 - 20.1	94	98			
16								
							Nominal 3-7/8" diameter	
17							HQ rock core, 6.5 to	
							24.1 feet.	
18								
19							2 inch PVC Screen	
							SCH. 40, 10 slot,	
20		C-4	20.1 - 24.1	96	96		from 9.0 to 24.1 feet.	
21								

WELL INSTALLATION DIAGRAM



Note: See notes on Page 2

DEPTH	SAMPLE: BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)	SAMPLE DESCRIPTION	WELL INSTALLATION DIAGRAM	WELL INSTALLATION DESCRIPTION	OVM (ppm)
22									
23									
24								PVC end cap at 24.1 feet.	
						Bottom of Boring 24.1 Feet.			
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									
41									
42									

S - Split Spoon Sample
C - Rock Core Sample

NOTES:
1) HNu PI - 101 organic vapor meter used to screen soil samples. Meter was calibrated to the equivalent of 57 ppm benzene in air.
2) Split spoon refusal at 4.2 feet, auger to 6.5 feet through a rock substance, augers grinding from 4.2 to 6.5 feet.
3) Approx. 2 gallons of core water lost during C-1, 9 gallons lost during C-2, 3 gallons lost during C-3 and no no water loss during C-4.

General Notes:
1) Stratification lines represent approximate boundary between soil types; transitions may be gradual.
2) Water level readings have been made at times and under conditions stated; fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CONTRACTOR	Earth Dimensions, Inc.	BORING LOCATION	See Location Plan
DRILLER	S. Gingrich	GROUND SURFACE ELEVATION	589.1 DATUM NGVD
START DATE 08/13/1997	END DATE 08/14/1997	GZA GEOENVIRONMENTAL REPRESENTATIVE	T. Seider

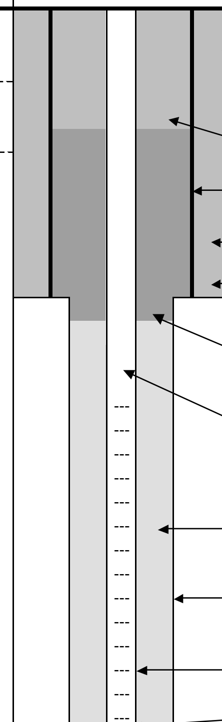
WATER LEVEL DATA

DATE	TIME	WATER	CASING	NOTES
08/13/1997	10:30	4.3'	none	open core hole

TYPE OF DRILL RIG	Dedrich D-50
CASING SIZE AND DIAMETER	6-1/4" HSA
OVERBURDEN SAMPLING METHOD	2" O.D. x 24" Split Spoon Sampler
ROCK DRILLING METHOD	HQ Size Rock Core

DEPTH	BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)	SAMPLE DESCRIPTION	OVM (ppm)
	4	S-1T	0 - 2	48	80	Dark and light brown, hard SILT	ND
1	13					& CLAY, little f-m Sand, damp,	
	35					root fragments (TOPSOIL).	
2	50	S-1B				Light brown, hard Clayey SILT,	
	100/1"	S-2	2 - 2.1	>100	100	little f-c Sand, little f-c Gravel, damp.	ND
3						Rock fragments at 2.1 feet.	
						Spoon refusal at 2.1 feet.	
4						Auger refusal at 3.6 feet	
						Roller bit from 3.6 to 6 feet	
5							
6						BEDROCK	
		C-1	6 - 11	54	96	LOCKPORT DOLOMITE FORMATION	
7							
						Gray, hard, very slight to moderate	
8						weathering, fine grained, horizontal	
						to low angle fractures.	
9							
10							
11							
		C-2	11.0 - 15.1	73	98		
12							
13							
14							
15							
						Bottom of Boring 15.1 feet.	

WELL INSTALLATION DIAGRAM



WELL INSTALLATION DESCRIPTION

- Top of Riser Elev.=590.7
- Concrete surface seal to 1'
- Nominal 10" diameter borehole to 3.6 feet
- Cement/bentonite grout
- 4 " Steel Casing to 6'.
- Cement/bentonite grout from 1 to 6 feet.
- Nominal 5-7/8" diameter borehole from 3.6 to 6 feet.
- Bentonite Pellets 2.5 to 6.5 feet.
- 2 inch PVC flush couple riser pipe to 8 feet.
- Sidley Sand #1240, 6.5 to 15.1 feet
- Nominal 3-7/8" diameter HV rock core, 6' to 15.1'.
- 2 inch PVC Screen Sch. 40, 10 slot, from 8' - 15.1'.
- PVC end cap at 15.1 feet.

S - Split Spoon Sample
C - Rock Core Sample

NOTES:
1) HNu PI - 101 organic vapor meter used to screen soil samples. Meter was calibrated to the equivalent of 57 ppm benzene in air.
2) Split spoon refusal at 2.1 feet, auger to 3.6 feet through a rock substance, augers grinding from 2.1 to 3.6 feet. Rollerbit to 6 feet with no water loss.
3) Approx. 18 gal. of core water lost during C-1, Approx. 460 gal. lost during C-2. 100 gal. purged, then well set.

General Notes:
1) Stratification lines represent approximate boundary between soil types; transitions may be gradual.
2) Water level readings have been made at times and under conditions stated; fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

GZA GEOENVIRONMENTAL OF NEW YORK

Delphi Harrison Thermal Systems
Focused Remedial Investigation
West Lockport Complex
Lockport, NY

BORING No. MW-13
SHEET 1 OF 1
FILE No. 55039.2
CHECKED BY: GJK

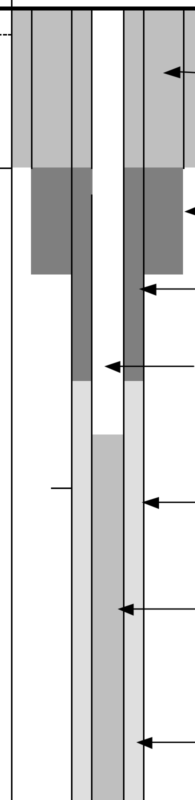
CONTRACTOR	Earth Dimensions, Inc.	BORING LOCATION	See Location Plan
DRILLER	B. Bartron	GROUND SURFACE ELEVATION	589.5 DATUM NGVD
START DATE	07/25/2001 END DATE 07/26/2001	GZA GEOENVIRONMENTAL REPRESENTATIVE	C. Boron

WATER LEVEL DATA				
DATE	TIME	WATER	CASING	NOTES

TYPE OF DRILL RIG	Dietrick D-50
CASING SIZE AND DIAMETER	8-1/4" HSA
OVERBURDEN SAMPLING METHOD	2" diameter x 24" long splitspoon
ROCK DRILLING METHOD	HQ Size Rock Core

DEPTH	SAMPLE BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)	SAMPLE DESCRIPTION	WELL INSTALLATION DESCRIPTION	OVM (ppm)
	6	S -1	0 - 2	27	70	Topsoil	Top of Riser Elev. = 589.02 feet	0
1	11					Brown SAND and GRAVEL, moist		
	16						Cement/bentonite grout	
2	8						from 0 to 3.7 feet.	
	11					Grades to:…trace Clayey Silt	11" Nominal diameter	0
3	100/2					Fractured Bedrock	borehole to 3.0'.	
						Splitspoon Refusal at 2.6'		
4						Auger Refusal at 3.0'	4 " Steel Casing to	
						Roller bit 3.0 to 5.0'	5.0 feet.	
5						BEDROCK		
		C-1	5 - 10	74	88	Lockport Dolomite Formation	Bentonite Pellets	
6						Gray, hard, very slight to	from 3.7 to 7 feet.	
						slight weathering, fine grained,		
7						horizontal and low angle fractures.	2-inch PVC flush	
							coupled riser pipe	
8							to 8 feet.	
9								
							Nominal 3.75" diameter	
10							rock hole 5.0 to 15.0 feet.	
		C-2	10.0 - 15.0	88	97			
11								
						Lost approximately 300 gallons of	2-inch PVC Screen	
12						water during coring.	SCH. 40, 10 slot,	
							from 8.0 to 15.0 feet.	
13								
14							Sand pack from	
							7.0 to 15.0 feet.	
15								
						Bottom of Boring at 15.0'		
16								
17								
18								
19								

WELL INSTALLATION DIAGRAM



S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) HNu PI - 101 organic vapor meter (OVM) used to screen soil samples. Meter was calibrated to the equivalent of 58 ppm benzene in air.
2) OVM reading shown taken on soil samples from splitspoons.

General Notes: 1) Stratification lines represent approximate boundary between soil types; transitions may be gradual.
2) Water level readings have been made at times and under conditions stated; fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

GZA GEOENVIRONMENTAL OF NEW YORK

Delphi Harrison Thermal Systems
Focused Remedial Investigation
West Lockport Complex
Lockport, NY

BORING No. MW-14
SHEET 1 OF 1
FILE No. 55039.2
CHECKED BY: GJK

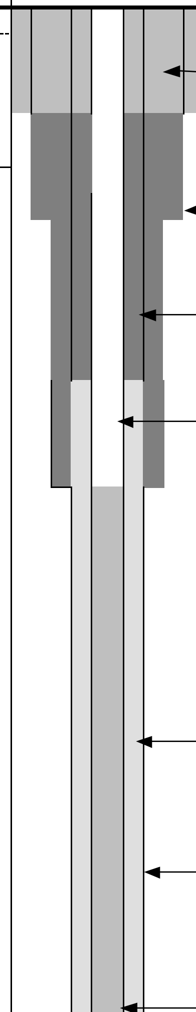
CONTRACTOR	Earth Dimensions, Inc.	BORING LOCATION	See Location Plan
DRILLER	B. Bartron	GROUND SURFACE ELEVATION	590.4 DATUM NGVD
START DATE	07/24/2001 END DATE 07/25/2001	GZA GEOENVIRONMENTAL REPRESENTATIVE	C. Boron

WATER LEVEL DATA				
DATE	TIME	WATER	CASING	NOTES

TYPE OF DRILL RIG	Dietrick D-50
CASING SIZE AND DIAMETER	8-1/4" HSA
OVERBURDEN SAMPLING METHOD	2" diameter x 24" long splitspoon
ROCK DRILLING METHOD	HQ Size Rock Core

DEPTH	SAMPLE BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)	SAMPLE DESCRIPTION	WELL INSTALLATION DESCRIPTION	OVM (ppm)
	7	S -1	0 - 2	12	95	Topsoil	Top of Riser Elev. = 592.77 feet	0
1	7					Brown SILT, little Sand, trace		
	5					Gravel, moist	Cement/bentonite grout	
2	4					Grades to:…Clayey SILT	from 0 to 3.5 feet.	
	7	S-2	2 - 4		50		11" Nominal diameter	0
3	7						borehole to 3.1'	
	50/1					Splitspoon Refusal at 3.0'		
4						Auger Refusal at 3.1'	4 " Steel Casing to	
		C-1	4.1 - 9.1	64	95	Roller bit 3.1 to 4.1'	4.1 feet.	
5						BEDROCK		
						Lockport Dolomite Formation		
6						Gray, hard, very slight to	Bentonite Pellets	
						slight weathering, fine grained,	from 3.5 to 7.2 ft.	
7						horizontal and low angle fractures.		
8							2-inch PVC flush	
							coupled riser pipe	
9							to 12.2 feet.	
		C-2	9.1 - 14.1	97	100			
10								
11								
12								
13								
14							Sand pack from	
		C-3	14.1 - 19.1	94	98		7.2 to 19.1 feet.	
15								
16								
							Nominal 3.75" diameter	
17							rock hole 4.1 to 19.1 feet.	
18						Lost approximately 20 gallons of		
						water during coring.	2-inch PVC Screen	
19							SCH. 40, 10 slot,	
						Bottom of Boring at 19.1'	from 9.1 to 19.1 feet.	

WELL INSTALLATION DIAGRAM



S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) HNu PI - 101 organic vapor meter (OVM) used to screen soil samples. Meter was calibrated to the equivalent of 58 ppm benzene in air.
2) OVM reading shown taken on soil samples from splitspoons.

General Notes: 1) Stratification lines represent approximate boundary between soil types; transitions may be gradual.
2) Water level readings have been made at times and under conditions stated; fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

GZA GEOENVIRONMENTAL OF NEW YORK

Delphi Harrison Thermal Systems
Focused Remedial Investigation
West Lockport Complex
Lockport, NY

BORING No. MW-15
SHEET 1 OF 1
FILE No. 55039.2
CHECKED BY: GJK

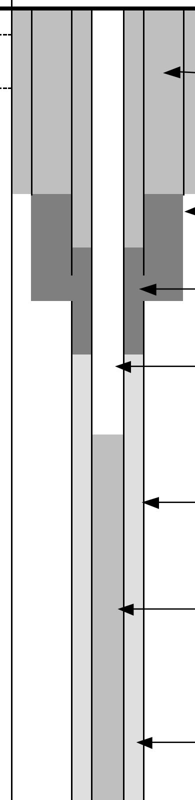
CONTRACTOR	Earth Dimensions, Inc.	BORING LOCATION	See Location Plan
DRILLER	B. Bartron	GROUND SURFACE ELEVATION	591.9 DATUM NGVD
START DATE	07/24/2001 END DATE 07/27/2001	GZA GEOENVIRONMENTAL REPRESENTATIVE	C. Boron

WATER LEVEL DATA				
DATE	TIME	WATER	CASING	NOTES

TYPE OF DRILL RIG	Dietrick D-50
CASING SIZE AND DIAMETER	8-1/4" HSA
OVERBURDEN SAMPLING METHOD	2" diameter x 24" long splitspoon
ROCK DRILLING METHOD	HQ Size Rock Core

DEPTH	SAMPLE BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)	SAMPLE DESCRIPTION	WELL INSTALLATION DESCRIPTION	OVM (ppm)
	7	S -1	0 - 2	36	80	Topsoil	Top of Riser Elev. = 594.04.	0
1	16					Brown SAND, some Silt, trace		
	20					Gravel, moist	Cement/bentonite grout	
2	100/2					Gray Fractured Bedrock, little	from 0 to 4.5 feet.	
						Sand, little Silt, moist	11" Nominal diameter	0
3							borehole to 3.4 feet.	
						Splitspoon Refusal at 2 '		
4						Auger Refusal at 3.4'	4 " Steel Casing to	
						Roller bit 3.4 to 5.4'	5.4 feet.	
5						BEDROCK		
		C-1	5.4 - 10.4	70	88	Lockport Dolomite Formation	Bentonite Pellets	
6						Gray, hard, very slight to	from 4.5 to 6.5 feet.	
						slight weathering, fine grained,		
7						horizontal and low angle fractures.	2-inch PVC flush	
							coupled riser pipe	
8							to 8.0 feet.	
9								
							Nominal 3.75" diameter	
10							rock hole 5.4 to 15.4 feet.	
		C-2	10.4 - 15.4	70	96			
11								
						Lost approximately 250 gallons of	2-inch PVC Screen	
12						water during coring.	SCH. 40, 10 slot,	
							from 8.0 to 15.0 feet.	
13								
14							Sand pack from	
							6.5 to 15.4 feet	
15								
						Bottom of Boring at 15.4'		
16								
17								
18								
19								

WELL INSTALLATION DIAGRAM



S - Split Spoon Sample
C - Rock Core Sample

NOTES: 1) HNu PI - 101 organic vapor meter (OVM) used to screen soil samples. Meter was calibrated to the equivalent of 58 ppm benzene in air.
2) OVM reading shown taken on soil samples from splitspoons.

General Notes: 1) Stratification lines represent approximate boundary between soil types; transitions may be gradual.
2) Water level readings have been made at times and under conditions stated; fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

APPENDIX C

ANALYTICAL LABORATORY REPORTS

APPENDIX D

MONITORED NATURAL ATTENUATION EVALUATION

APPENDIX E

MONITORED NATURAL ATTENUATION EVALUATION

GZA performed a monitored natural attenuation (MNA) evaluation to evaluate the extent to which natural processes control chlorinated aliphatic hydrocarbon (CAH) fate and transport at the Site. The evaluation included:

- Evaluation of the hydrogeochemical data collected to date to assess the nature of the natural attenuation (NA) processes operating at the Site as well as the limitations of those processes for controlling CAH fate and transport; and
- Computer modeling to evaluate the maximum anticipated extent of the CAH plume and the time it might take for Site groundwater to comply with applicable groundwater quality standards.

HYDROGEOCHEMICAL EVALUATION

GZA's evaluation included both indicator parameters as well as historical CAH data. The indicator parameter data provide information on the nature of the NA processes potentially operating at the Site, and the historical CAH data provide information on the extent to which CAH data are consistent with those processes.

Indicator Parameter Data

To assess the nature of potential NA processes that may be important at the Site, GZA typically evaluates indicator parameter data for samples collected from contaminated monitoring well locations (*i.e.,* those with exceedances of regulatory standards) with data obtained for samples from background and/or less-contaminated locations. The difference in mean results for samples collected from contaminated locations, relative to background/less contaminated locations, provides information on the nature and significance of the biological NA processes acting upon CAHs. GZA focuses on biological NA processes because, according to EPA (1998)[1], such processes are typically more important than physiochemical ones.

Of the biological NA processes for CAHs, reductive dehalogenation is the most important. Reductive dehalogenation involves the microbial-mediated replacement of chlorine, on the CAH, with elemental hydrogen, and subsequent transformation to a less chlorinated compound. The transformation occurs only under anaerobic, chemically reducing conditions, and requires the presence of dissolved organic carbon (DOC) to drive the reaction. During this process, DOC is fermented to yield hydrogen, which fuels dehalogenation. During reductive dehalogenation, soil microflora utilize DOC, as an electron donor, and the CAH, as a terminal electron acceptor (TEA), in the growth-coupled process of dehalorespiration[2], but only in the general absence of other potential TEAs including DO, nitrate, oxidized metals, and sulfate. Dehalogenation is generally more important for parents than daughters, and when both are present, the parents are dehalogenated first, followed by the daughters. While dehalogenation

[1] EPA, 1998, Technical protocol for evaluating natural attenuation of chlorinated solvents in groundwater, USEPA/600/R-98/128, 78 p.

[2] Dehalorespiration refers to metabolic dehalogenation, in which the microflora metabolize DOC and "breath" CAHs.

can also occur co-metabolically, without added benefit to microbes (Gossett and Zinder, 1996)[3], this process is typically not as important as growth-coupled dehalorespiration. Therefore, MNA programs for CAHs focus, to a large extent, on biochemical oxidation-reduction reactions among CAHs, DOC, and TEAs, mediated by native soil microflora.

The following table compares mean indicator parameter results for samples collected from contaminated locations with those collected from background/less contaminated locations:

INDICATOR PARAMETER	MEAN DATA	
	BACKGROUND LOCATION	CONTAMINATED LOCATIONS
Dissolved Oxygen (DO), mg/L	1.1	0.8
Oxidation-Reduction Potential (ORP), mV	+21	-20
Nitrate, *ug*/L	250	210
Dissolved Iron, *ug*/L	-	160
Dissolved Manganese, *ug*/L	-	390
Sulfate, *ug*/L	132,500	236,000
Sulfide, *ug*/L	240	320
Methane, *ug*/L	16	140
* Total ~~Oxygen~~ Organic Carbon (TOC), *ug*/L	10,900	23,100
Chloride, *ug*/L	1,262,000	940,000
Alkalinity, *ug*/L	345,000	349,000

Notes:

1. "mg/L" indicates milligrams per liter; "mV" indicates millivolts; "ug/L" indicates micrograms per liter.
2. Parameters not detected above the laboratory's practical quantification limit (PQL) were factored into the data set at one half the PQL.
3. Means for each parameter generally represent an arithmetic mean unless concentrations varied by more than one order of magnitude. In such cases, a geometric mean was calculated was used.
4. Locations selected to be generally representative of background conditions include wells TK-2, MW-13, and MW-14; locations selected to be generally representative of contaminated conditions include wells MW- 3S, MW- 4, MW- 6, MW- 7, MW- 8, MW- 9, and MW- 10.

- DO Data

  Mean DO concentrations for samples collected from contaminant plume locations are depressed, relative to background, suggesting the presence of a biologically-available DOC, which has stimulated native soil microflora to scavenge this TEA from Site groundwater. It is likely that the BTEX, within the plume, contributes to that DOC. DO is a TEA, which can compete with CAHs for electron donor (provided by the DOC) and readily inhibit dehalogenation. According to EPA (1998) DO concentrations less than about 0.5 mg/L can support reductive dehalogenation, the primary biological NA mechanism for CAHs, especially parent compounds. Given that the contaminant plume mean DO concentration is about 0.8 mg/L, these data suggest that DO might be inhibiting reductive dehalogenation, especially at locations where DO concentrations exceed about 0.5 mg/L (*e.g.,* well locations MW-3S,

[3] Gossett, J.M. and Zinder, S.H., 1996, Microbiological aspects relevant to natural attenuation of chlorinated ethenes, in proceedings, Symposium on Natural Attenuation of Chlorinated Organics in Ground Water, p. 10-13

MW-7, MW-8, and MW-9). GZA notes that many daughter CAHs, produced during the dehalogenation of parents, can be readily destroyed by a variety of biological processes that involve DO (EPA, 1998).[4] Therefore, the presence of DO at downgradient locations likely stimulates the NA of daughter CAHs and may, in part, explain the fact that daughter CAHs appear to have reached steady-state conditions along the plume leading edge.

- <u>ORP Data</u>

Mean ORP values for samples collected from contaminant plume locations are depressed, relative to background, similar to the DO data discussed above. These data suggest the presence of a DOC source, which has stimulated native soil microflora to scavenge TEAs from Site groundwater. As discussed previously, it is likely that the BTEX within the plume is serving as that DOC source.[5] EPA (1998) indicates that ORP values less than about 50 mV can support reductive dehalogenation. Given that the contaminant plume mean ORP of –20 mV, the ORP data suggest that oxidation-reduction conditions may be suitable for reductive dehalogenation, especially at locations with ~~DO concentrations~~ ORP values less than –20 mV * (*e.g.,* well locations MW-3S, MW-4, MW-6, MW-7, and MW-8).

- <u>Nitrate Data</u>

Mean nitrate concentrations for samples collected from contaminant plume locations are slightly depressed, relative to background. These data suggest the presence of a DOC source (likely BTEX), which has stimulated denitrification to scavenge nitrate from Site groundwater. In the absence of DO, nitrate can serve as a TEA so its present in a CAH plume can inhibit reductive dehalogenation. According to EPA (1998), nitrate concentrations less than about 1 mg/L can support CAH dehalogenation. Given that the contaminant plume mean nitrate concentration is 0.21 mg/L, the nitrate data suggest that this TEA is not competing with CAHs for electron donor, especially at locations with nitrate concentrations less than 1 mg/L (*e.g.,* well locations MW-3S, MW-4, MW-6, MW-7, MW-8, MW-9 and MW-10).

- <u>Dissolved Iron/Manganese Data</u>

There were no background concentration data available for dissolved iron and manganese; however, mean concentrations for samples collected from contaminant plume locations were 160 *u*g/L and 390 *u*g/L, respectively. Oxidized forms of these metals (iron III and manganese IV, respectively) can serve as TEAs in the absence of DO and nitrate, so the presence of the reduce forms (iron II and manganese III,

[4] For example, they can be used as food during aerobic metabolism, and they may be co-oxidized (*i.e.,* destroyed serendipitously by microflora during the metabolism of a primary substrate).

[5] Parent CAHs <u>cannot</u> be metabolized by microflora. Therefore, parents do not serve as "food" for soil microflora and <u>cannot</u> exert an oxidant demand upon groundwater. BTEX, however, can serve as "food" and it does pose an oxidant demand; therefore, its presence in the CAH plume likely constitutes a bulk of the biodegradable DOC that drives dehalogenation for this Site.

respectively) in CAH-contaminated groundwater flow systems can inhibit dehalogenation. EPA (1998) indicates that dissolved iron concentrations greater than about 1 mg/L are consistent with dehalogenation (*i.e.,* they demonstrate that iron III is being biochemically reduced, suggesting there is sufficient DOC (likely BTEX) in the groundwater system to scavenge iron III from the formation). Given that the contaminant plume mean dissolved iron concentration is 160 *ug*/L (390 *ug*/L dissolved manganese), the metals data are not consistent with the presence of sufficient DOC to scavenge these metals from the groundwater flow system. Note that because iron reduction is biochemically equivalent to manganese reduction, GZA anticipates that oxidized manganese in the groundwater flow system can pose the same inhibition to CAH dehalogenation as oxidized iron.

- <u>Sulfate/Sulfide Data</u>

Mean sulfate concentrations for samples collected from contaminant plume locations are elevated by about a factor of two above background concentrations. These data suggest the presence of a sulfate source in the plume, and that there is likely insufficient DOC available to enhance sulfate reduction and scavenge sulfate from Site groundwater. In the absence of DO, nitrate, and oxidized iron/manganese, sulfate can serve as a TEA during the metabolism of DOC (likely BTEX) so its present in a CAH plume can inhibit dehalogenation. According to EPA (1998), sulfate concentrations less than about 20 mg/L can support CAH dehalogenation. Given that the contaminant plume mean sulfate concentration is 236 mg/L, about an order of magnitude greater than the threshold value reported by EPA, the sulfate data suggest that this TEA may be competing with CAHs for electron donor, especially at locations with sulfate concentrations greater than 20 mg/L (*e.g.,* well locations MW-4, MW-6, MW-7, MW-8, MW-9, and MW-10).

Sulfide concentrations for contaminant plume locations are elevated, relative to background. Sulfide is the biochemically-reduced product of sulfate reduction, described in the preceding paragraph, and as such is an indicator for sulfate reduction. * These data suggest ~~indicate~~ that sulfate reduction is occurring within the plume, and yielding sulfide. However, sulfide is present in contaminant plume groundwater at a mean concentration about two orders of magnitude less than the mean sulfate concentration. Therefore, there is insufficient DOC (likely BTEX compounds) to drive sulfate reduction to completion such that it scavenges the bulk of available sulfate and reduces it to sulfide. According to EPA (1998), sulfide concentrations greater than about 1 mg/L are consistent with CAH dehalogenation. Given that the contaminant plume mean sulfide concentration is 0.32 mg/L, the sulfide data are not consistent with dehalogenation. Therefore, the mean sulfate and sulfide data suggest that dehalogenation may be limited by the presence of sulfate in contaminant plume groundwater, which can compete for the DOC that drives dehalogenation.

- Methane Data

The mean concentrations of methane, produced during methanogenesis, for samples collected from contaminant plume locations are elevated by an order of magnitude, relative to background. During methanogenesis, native soil microflora metabolize DOC (likely BTEX compounds) in the absence of DO, nitrate, oxidized metals, and sulfate, utilizing carbon dioxide as the TEA. The methane data suggest the presence of microniches[6] in the formation, where DOC has stimulated microflora to scavenge the other TEAs, thereby allowing methanogenic conditions to become established. The presence of microniches is demonstrated by the occurrence of relatively high sulfate concentrations, which can inhibit methanogenesis. Because sulfate concentrations are generally elevated for samples collected throughout the contaminant plume, it is likely that methanogenesis can only proceed in microniches, such as dead-end pore spaces in the formation, where sulfate and the other TEAs have become depleted. According to EPA (1998), methane concentrations greater than about 0.5 mg/L are generally consistent with CAH reductive dehalogenation. Given that the contaminant plume mean methane concentration is 0.14 *ug*/L, the methane data suggest there is insufficient DOC in the formation to generally induce the conditions required for CAH dehalogenation, while such conditions likely exist in microniches throughout the Site.

- TOC Data

Mean TOC concentrations for samples collected from contaminant plume locations are elevated by a factor of two, relative to background. These data suggest the presence of DOC (likely BTEX) that can stimulate native microflora to scavenge TEAs and drive dehalogenation. According to EPA (1998), TOC concentrations greater than about 20 mg/L can support reductive dehalogenation. Given that the plume mean TOC concentration is 23.1 mg/L, these data suggest that there may be sufficient TOC to drive dehalogenation. Significantly, however, the TOC concentration is an order of magnitude less than the sulfate concentration (*i.e.*, 23.1 mg/L versus 236 mg/L, respectively), suggesting that while TOC is elevated, it is not sufficient to stimulate microflora to scavenge sulfate.

- Chloride Data

Mean chloride concentration data for samples collected from contaminant plume locations are depressed, relative to background. During reductive dehalogenation, inorganic chloride is liberated as it is replaced by hydrogen so increased chloride concentrations for contaminated locations, relative to background, is an indicator that reductive dehalogenation is occurring. EPA (1998) indicates that chloride

[6]Microniches represent small-scale (microns to millimeters) environments where gradients of biologically important environmental parameters occur that perturb and control the nature of the biochemical processes occurring at that scale. Thus, the presence of microniches in the formation provides for the occurrence of processes that may not be significant at larger scale.

concentrations about two times greater than background are consistent with reductive dehalogenation. While it is possible that there is a source contributing chloride to background groundwater, and not to contaminant plume groundwater (*e.g.*, road salt application), the data are generally consistent with the other MNA parameters, and suggest that while dehalogenation may be occurring, it is likely limited.

- Alkalinity

  Mean alkalinity values for samples collected from contaminant plume locations are ostensibly the same as for background locations. Alkalinity refers to the capability of water to neutralize acid. During metabolism of DOC, organic carbon is biochemically oxidized to carbon dioxide, which is then hydrolyzed to carbonic acid. In the presence of carbonaceous formation materials, the carbonic acid dissolves formation materials thereby increasing solution alkalinity, typically expressed as an equivalency to milligrams of calcium carbonate. EPA (1998) indicates that alkalinity values about a factor or two greater than background are consistent with the conditions required for dehalogenation to occur. While it is possible that there is a chloride source for background locations, that is not present for contaminated locations (*e.g.*, road salt application), the data are generally consistent with the other MNA parameters (*i.e.*, while MNA is occurring, it appears to be limited).

Historical CAH Data

This evaluation focused on trends in CAH data within the source area and along the plume leading edge to assess whether those trends are consistent with the indicator parameter data discussed above.

- Source Area CAH Trends

  While PCE was not detected above PQLs for groundwater samples collected from monitoring wells MW-4 and MW-7, located in the general vicinity of the source area, the associated PQLs were relatively high due to the detection of TCE concentrations in those samples at concentrations approaching aqueous solubility limits for those CAHs. The elevated TCE concentrations for those samples reflect the presence of DNAPL within the source area. As shown on attached Figures 1 and 2, TCE concentrations at the well MW-4 location appear to be slowly attenuating with time whereas TCE concentrations at the well MW-7 location appear to be attenuating somewhat faster. It is important to note that groundwater conditions for reductive dehalogenation are more important for the well MW-7 location than the well MW-4 location, which likely explains the more rapid attenuation rate for the former well location. For example, TOC concentrations are higher at the well MW-7 location than the MW-4 location (47,000 *u*g/L versus 21,000 *u*g/L) and nitrate concentrations are lower at the well MW-7 location than the MW-4 location (<50 *u*g/L versus 120 *u*g/L), which suggests that dehalogenation at well MW-4 may be limited by the low TOC and elevated nitrate.

As shown on attached Figures 1 and 2, it should be noted that TCE concentrations at both locations are decreasing at a rate greater than that of potassium, which are plotted on those figures to serve as non-reactive tracers. This indicates that another mechanism other than hydrodynamic dispersion (*i.e.,* biological attenuation by reductive dehalogenation) is responsible for the decreasing TCE concentrations. Daughter CAH concentrations for samples collected from well MW-4 are steadily decreasing with time, but have reached an apparent steady-state condition for samples collected from well MW-7. This is likely related to the lower TOC and higher nitrate concentrations for the well MW-7 location than the MW-4 location, because daughter CAHs are more amenable to biological attenuation under these conditions.

- <u>Plume Leading Edge CAH Trends</u>

  As shown on attached Figures 3 and 4, daughters CAHs continue to be detected in groundwater samples collected at both locations, and appear to have reached steady-state conditions. Attached Tables 1 and 2 respectively summarize parent ratios[7] for groundwater samples collected from source area wells MW-4 and MW-7. Attached Tables 3 and 4 respectively summarize parent ratios for groundwater samples collected from leading edge wells MW-11 and MW-12. As shown in these tables, parent ratios were higher in the source area (geometric mean of 30.5%) than along the plume leading edge (geometric mean of 1.1%). Parent ratios suggest that parent CAHs are being reductively dehalogenated in the source area and along the flow path such that only daughter CAHs persist along the plume leading edge. Significantly, because daughter concentrations appear to have reached steady state conditions along the plume leading edge, it is likely that the plume has reached steady state conditions and is now stabilized (*i.e.,* it is neither advancing nor retreating).

COMPUTER MODELING

GZA's MNA evaluation at the Site including computer modeling using the computer code BIOCHLOR – Natural Attenuation Decision Support System (BIOCHLOR, Version 1.0). The purpose of this modeling was to evaluate the maximum anticipated extent of the CAH plume and the time it might take for Site groundwater to comply with applicable groundwater quality standards. BIOCHLOR, which was developed by Groundwater Services, Inc. of Houston, Texas for the Air Force Center for Environmental Excellence, is an analytical computer model operating in the Microsoft Excel® environment. The model is based on the Domenico analytical solute transport model, and has the ability to simulate advection, dispersion, adsorption, and biotransformation via reductive dechlorination. Requisite model input parameters include the following Site data:

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[7] **Parent ratios are a molar ratio of total parent concentration to total CAH (parent + daughter) concentration used to normalize CAH data.**

- Hydrogeology;
- Dispersion;
- Adsorption;
- First Order Decay Coefficients;
- Plume morphology and simulation time;
- Source data; and
- Field CAH concentration data.

Attached Table 5 presents the input parameters necessary to run the BIOCHLOR model.

First order decay rates for the CAHs were calculated based on analytical data for groundwater samples collected from monitoring wells located along the plume centerline (Figure 1). The time axis is based on travel time for the CAH plume between monitoring locations assuming a seepage velocity of 200 feet/year. The y-axis represents the normalized decrease for each CAH at each downgradient monitoring location. The slopes of the best-fit lines for each CAH were the decay rates used for BIOCHLOR modeling.

GZA ran the model using simulation time steps of 10 and 100 years for PCE, TCE, total 1,2-DCEs, and VC. The model suggests that PCE and TCE concentrations will be attenuated below groundwater quality standards no greater than about 800 feet downgradient of the source. Daughter compounds (total 1,2-DCEs and VC) would persist above groundwater quality standards no greater than about 1,200 feet downgradient of the source. According to the model, these conditions should become established within 10 years. It should be noted that these generalizations are consistent with the CAH data for well MW-13, located about 1,400 feet downgradient of the source, where CAHs have not been detected above PQLs. While parent CAHs have not been detected above their respective PQLs for samples collected from monitoring wells MW-11 and MW-12, each located about 1,300 feet downgradient of the source, daughter CAH concentrations for samples from these wells continue to exceed, albeit slightly, their respective groundwater quality standards. Monitoring wells MW-11 and MW-12 are located near the leading edge of the CAH plume, about 100 feet further than the modeled plume length. (See attached Output Plots for 10-year and 100-year time step runs). Within the source area, modeling results suggest that CAH concentrations will continue to exceed groundwater quality standards for a significant period of time, in part, to source strengths that approach the aqueous solubility of parent CAHs.

only centerline plots included

BIOCHLOR also has the ability to model contaminant plume conditions transversely (perpendicular to the groundwater flow path). GZA has included output plots depicting transverse dispersion conditions at the Site after 10 years. The 10-year and 100-year time steps are ostensibly the same so, therefore, only the 10-year time step Output Plot is included. In general, the model predicted that CAH concentrations, at sidegradient monitoring locations, would be one order of magnitude lower than actual Site conditions, consistent with actual CAH data for groundwater samples collected from wells MW-6 and MW-8.

APPENDIX E

MONITORED NATURAL ATTENUATION EVALUATION

Groundwater samples collected at well MW-15 contain detectable concentrations of PCE that the model does not predict transversely. This well location is approximately 1,000 feet downgradient from the source and, according to the model, PCE should not be detected above PQL at this location. Analytical data collected for well location MW-15 for three separate rounds indicate that PCE is present at 13 to 20 *u*g/L. GZA was unable to model the conditions for this specific location due to the lack of control points needed to estimate a first order decay constant for PCE. GZA believes PCE has not decayed in this general area of the Site due to the groundwater biogeochemistry. DO concentrations are very low at this location, but mean nitrate concentrations for that location~~s~~ (1 mg/L), exceed those for all other locations at the Site. * Because the presence of nitrate at concentrations exceeding about 1 mg/L can inhibit, it is possible that the presence of nitrate is inhibiting dehalogenation. Furthermore, dechlorination can only occur under chemically reducing conditions; however, ORP values for that location, on average (+187 mV), reflect chemically oxidizing conditions. Therefore, in addition to the elevated nitrate, the oxidizing conditions at that well location likely inhibit dehalogenation. Moreover, TOC concentrations are also lower, on average (6.5 mg/L), than every other monitoring location. Because CAH dehalogenation is directly controlled by the presence of DOC, the data show that the low DOC does not support dehalogenation at this location.

BIOCHLOR is limited as a modeling tool because it assumes uniform Site conditions such as non-varying source strength and isotropic conditions. In addition, BIOCHLOR does not consider groundwater chemistry. BIOCHLOR assumes that reductive dechlorination can be simply modeled as a sequential first order decay process, meaning that a parent compound (PCE, for example) undergoes first order decay to produce a daughter product (TCE). Similarly, TCE undergoes a separate first order decay to produce DCEs and, likewise, DCEs to produce VC. BIOCHLOR assumes that groundwater conditions are anaerobic and chemically reducing, and generally conducive for dehalogenation, which is generally consistent with Site conditions.

GZA performed a sensitivity analysis by varying one selected model input parameter. (refer to the BIOCHLOR Sensitive Analyses Input Data/Output Plots for additional information). GZA's sensitivity analysis consisted of varying foc because, in our experience, this parameter can vary widely. The input parameters and output results for the two foc sensitivity analyses are included herein. Foc was varied by one order of magnitude above and below the model input value data (0.001). Results of these sensitivity runs were that foc does not effect first order kinetics, but it slightly effects the migration pattern of the CAH plume. With a smaller foc value (0.0001), no apparent change in plume migration patterns is apparent, in comparison to the original model. not included

Conversely, with a larger foc value (0.01), the velocity at which the plume travels decreases. In effect, the plume length is decreased by about 200 feet for PCE and TCE and about 500 feet for total 1,2-DCEs and VC. These results are consistent with the fact that environments with larger foc values tend to sorb higher concentrations of DOC than materials with smaller foc values.

TABLES

Table 1

MW-4 Parent Ratios

CAH DATA																
Sampling Round	Sampling Round Date	PCE		TCE		Total Parents (mg/l)	Total Parents (mol/l)	DCEs		VC		Total Daughters (mg/l)	Total CAHs (mg/l)	**Parent Ratio Mass (%)**	Total CAHs (mol/l)	**Parent Ratio Molar (%)**
		mg/L	Moles/L	mg/L	Moles/L			mg/L	Moles/L	mg/L	Moles/L					
1	5/1/96	0.25	1.51E-06	32	2.44E-04	32.250	2.45E-04	170	1.75E-03	40	6.40E-04	210	242.25	13.3%	2.64E-03	9.3%
2	6/20/96	0.25	1.51E-06	19	1.45E-04	19.250	1.46E-04	110	1.13E-03	19	3.04E-04	129	148.25	13.0%	1.58E-03	9.2%
3	10/30/96	0.25	1.51E-06	34	2.59E-04	34.250	2.60E-04	120	1.24E-03	14	2.24E-04	134	168.25	20.4%	1.72E-03	15.1%
4	11/21/96	0.25	1.51E-06	37	2.82E-04	37.250	2.83E-04	120	1.24E-03	18	2.88E-04	138	175.25	21.3%	1.81E-03	15.7%
5	8/28/97	0.1	6.03E-07	29	2.21E-04	29.100	2.21E-04	100	1.03E-03	14	2.24E-04	114	143.10	20.3%	1.48E-03	15.0%
6	10/10/97	0.1	6.03E-07	33	2.51E-04	33.100	2.52E-04	110	1.13E-03	27	4.32E-04	137	170.10	19.5%	1.82E-03	13.8%
7	12/2/98	0.1	6.03E-07	21	1.60E-04	21.100	1.60E-04	110	1.13E-03	12	1.92E-04	122	143.10	14.7%	1.49E-03	10.8%
8	10/7/99	0.025	1.51E-07	20	1.52E-04	20.025	1.52E-04	100.14	1.03E-03	14	2.24E-04	114.14	134.17	14.9%	1.41E-03	10.8%
9	8/9/01	0.003	1.81E-08	30	2.28E-04	30.003	2.28E-04	93.28	9.62E-04	18	2.88E-04	111.28	141.28	21.2%	1.48E-03	15.4%
10	10/31/01	0.001	6.03E-09	22	1.67E-04	22.001	1.67E-04	84.25	8.69E-04	18	2.88E-04	102.25	124.25	17.7%	1.32E-03	12.6%

Table 2
MW-7 Parent Ratios

CAH DATA																
Sampling Round	Sampling Round Date	PCE		TCE		Total Parents (mg/l)	Total Parents (mol/l)	DCEs		VC		Total Daughters (mg/l)	Total CAHs (mg/l)	Parent Ratio Mass (%)	Total CAHs (mol/l)	Parent Ratio Molar (%)
		mg/L	Moles/L	mg/L	Moles/L			mg/L	Moles/L	mg/L	Moles/L					
1	5/1/96	0.25	1.51E-06	1300	9.89E-03	1300.250	9.90E-03	37	3.82E-04	1.8	2.88E-05	39	1,339.05	97.1%	1.03E-02	96.0%
2	6/20/96	0.25	1.51E-06	1100	8.37E-03	1100.250	8.37E-03	24	2.48E-04	2.4	3.84E-05	26	1,126.65	97.7%	8.66E-03	96.7%
3	10/30/96	0.25	1.51E-06	790	6.01E-03	790.250	6.01E-03	32	3.30E-04	2.3	3.68E-05	34	824.55	95.8%	6.38E-03	94.3%
4	11/21/96	0.25	1.51E-06	850	6.47E-03	850.250	6.47E-03	35	3.61E-04	3.1	4.96E-05	38	888.35	95.7%	6.88E-03	94.0%
5	8/28/97	0.1	6.03E-07	820	6.24E-03	820.100	6.24E-03	22	2.27E-04	1.1	1.76E-05	23	843.20	97.3%	6.49E-03	96.2%
6	10/10/97	0.1	6.03E-07	720	5.48E-03	720.100	5.48E-03	43	4.44E-04	4.8	7.68E-05	48	767.90	93.8%	6.00E-03	91.3%
7	12/2/98	0.1	6.03E-07	570	4.34E-03	570.100	4.34E-03	55	5.67E-04	4.2	6.72E-05	59	629.30	90.6%	4.97E-03	87.2%
8	10/7/99	0.025	1.51E-07	540	4.11E-03	540.025	4.11E-03	41	4.23E-04	3.5	5.60E-05	44.50	584.53	92.4%	4.59E-03	89.6%

Notes:

1. Concentrations below the practical quantification limit (PQL) reported as one half the PQL for calculation purposes.

Table 3

MW-11 Parent Ratios

CAH DATA																
Sampling Round	Sampling Round Date	PCE		TCE		Total Parents (mg/l)	Total Parents (mol/l)	DCEs		VC		Total Daughters (mg/l)	Total CAHs (mg/l)	Parent Ratio Mass (%)	Total CAHs (mol/l)	Parent Ratio Molar (%)
		mg/L	Moles/L	mg/L	Moles/L			mg/L	Moles/L	mg/L	Moles/L					
5	8/28/97	0.00025	1.5E-09	0.00025	1.9E-09	0.001	3.4E-09	0.0045	4.6E-08	0.0039	6.2E-08	0	0.01	5.6%	1.1E-07	3.0%
6	10/10/97	0.00025	1.5E-09	0.00025	1.9E-09	0.001	3.4E-09	0.0032	3.3E-08	0.0012	1.9E-08	0	0.00	10.2%	5.6E-08	6.1%
7	12/2/98	0.00025	1.5E-09	0.00025	1.9E-09	0.001	3.4E-09	0.013	1.3E-07	0.0046	7.4E-08	0	0.02	2.8%	2.1E-07	1.6%
8	10/7/99	0.00025	1.5E-09	0.00025	1.9E-09	0.001	3.4E-09	0.01	1.0E-07	0.0019	3.0E-08	0.01	0.01	4.0%	1.4E-07	2.5%
9	8/8/01	0.001	6.0E-09	0.001	7.6E-09	0.002	1.4E-08	0.009	9.3E-08	0.008	1.3E-07	0.02	0.02	10.5%	2.3E-07	5.8%
10	10/30/01	0.001	6.0E-09	0.001	7.6E-09	0.002	1.4E-08	0.008	8.3E-08	0.006	9.6E-08	0.01	0.02	12.5%	1.9E-07	7.1%

Notes:

1. Concentrations below the practical quantification limit (PQL) reported as one half the PQL for calculation purposes.

Table 4

MW-12 Parent Ratios

CAH DATA																
Sampling Round	Sampling Round Date	PCE		TCE		Total Parents (mg/l)	Total Parents (mol/l)	DCEs		VC		Total Daughters (mg/l)	Total CAHs (mg/l)	**Parent Ratio Mass (%)**	Total CAHs (mol/l)	**Parent Ratio Molar (%)**
		mg/L	Moles/L	mg/L	Moles/L			mg/L	Moles/L	mg/L	Moles/L					
5	8/28/97	0.00025	1.51E-09	0.00025	1.90E-09	0.001	3.41E-09	0.089	9.18E-07	0.110	1.76E-06	0	0.20	0.3%	2.68E-06	0.1%
6	10/10/97	0.00025	1.51E-09	0.00025	1.90E-09	0.001	3.41E-09	0.16	1.65E-06	0.170	2.72E-06	0	0.33	0.2%	4.37E-06	0.1%
7	12/2/98	0.00025	1.51E-09	0.00025	1.90E-09	0.001	3.41E-09	0.047	4.85E-07	0.088	1.41E-06	0	0.14	0.4%	1.90E-06	0.2%
8	10/7/99	0.00025	1.51E-09	0.00025	1.90E-09	0.001	3.41E-09	0.027	2.79E-07	0.032	5.12E-07	0.06	0.06	0.8%	7.94E-07	0.4%
9	8/8/01	0.001	6.03E-09	0.001	7.61E-09	0.002	1.36E-08	0.14	1.44E-06	0.130	2.08E-06	0.27	0.27	0.7%	3.54E-06	0.4%
10	10/30/01	0.001	6.03E-09	0.001	7.61E-09	0.002	1.36E-08	0.032	3.30E-07	0.011	1.76E-07	0.04	0.05	4.4%	5.20E-07	2.6%

Notes:

1. Concentrations below the practical quantification limit (PQL) reported as one half the PQL for calculation purposes.

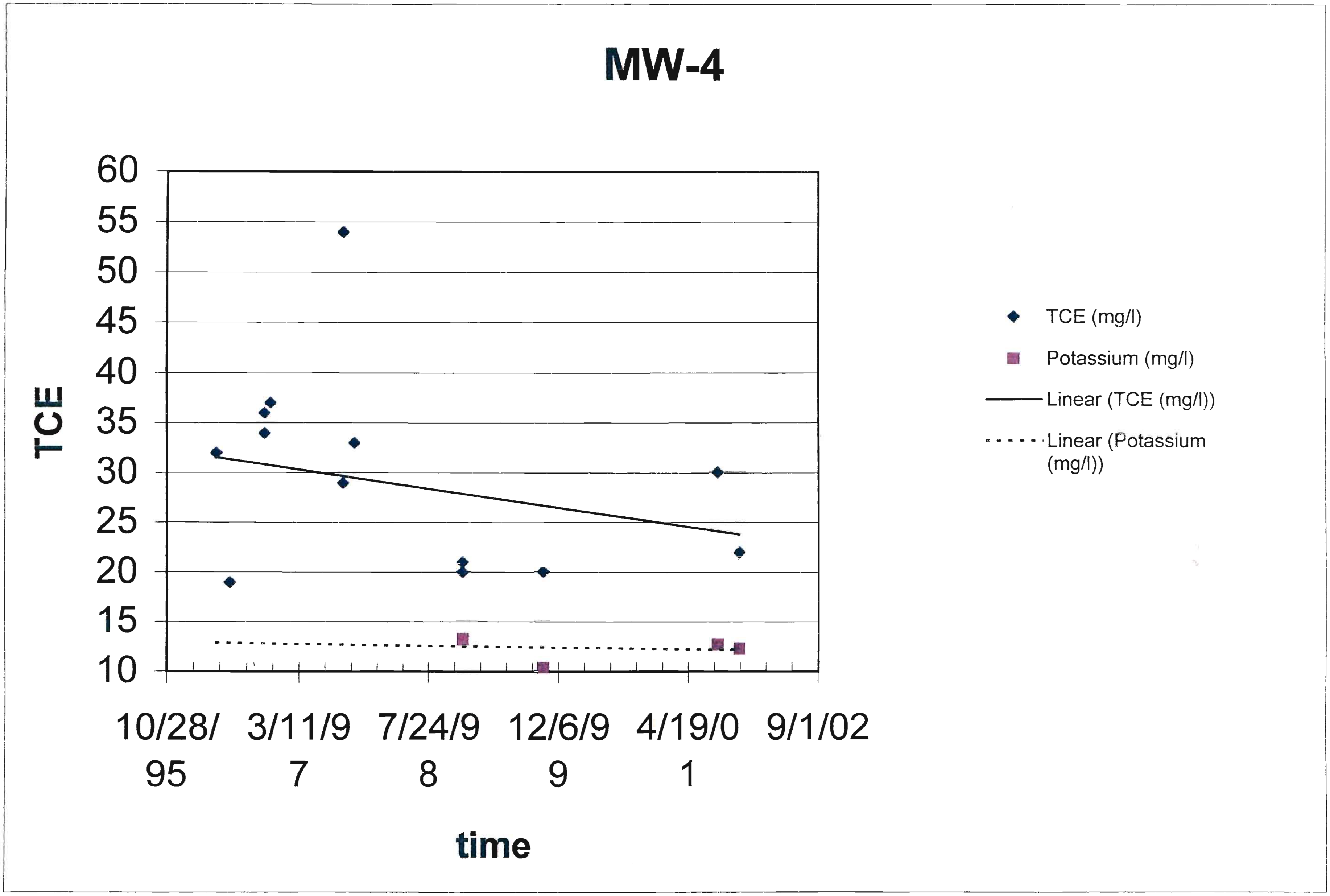
TABLE 5
SUMMARY OF BIOCHLOR INPUT DATA

PARAMETER	VALUE	EXPLANATION
1 – Seepage Data		
Seepage Velocity	200 ft/year	Estimated seepage velocity from Supplemental Phase III Extent of Contamination Studies and Evaluation of Alternatives, prepared by GZA, dated February 1997.
2 – Dispersion		
Alpha x	100 ft	10% of plume length, from BIOCHLOR manual
Alpha y	10 ft	10% of alpha x, from BIOCHLOR manual
Alpha z	5 ft	5% of alpha x, from BIOCHLOR manual
3 – Adsorption		
Soil Bulk Density	2.25 kg/L	Fetter, Applied Hydrogeology 1994.
Partitioning Coefficient	426 L/kg (Tetrachloroethene) 130 L/kg (Trichloroethene) 125 L/kg (Dichloroethenes) 29.6 L/kg (Vinyl Chloride)	From BIOCHLOR manual
Effective Porosity	0.005	Supplemental Phase III report
Fraction Organic Carbon	0.001	Assumed value
4 – First Order Decay Coefficients		
Tetrachloroethene	1.37 $year^{-1}$	Calculations based on field data from wells MW-7, MW-9, MW-10, and MW-11.
Trichloroethene	2.91 $year^{-1}$	
Total Dichloroethenes	1.67 $year^{-1}$	
Vinyl Chloride	1.47 $year^{-1}$	
	Biotransformation Rates	
TCE/PCE	0.795	From BIOCHLOR manual
DCE/TCE	0.737	From BIOCHLOR manual
VC/DCE	0.645	From BIOCHLOR manual
5 – General Data		
Modeled Area Length	1000 ft	Plume morphology
Modeled Area Width	500 ft	Plume morphology
Simulation Time	1, 10, and 100 years	
6 – Source Area Concentrations		
Saturated Zone Thickness in Source Area	20 ft	
Plume Width vs. Contaminant Concentration		
150 feet	260 mg/L $_{\text{Tetrachloroethene}}$ 540 mg/L $_{\text{Trichloroethene}}$ 41 mg/L $_{\text{Dichloroethenes}}$ 3.5 mg/L $_{\text{Vinyl Chloride}}$	Plume morphology
Field Data for Comparison		
Tetrachloroethene		
0 feet from source	120 mg/L	Plume morphology
190 feet from source	0.21 mg/L	
330 feet from source	0.12 mg/L	
Trichloroethene		
0 feet from source	540 mg/L	Plume morphology
510 feet from source	1.4 mg/L	
650 feet from source	0.25 mg/L	
1245 feet from source	0.00025 mg/L	
Total Dichloroethenes		
0 feet from source	41 mg/L	Plume morphology
510 feet from source	1.6 mg/L	
650 feet from source	0.473 mg/L	
1245 feet from source	0.01 mg/L	
Vinyl Chloride		
0 feet from source	3.5 mg/L	Plume morphology
510 feet from source	0.11 mg/L	
650 feet from source	0.053 mg/L	
1245 feet from source	0.0019 mg/L	

Notes:
1. "ft" indicates feet; "kg" indicates kilogram; "l" indicates liter; and "mg" indicates milligrams.
2. First order decay coefficients were calculated based on Site analytical data and distances between monitoring locations listed above.
3. MW-7 considered as source area for trichloroethene, total dichloroethenes, and vinyl chloride. MW-5 considered source area of tetrachloroethene.

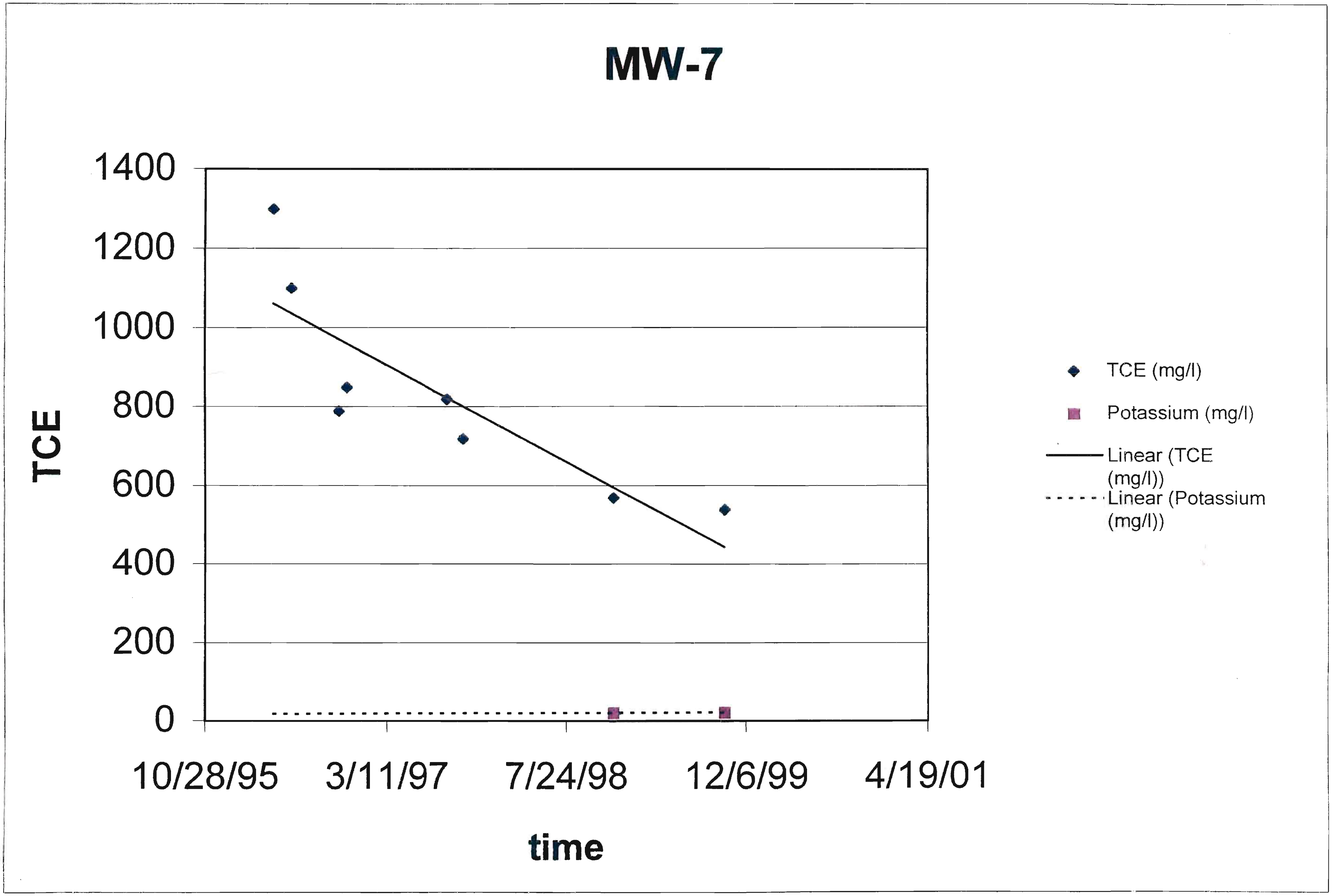
FIGURES

Figure 1



MW-4
60
55
50
45
40
35
30
25
20
15
10
TCE
10/28/95
3/11/97
7/24/98
12/6/99
4/19/01
9/1/02
time
TCE (mg/l)
Potassium (mg/l)
Linear (TCE (mg/l))
Linear (Potassium (mg/l))

Figure 2



MW-7
1400
1200
1000
800
600
400
200
0
TCE
10/28/95
3/11/97
7/24/98
12/6/99
4/19/01
time
TCE (mg/l)
Potassium (mg/l)
Linear (TCE (mg/l))
Linear (Potassium (mg/l))

Figure 3

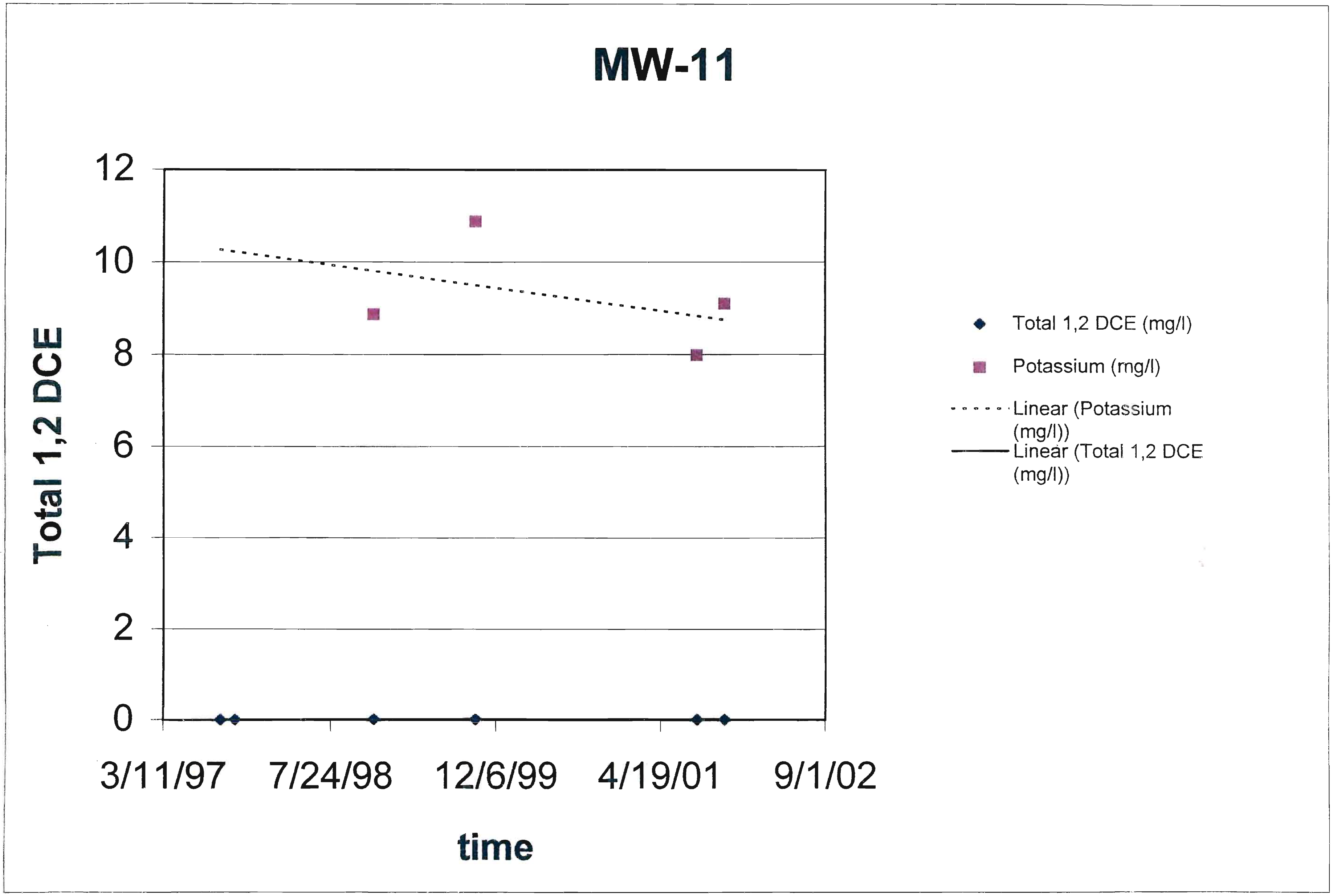
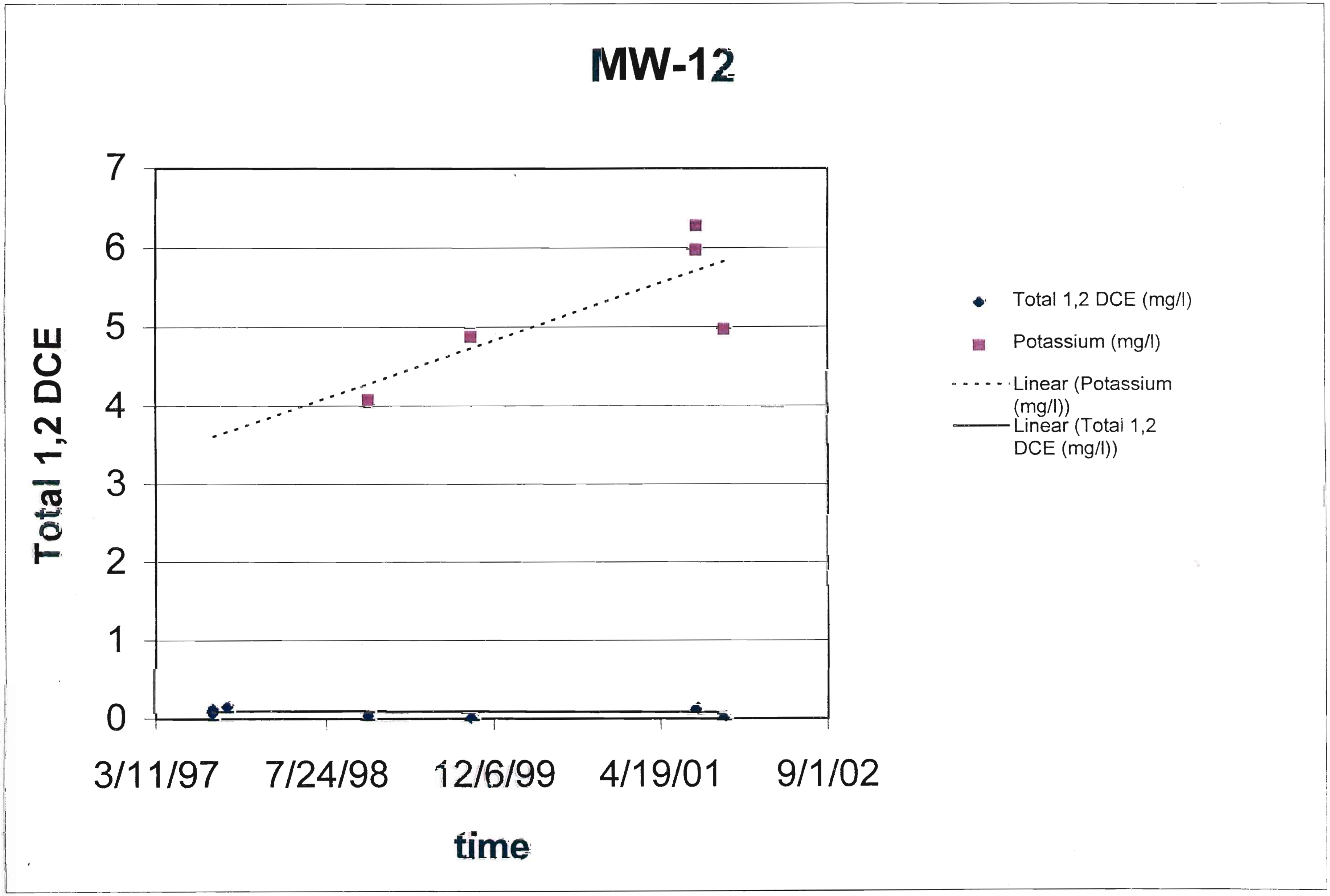

MW-11
12
10
8
6
4
2
0
Total 1,2 DCE
3/11/97
7/24/98
12/6/99
4/19/01
9/1/02
time
Total 1,2 DCE (mg/l)
Potassium (mg/l)
Linear (Potassium (mg/l))
Linear (Total 1,2 DCE (mg/l))

Figure 4


MW-12
Total 1,2 DCE
7
6
5
4
3
2
1
0
3/11/97
7/24/98
12/6/99
4/19/01
9/1/02
time
Total 1,2 DCE (mg/l)
Potassium (mg/l)
Linear (Potassium (mg/l))
Linear (Total 1,2 DCE (mg/l))

BIOCHLOR INPUT/OUTPUT PLOTS

BIOCHLOR Natural Attenuation Decision Support System

Version 1.1
for Excel 7.0/ '95

Delphi Thermal Systems
Lockport, NY
Run Name

Data Input Instructions:

115	1. Enter value directly....or
or	2. Calculate by filling in gray
0.02	cells. Press Enter, then C

(To restore formulas, hit "Restore Formulas" button)
Variable* → Data used directly in model.

Test if Biotransformation is Occurring → Natural Attenuation Screening Protocol

TYPE OF CHLORINATED SOLVENT: Ethenes ◉ Ethanes ○

1. ADVECTION

Seepage Velocity*	Vs	200.0	(ft/yr)
or		or	
Hydraulic Conductivity	K	1.8E-02	(cm/sec)
Hydraulic Gradient	i	0.0012	(ft/ft)
Effective Porosity	n	0.2	(-)

2. DISPERSION

Alpha x Calc. Method	100	(ft)
(Alpha y) / (Alpha x)	10	(-)
(Alpha z) / (Alpha x)	5.E+00	(-)

Change Alpha x Calc. Method

3. ADSORPTION

Retardation Factor* → R
or

Soil Bulk Density, rho	2.25	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc			
PCE	426	(L/kg)	5.8	(-)
TCE	130	(L/kg)	2.5	(-)
DCE	125	(L/kg)	2.4	(-)
VC	30	(L/kg)	1.3	(-)
ETH	302	(L/kg)	4.4	(-)

Common R (used in model)* = 2.5

4. BIOTRANSFORMATION -1st Order Decay Coef*

Zone 1	λ (1/yr)	half-life (yrs)	Yield*
PCE → TCE	1.37		0.79
TCE → DCE	2.91		0.74
DCE → VC	1.67		0.64
VC → ETH	1.47		0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.00	
TCE → DCE	0.00	
DCE → VC	0.00	
VC → ETH	0.00	
ETH → Ethane	0.00	

5. GENERAL

Simulation Time*	10	(yr)
Modeled Area Width*	500	(ft)
Modeled Area Length*	1000	(ft)
Zone 1 Length*	1000	(ft)
Zone 2 Length*	0	(ft)

Zone 2= L - Zone 1

6. SOURCE DATA

Source Options

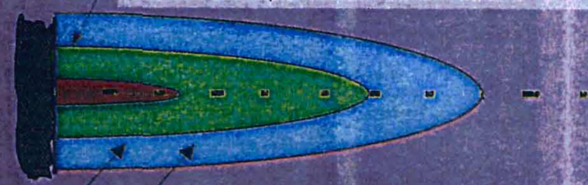
TYPE: Single Planar

Source Thickness in Sat. Zone* 20 (ft)

Width* (ft) 150

Conc. (mg/L)*	C1
PCE	260.0
TCE	540.0
DCE	41.0
VC	3.5
ETH	

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

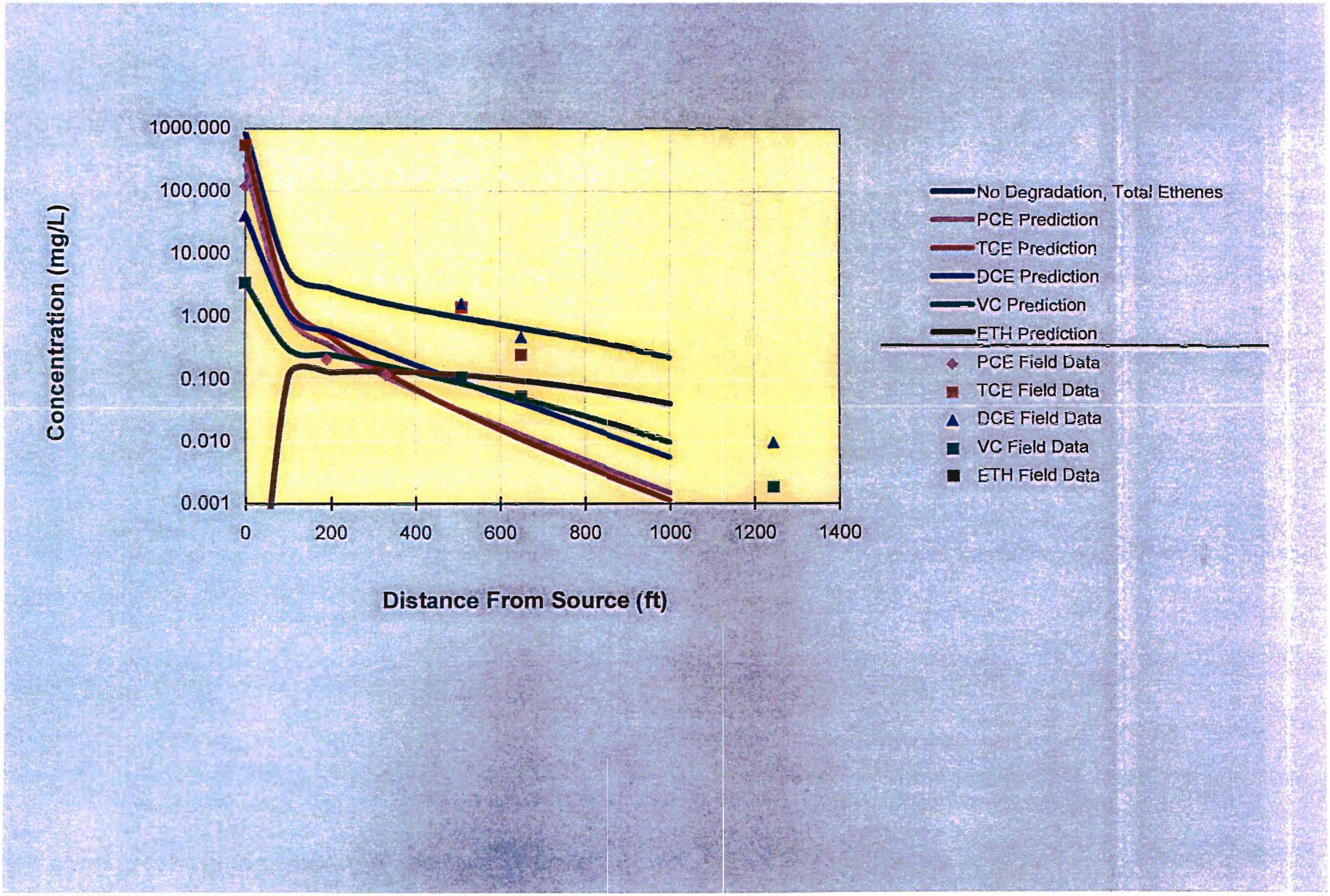
7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)	120.0	.21	.12								
TCE Conc. (mg/L)	540.0			1.4	.25	.0					
DCE Conc. (mg/L)	41.0			1.6	.473	.01					
VC Conc. (mg/L)	3.5			.11	.053	.002					
ETH Conc. (mg/L)											
Dist. from Source (ft)	0	190	330	510	650	1245					

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | Help | Restore Formulas | RESET | SEE OUTPUT | Paste Example Dataset

Centerline Output Chart 3



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Version 1.1
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Delphi Thermal Systems
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Run Name

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Alpha x Calc. Method	100	(ft)
(Alpha y) / (Alpha x)	10	(-)
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PCE → TCE	0.00	
TCE → DCE	0.00	
DCE → VC	0.00	
VC → ETH	0.00	
ETH → Ethane	0.00	

5. GENERAL

Simulation Time*	100	(yr)
Modeled Area Width*	500	(ft)
Modeled Area Length*	1000	(ft)
Zone 1 Length*	1000	(ft)
Zone 2 Length*	0	(ft)

L
W
Zone 2= L - Zone 1

6. SOURCE DATA

Source Options
TYPE: Single Planar
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Width* (ft) 150

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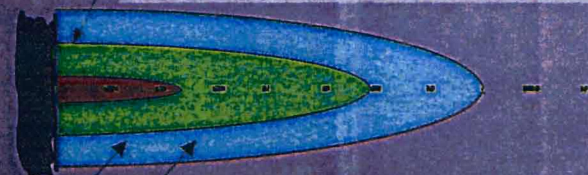

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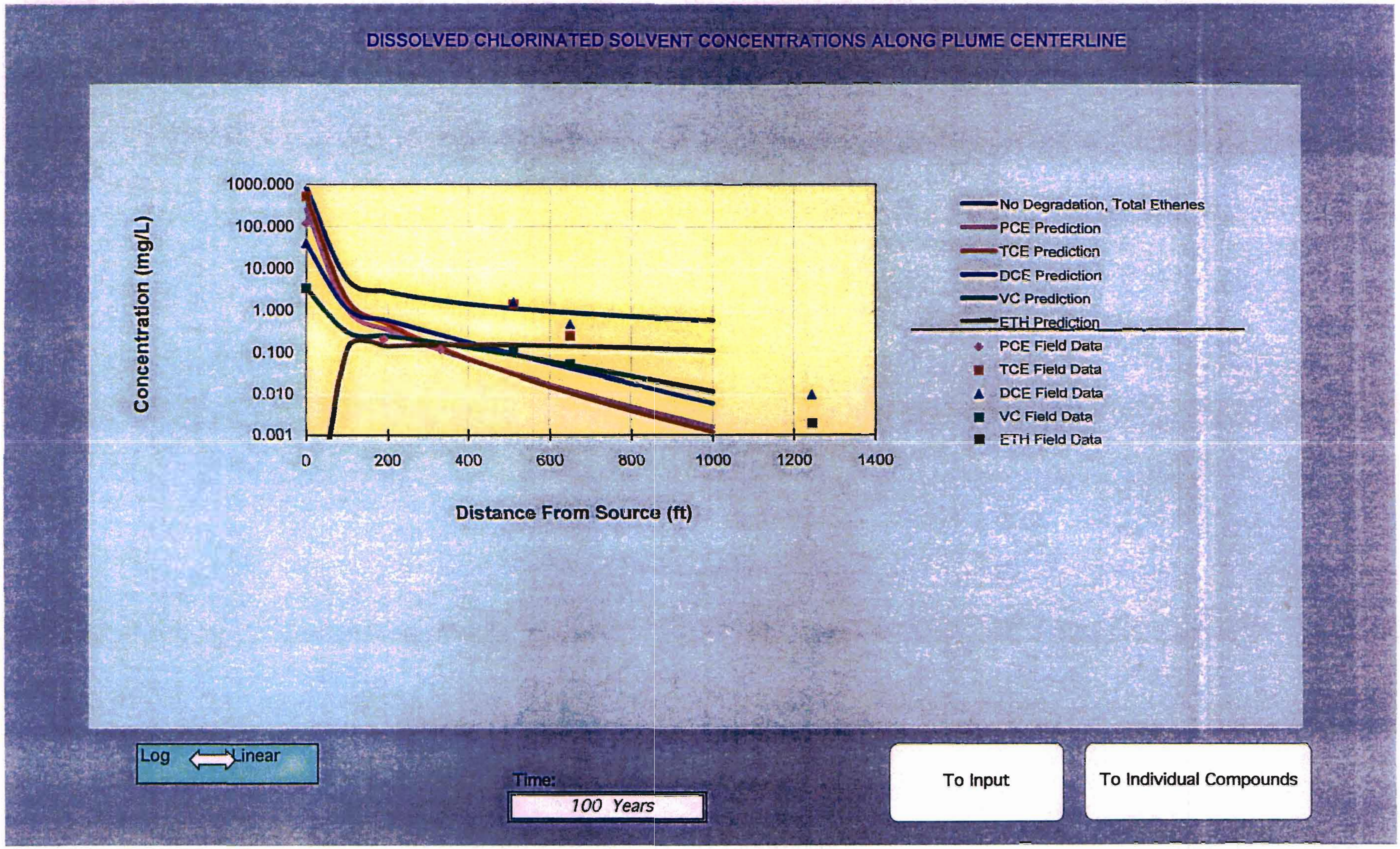
RUN CENTERLINE | RUN ARRAY | Help | Restore Formulas | RESET | SEE OUTPUT | Paste Example Dataset


DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE
Concentration (mg/L)
1000.000
100.000
10.000
1.000
0.100
0.010
0.001
0
200
400
600
800
1000
1200
1400
Distance From Source (ft)
No Degradation, Total Ethenes
PCE Prediction
TCE Prediction
DCE Prediction
VC Prediction
ETH Prediction
PCE Field Data
TCE Field Data
DCE Field Data
VC Field Data
ETH Field Data
Log
Linear
Time:
100 Years
To Input
To Individual Compounds