Summary Report for the Multi-Phase Extraction Design Optimization Study AAFES Station Fort Hamilton, New York

Prepared for

U.S. Army Corps of Engineers–Baltimore District
Engineering Division–HTRW Branch
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December 2005
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1. INTRODUCTION

The U.S. Army Corps of Engineers (USACE)–Baltimore District, under Contract No. W912DR-05-D-0008, Delivery Order No. 0006, tasked EA Engineering, P.C. and its affiliate EA Science and Technology to conduct a multi-phase extraction (MPE) optimization study at the Army Air Force Exchange Service (AAFES) station, Building 200, Fort Hamilton (Brooklyn), New York. This report summarizes the results of the MPE optimization study conducted in July-August 2005.

1.1 PROJECT OBJECTIVES

The study was designed to provide the data necessary to evaluate MPE as a corrective measure for the removal and treatment of separate and dissolved-phase hydrocarbons in the subsurface soil and groundwater at the AAFES site. In addition, the data collected was analyzed to estimate additional site-specific parameters (i.e., radius of influence, vadose zone soil properties and parameters, and extracted air and water discharge rates and contaminant concentrations).

1.2 REPORT ORGANIZATION

This report is organized as follows:

- ***Section 1 – Introduction***—Presents an introduction to the project and its objectives, a site description, and an overview of the MPE technology.
- ***Section 2 – Field Activities***—Details the field tasks performed and the equipment used during field activities.
- ***Section 3 – Results***—Presents the results of the optimization study.
- ***Section 4 – Conclusions and Recommendations***—Presents an evaluation of MPE as a remedial technology at the site, including selection of extraction wells, air and liquid discharge rates, and treatment methods.

1.3 SITE DESCRIPTION

The site is located at 200 General Lee Avenue in Fort Hamilton, Brooklyn, New York (Figure 1). The station was constructed in the 1960s as a service station with two service bays, three gasoline underground storage tanks (USTs), and one waste oil UST. The 3 gasoline USTs (two 3,000-gal and one 4,000-gal) were replaced in 1991. Soil staining from petroleum leaks was noted during tank removal. The new tanks were located in the existing excavation, however, some contaminated soil remained. During 1999-2000, the service station was converted into a convenience store. The site is currently operating as an active retail gasoline service station.

1.3.1 Previous Investigations

TRC Environmental Corporation conducted a site investigation in June 1997, including installation and sampling of three soil borings using hollow-stem auger methods. The results indicated elevated benzene, toluene, ethylbenzene, and total xylene (BTEX) concentrations in soil at approximately 19-31 ft below ground surface (bgs). In particular, a sample from boring TRC-2 contained significant concentrations of BTEX, totaling 11,160 mg/kg. Groundwater samples were not collected during the investigation.

Parsons Engineering Science conducted a site investigation from March to May 2000. The Parsons investigation included installation and sampling of five monitoring wells using hollow-stem auger methods. Ten soil samples were collected and analyzed for the New York State Spill Technology and Remediation Series volatile organic compounds and base neutral compounds. None of the base neutral compounds were detected above method detection limits. Benzene, total BTEX, and methyl tertiary-butyl ether (MTBE) concentrations detected in the soil samples collected from MW-05 ranged from non-detect to a maximum of 12,237 mg/kg, 69,669 mg/kg, and 4,554 mg/kg, respectively. Monitoring well MW-05 is located adjacent to soil boring TRC-2, which exhibited the highest concentrations during the TRC investigation.

General Physics completed a site assessment in June 2003, including the installation and sampling of nine direct-push soil borings and two additional monitoring wells to delineate the down gradient extent of impacted soil and groundwater. The analytical results indicated that soil is impacted at the site in an area approximately 100 ft × 75 ft extending down gradient from the UST pit. The vertical extent of impacted soil is between 15 and 30 ft bgs. Groundwater impacts (i.e., BTEX, MTBE, and naphthalene) were reported at concentrations above New York State Department of Environmental Conservation Class GA standards extending from the tank pit to the northeast site boundary along General Lee Avenue. Light non-aqueous phase liquid (LNAPL) was observed in MW-01 and MW-05. General Physics estimated that 2,020 gal of LNAPL and 210 lb of BTEX compounds are present at the site.

Based on the results of the June 2003 site assessment, General Physics proposed implementing mobile high vacuum extraction as a corrective action for the site. During September and October 2003, General Physics installed three additional soil borings, collected two geotechnical samples, performed a short-term pumping test on MW-07, performed *in situ* respirometry tests, and performed high vacuum extraction tests on MW-01, MW-04, and MW-05 using a mobile unit. Following the additional field activities, General Physics completed a corrective action plan for the site in June 2004. The corrective action plan evaluated remedial alternatives and recommended that a bioslurping/MPE treatment system be installed to address areas of the site impacted by LNAPL.

1.3.2 Nature and Extent of Impacts

Currently, LNAPL is observed in MW-01 and MW-05. The intermittent presence of LNAPL in MW-02, MW-03, and MW-04 can be attributed to seasonal water table fluctuations. The

observed groundwater impacts are likely the result of groundwater contact with LNAPL and/or residual petroleum.

Based on multiple water level measurements, the groundwater flow direction is toward the north-northeast. The fine-grained silty sand and clayey sand facies that comprise the water table aquifer result in a low groundwater yield. Horizontal extent of soil contamination is approximately 100 ft × 75 ft, with the major axis of the plume in north-south direction. Benzene contamination is limited to the vicinity of MW-05 near the tank pit. Shallow contamination, from 10 to 15 ft bgs, appears to exist in the vicinity of the tank pit. The vertical extent of contamination in the remainder of the area is from 15 to 30 ft bgs, with the majority of the impacts observed near the water table.

1.4 TECHNOLOGY OVERVIEW

MPE combines two remedial technologies: soil vapor extraction and liquid recovery. Soil vapor extraction is designed to volatilize low molecular-weight compounds using relatively high air flow rates. Liquids (both LNAPL and groundwater) are also entrained in the extracted air and treated via conventional methods (i.e., containerization, air stripping, granular activated carbon, etc.).

MPE systems consist of a vacuum pump that withdraws a mixture of groundwater, LNAPL, and soil vapor through a drop-tube positioned just above or at the LNAPL-water interface. The rate of liquid and soil gas extraction is dependent upon the permeability of the formation, the applied vacuum, and the position of the drop-tube. The extracted process stream enters an air/liquid separator where the liquid component remains and the air component is withdrawn by the vacuum pump and treated prior to discharge. The remaining liquid component, consisting of water, and potentially, LNAPL, is transferred to an oil/water separator.

MPE has several advantages over conventional single and dual pump technologies, including:

- Exposure of the LNAPL smear zone by depressing the groundwater table
- Creation of a zone of reduced pressure around the well, which increases the hydraulic gradient to the well
- Release/recovery of LNAPL that is held in the soil by capillary forces when vacuum pressures exceed capillary pressures
- Recovery of up to 100 percent of residual LNAPL within the vadose zone (if the LNAPL is volatile) through soil vapor extraction component

Simultaneous treatment of vadose zone soil, LNAPL on the water table, and the dissolved-phase hydrocarbons in the groundwater, results in decreased final treatment costs.

2. FIELD ACTIVITIES

This section presents the field activities that were implemented at the AAFES Station to achieve the objectives of the MPE optimization study. No significant field modifications to the work plan (EA 2005)[1] were necessary over the duration of the study, but several minor modifications are identified and discussed below.

2.1 SEQUENCE OF FIELD TASKS

The following field tasks were performed as part of the optimization study:

- Obtained underground utility clearances for intrusive (i.e., drilling) operations.
- Installed four temporary vapor monitoring points (TMP-01 through TMP-04) located adjacent to an existing groundwater monitoring well.
- Collected a soil sample from monitoring point TMP-03, installed outside of the LNAPL plume for microbial analysis.
- Performed bail-down tests at two site groundwater monitoring wells (MW-01 and MW-04) where LNAPL was observed.
- Collected groundwater samples at three site groundwater monitoring wells (MW-02, MW-06, and MW-07), including laboratory analysis for monitored natural attenuation parameters.
- Collected a groundwater sample from monitoring point TMP-03 installed outside of the LNAPL plume for microbial analysis.
- Performed a three-day MPE optimization study at two monitoring wells, including the collection of aqueous and vapor effluent samples for laboratory analysis.

2.2 SOIL BORING/TEMPORARY MONITORING POINTS

System performance was monitored using a combination of existing monitoring wells and four newly installed 1 in. diameter monitoring points (Figure 2). Three of the four monitoring points were installed at distances of 5 ft, 10 ft, and 15 ft (TMP-01 through TMP-03) an completed to a depth of approximately 28 ft bgs. The fourth temporary monitoring point (TMP-04) was installed to a shallower depth of approximately 10 ft bgs, at a distance of approximately 5 ft from MW-03, to assess potential variability in observed extraction pressure due to the presence of a gravel layer underlying the site at approximately 20 ft bgs.

1 EA. 2005. Work Plan for the Multi-Phase Extraction Optimization Study, AAFES Station, Fort Hamilton, New York. July.

On 28 July 2004, a truck-mounted combination direct-push/hollow stem auger drill rig was used to install the temporary vapor monitoring points using the direct-push. Continuous soil samples were collected at TMP-03 from the unsaturated zone through the smear zone using a 2-in. diameter by 4-ft-long stainless steel sample barrel with clean acetate liner (via direct-push drilling technique). The soil samples were described using the Unified Soil Classification System and screened for volatile organic compounds in the soil headspace using a Minirae® photoionization (PID) detector. The soil boring log is provided in Appendix A. A soil sample was collected from TMP-03 at the water table interface (i.e., 21.2 to 21.7 ft bgs) and submitted to Microbial Insights of Rockford, Tennessee, for quantitative analysis of the microbial community.

The 1-in. diameter monitoring points were installed at a depth of 28 ft bgs with 15 ft of Schedule 40, 0.010-slot, polyvinyl chloride screen and an appropriate amount of riser, with the exception of TMP-04, which was installed to 10 ft bgs with 5 ft of screen. The temporary points were completed flush to the surface with traffic-rated curb boxes set in concrete collars to protect the risers from damage.

2.3 LNAPL BAIL-DOWN TESTS

On 9 August 2005, bail-down testing was conducted to determine the rate of LNAPL recovery at existing groundwater monitoring wells MW-01 and MW-04. These wells were selected because they contained measurable LNAPL during the baseline gauging performed at the start of the optimization study. Following removal of the LNAPL, the wells were gauged using an oil/water interface probe to determine the rate of LNAPL recharge.

LNAPL was also observed in MW-05, however this well was originally planned to be used for the MPE portion of the study. In order to minimize disruption of the MPE testing (which included evaluation of LNAPL recovery), bail-down testing was not performed at this well.

2.4 BASELINE GROUNDWATER SAMPLING

Baseline groundwater samples were collected from groundwater monitoring wells, MW-02, MW-06, and MW-07 from 8-9 August 2005. A groundwater sample was originally planned at well MW-04, however, the sample was collected from MW-06 due to the presence of LNAPL in MW-04.

Groundwater samples were collected via low-flow sampling techniques using a bladder pump and dedicated teflon tubing. Field measurements of water quality parameters, including temperature, pH, conductivity, dissolved oxygen, oxidation/reduction potential, and turbidity, were monitored and recorded during purging to document stabilization prior to sample collection. Water quality indicator parameters were monitored using a Horiba® Model U-22 Water Quality Meter. Field Records of Gauging, Purging, and Sampling are provided in Appendix B.

Groundwater samples collected from the wells were analyzed for the following parameters:

- Volatile organic compounds (including MTBE)
- Nitrate
- Sulfate
- Iron
- Manganese
- Dissolved and total organic carbon.

Groundwater samples were submitted to Chemtec in Mountainside, New Jersey, for analysis of New York State Department of Environmental Conservation (NYSDEC) Spill Technology Remediation Series list volatile organic compounds using U.S. Environmental Protection Agency (EPA) Method 8260, nitrate by IC Method E300, sulfate by U.S. EPA Method 375.4, iron by Ferrous Hach Method 8146, and manganese by Hach Method 8149.

On 11 August 2005, a groundwater sample was also collected using a bailer from monitoring point TMP-03 and submitted to Microbial Insights of Rockford, Tennessee, for a quantitative analysis of the microbial community.

2.5 MULTI-PHASE EXTRACTION OPTIMIZATION STUDY EQUIPMENT

2.5.1 MPE System Components

The major components of the mobile MPE system used during the optimization study included a positive displacement vacuum pump, air/water separator, equalization tank, and associated transfer pumps mounted inside an enclosed trailer (Figure 3 and Appendix C, Photo 1).

2.5.2 Liquid Containerization

A 4,000-gal frac tank was staged onsite to contain extracted groundwater and LNAPL; however, due to the limited amount of liquid recovered during field activities (approximately 25 gal generated during well purging/sampling and 125 gal during MPE testing), the tank was not used. Extracted liquids were staged onsite in 30-gal drums pending offsite disposal.

2.5.3 Offgas Treatment

Generally, offgas treatment is not required by the NYSDEC for an optimization study; however, granular activated carbon was used during the optimization study to minimize nuisance petroleum odor at the site. A changeout of the carbon was not required during the optimization study.

2.5.4 Wellhead Configuration

To allow the installation of the drop-tube, the wells were retrofitted with Fernco® reducers to seal the drop-tube to the 4-in. diameter monitoring well. Vacuum lines consisted of a combination of 1-in. diameter flexible hose and Schedule 80 polyvinyl chloride piping installed on grade. The vacuum line contained an in-line sample port and flow gauge ahead of a manifold connecting it to the process equipment. A pressure gauge was also installed at the wellhead and drop-tube. A schematic of the well as configured for the MPE study is presented in Figure 4 and a photograph of the wellhead is provided in Appendix C, Photo 2.

2.6 FIELD TESTING PROCEDURES

The field testing associated with the MPE optimization study was conducted from 9-11 August 2005 on groundwater monitoring wells MW-03 and MW-05. The MPE optimization study was conducted to evaluate the removal rates and radius-of-influence of the proposed technology. The test included extracting soil vapor, groundwater, and LNAPL simultaneously through the drop-tube installed in the extraction well using the system outlined in Section 2.7.

Five MPE subtests were performed at groundwater monitoring well MW-03 during the study. Prior to the first MPE subtest, a soil vapor extraction (SVE)-only test was performed by placing the drop-tube above the water table interface. The purpose of the SVE test was to establish a baseline for vacuum influence and recovery rates, which can be compared against recovery rates measured during the MPE subtests.

Five MPE subtests were performed in the following sequence:

- **Subtest No. 1**—Minimum depth of drop-tube/low vacuum
- **Subtest No. 2**—Minimum depth/medium vacuum
- **Subtest No. 3**—Minimum depth/high vacuum
- **Subtest No. 4**—Maximum depth/low vacuum
- **Subtest No. 5**—Maximum depth/high vacuum.

The static depth to the water table on MW-03 was measured at 19 ft below the top of casing on 8 August 2005. Therefore, the minimum depth at which the drop-tube was located during the study was approximately 19.5 ft below the top of casing on MW-03, or 0.5 ft below the static water table. The maximum depth of the drop-tube was 24 ft below the top of casing, or 5 ft below the static water table elevation.

The SVE-only portion of the test was performed on 9 August 2005. Following the SVE test, vacuum levels for the remaining portion of the test were determined. Low vacuum was established as the minimum threshold at which fluid flow was initiated. High vacuum corresponded with the maximum amount of vacuum that could be generated by the test equipment (i.e., without dilution air). Medium vacuum corresponded to the approximate midpoint between the low and high vacuum.

A summary of the vacuum levels established for the MPE test on MW-03 is provided below:

Vacuum Level Applied to Well	Well Head Vacuum Measurements (in. of water column)	
	Drop-tube at 19.5 ft Below the Top of Casing	Drop-tube at 24 ft Below the Top of Casing
Low	53	27
Medium	61	---
High	90	87

As per the Work Plan, no medium-level vacuum test was performed on MW-03 with the drop-tube positioned at 24 ft below top of casing.

During the subtests, differential pressure measurements were recorded from the monitoring points until pressure readings reached stabilization (±10 percent) at which point the subtest was completed. Soil gas pressures were recorded at monitoring points using magnehelic gauges.

Following completion of subtesting on MW-03, a condensed sequence of subtests was planned on MW-05 to assess recovery rates based on the results of the subtests performed on MW-03. The MW-05 subtests are described below:

- **Subtest No. 1**—Drop-tube located at the groundwater/LNAPL interface
- **Subtest No. 2**—Vacuum at which the greatest amount of liquid was recovered on MW-03.

Because the LNAPL thickness on MW-05 was approximately 4.7 ft, the drop-tube was set at approximately the same depth as the maximum drop-tube depth on MW-03 (i.e., 5 ft below the water table) and the amount of vacuum required to entrain liquid in the drop-tube at the groundwater/LNAPL interface corresponded to the vacuum at which the greatest amount of liquid was recovered on MW-03. Therefore, only one subtest was performed on MW-05. The static depth to LNAPL[2] on MW-05 was measured at 18.82 ft below the top of casing on 11 August 2005. The depth of the drop-tube was approximately 23 ft below the top of casing, or 5 ft below the LNAPL/groundwater table elevation.

2.7 PERFORMANCE MONITORING

Performance monitoring included LNAPL/groundwater levels, air and water flow rates, pressure, temperature, and soil gas hydrocarbon concentrations (Table 1).

2.7.1 Water Level Measurements

Water level elevations and LNAPL thickness were determined periodically (between steps on MW-03) by temporarily removing the cap at each monitoring point and measuring the depth to

2 The static depth to LNAPL used to set the drop-tube on MW-05 was measured following the MW-03 tests. The static depth to LNAPL measured prior to the start of testing at the site was 19.64 ft below top of casing (LNAPL). The thickness of LNAPL in MW-05 increased approximately 0.8 ft during the MW-03 tests.

LNAPL and groundwater using an interface probe. Groundwater and LNAPL measurements were also collected from adjacent monitoring wells between steps.

In addition, a pressure transducer was installed in groundwater monitoring well MW-02 prior to the beginning of testing to provide baseline water level data and record the water level response to liquid extraction. The transducer was installed in the 4-in. monitoring well instead of one of the temporary monitoring points because the diameter of the probe was greater than 1 in.

2.7.2 Vacuum

Vacuum was recorded at the wellhead, drop-tube, and MPE equipment during each step on MW-03 and MW-05. Vacuum was also recorded at the temporary monitoring points during each step on MW-03. Existing wells MW-04 and MW-05, located approximately 24 ft and 36 ft, respectively, from MW-03, were also used to evaluate pressure influence during each step on MW-03. The wellhead, drop-tube and MPE equipment were equipped with a direct reading gauge to allow for measurement. Vacuum at the monitoring points was measured using magnehelic gauges.

2.7.3 Flow Rates

Airflow rates were measured during each step on MW-03 and MW-05 using a pitot tube and/or anemometer within the extraction line after the vacuum pump system. Airflow rates also included measurement of any bleed air at the vacuum pump and/or extraction well.

The volumes of extracted groundwater, LNAPL, and air were measured during each step on MW-03 and MW-05. The groundwater flow rate and LNAPL recovery rate were calculated based on periodic gauging of the volume of groundwater and LNAPL collected into the equalization tank inside the equipment trailer.

2.7.4 Extracted Soil Vapor/Groundwater Concentrations

The relative hydrocarbon concentrations in the soil gas were measured during each step of the test on MW-03 and MW-05 using a PID and Tedlar bag. One soil vapor sample was also collected from a sample port located between the vacuum blower and the granular activated carbon unit on 11 August 2005. Since no LNAPL was present in MW-03 during the study, the vapor sample was obtained during testing on MW-05 to provide a maximum value for mass recovery calculations. The sample was collected using a summa canister and submitted to Severn Trent Laboratories in Los Angeles, California, for analysis of BTEX, MTBE, and total petroleum hydrocarbons by EPA Method TO-3.

One groundwater effluent sample was collected from the system on 11 August 2005, while the MPE equipment was operating on MW-05. The sample was collected during the MW-05 test to provide a maximum estimate of mass recovery (via groundwater) from a well where measurable LNAPL was also present. The sample was submitted to Chemtec in Mountainside, New Jersey,

for analysis of NYSDEC Spill Technology Remediation Series list volatile organic compounds using EPA Method 8260.

2.8 INVESTIGATIVE-DERIVED MATERIAL

Extracted groundwater and LNAPL were staged at the site in five 30-gal drums (labeled as "non-hazardous waste") pending offsite disposal. Spent activated carbon from the treatment of extracted soil vapor was also staged at the site in two 30-gal drums (labeled as "non-hazardous waste") pending offsite disposal. No soil cuttings were generated during installation of the temporary monitoring points.

3. RESULTS

3.1 SITE GEOLOGY

Based on the continuous soil sample collected during installation of TP-03, the predominant lithology at the site is sandy silt with varying amounts of very fine sand and fine gravel (Appendix A). A silty sand and gravel layer was verified during direct-push soil sampling from approximately 20 to 25 ft bgs. Groundwater was encountered at a depth of approximately 21.5 ft bgs at TP-03, however no LNAPL was observed at this location during installation.

3.2 LNAPL BAIL-DOWN TESTS

Approximately 1 gal of LNAPL was recovered from each of the monitoring wells during bail-down testing peformed on 9 August 2005. The following table summarizes the recharge rate of LNAPL in the monitoring wells:

Elapsed Time (hr)	Depth to LNAPL (ft btoc)	Depth to Water (ft btoc)	LNAPL Thickness (ft)
MW-01			
Static	21.35	22.40	1.05
After bailing	22.00	22.39	0.39
0.25	21.91	22.24	0.33
0.5	21.86	22.24	0.38
1	21.71	22.20	0.49
4	21.53	22.15	0.62
Post-test[(a)]	21.54	22.20	0.66
MW-04			
Static	18.45	18.71	0.26
After bailing	18.65	18.85	0.20
0.25	18.64	18.78	0.14
0.5	18.63	18.78	0.15
1	18.61	18.75	0.14
4	18.59	18.72	0.13
Post-test[(a)]	18.62	18.75	0.13

(a) Post-test gauging was performed four hours after MPE test activities were completed on 11 August 2005.

3.3 ANALYTICAL RESULTS

3.3.1 Baseline Groundwater Sampling

Estimated or non-detect concentrations of total BTEX and MTBE were reported in monitoring wells MW-06 and MW-07 located downgradient from the source area. Higher total BTEX and MTBE concentrations were reported in MW-02 (918 µg/L and 350 µg/L, respectively), located directly upgradient of the tank vault. Nine other volatile organic compounds were also reported

in MW-02 above the corresponding NYSDEC guidance value. A summary of the baseline groundwater sampling results, including the natural attenuation parameters, is provided in Table 2.

3.3.2 Microbial Results

Catechol dioxygenase was detected at 4.54E+04 cells/gram and 3.47E+05 cells/gram, respectively, in the soil and the groundwater samples collected from TMP-03. Catechol dioxygenases are key enzymes in the metabolism of aromatic rings by soil bacteria; therefore, they play a key role in bioremediation of halogenated pollutants (Broderick 1999)[3].

3.4 MPE FIELD TESTING

Data collected during field testing associated with the MPE optimization study were qualitatively and quantitatively analyzed to evaluate the feasibility of using full-scale MPE remediation at the site. The data were reduced to estimate the radius-of-influence in the vadose zone, contaminant recovery rates, and to assess technology optimization/applicability at the site.

3.4.1 Depth to LNAPL/Groundwater

LNAPL was not observed in the temporary points prior to, during, or after the MPE testing. Groundwater and LNAPL elevations were monitored periodically during the tests. The following drawdown in water table elevation was observed during the tests on MW-03:

Monitoring Point	Distance from MW-03 (ft)	Observed Drawdown (ft)	
		Drop-tube at 19.5 ft Below the Top of Casing	Drop-Tube at 24 ft Below the Top of Casing
TMP-01	5	-2.47	-3.31
TMP-02	10	-0.97	-1.33
MW-04	24	-0.10	-0.02
MW-05	36	-0.25	-0.29

A slight increase was observed in the apparent thickness of LNAPL in MW-05 (i.e., approximately 0.8 ft) during MPE testing on MW-03.

3.4.2 Vacuum

Vacuum levels were monitored throughout the test at the four temporary well points and two of the site groundwater monitoring wells. A summary of the vacuum levels observed throughout the MW-03 test is provided in Table 3. The greatest amount of vacuum influence was observed in temporary monitoring points TMP-01 and TMP-02, located 5 and 10 ft, respectively, from MW-03. Vacuum influence in TMP-04 (installed to a depth of 10 ft bgs, and located 5 ft from

3 Broderick, J.B. 1999. Catechol dioxygenases. Essays Biochem, v 34, p 173-89.

MW-03) was similar to that observed in TMP-01. Vacuum influence was observed as far as 36 ft from the test well (in MW-05).

Since the intent of the MPE testing on MW-05 was to assess recovery rates, and no additional temporary points were installed in the vicinity of MW-05, vacuum influence in the vicinity of this well was not evaluated as part of this study.

3.4.3 Flow Rates

The calculated air flow rates during the MW-03 testing ranged from 5 to 25 cfm (Table 3). Approximately 125 gal of groundwater and approximately 8 gal of LNAPL were recovered during MPE testing. No LNAPL was recovered from MW-03. The breakdown of volumes of liquid recovered and calculated liquid recovery rates for each step of the test are provided below:

Test	Volume Water Recovered (gal)	Volume LNAPL Recovered (gal)	Test Duration (hr)	Recovery Rate (gpm)
MW-03				
Step 1	<1	---	1	0.02
Step 2	2	---	2	0.02
Step 3	5	---	2	0.04
Step 4	5	---	0.5	0.17
Step 5	30	---	1	0.50
MW-05				
Step 1	83	8	1.75	0.86

3.4.4 Extracted Soil Vapor/Groundwater Concentrations

The influent total volatile hydrocarbon concentrations measured with a PID during extraction at MW-03 (with no LNAPL present) ranged from 53 to 172 ppm_v. The influent total volatile hydrocarbon concentrations measured during extraction on MW-05 (with LNAPL present) ranged from 1,197 to 1,368 ppm_v. The PID measurements were obtained on the discharge side of the vacuum pump (i.e., after dilution) prior to granular activated carbon treatment.

A soil vapor sample was collected prior to granular activated carbon treatment (during testing on MW-05) and analyzed for BTEX and total petroleum hydrocarbons via EPA Method 19 (TO-3). The total BTEX concentration reported in the sample was 369 $ppm_{v,}$ and the total petroleum hydrocarbon (as gasoline) concentration reported was 2,900 ppm_v. The analytical chain-of-custody, narrative, and results are provided in Appendix D.

The total BTEX and MTBE concentrations in the groundwater sample collected during the MW-05 test were 262,100 μg/L and 13,000 μg/L, respectively (Table 2). The analytical chain-of-custody, narrative, and results are provided in Appendix D.

3.5 ESTIMATED MPE RADIUS-OF-INFLUENCE

3.5.1 Vacuum

The estimated radius-of-influence of the MPE test (defined as 0.1 in. of water differential or greater) was assessed by evaluating the five steps performed on MW-03. For each of the steps, the differential pressures recorded in each of the monitoring points and monitoring wells were plotted against distance from the extraction well. Using a linear regression analysis, the equation of the best-fit line was determined for the data set, and the distance corresponding to a differential pressure of 0.1 in. of water was considered to be the radius-of-influence during that particular test.

The radius-of-influence plot for each test is presented in Appendix E. The results of these tests, summarized in the table below, indicate that the estimated radius-of-influence was similar among all of the tests, and ranged from 28 to 41 ft:

Step	Radius of Influence (ft)
SVE	20
1	28
2	36
3	41
4	29
5	38

3.5.2 Subsurface Permeability

Air permeability in the subsurface at the site was estimated using HyperVentilate[4]. Hydraulic conductivity was estimated from the air permeability values with the following results:

Geologic Unit	Soil Permeability (darcy)	Estimated Hydraulic Conductivity (ft/day)
Fine Sand/Silty Sand	0.143 darcy	6
Gravel Layer	3.547 darcy	148

The output of the HyperVentilate program is provided in Appendix F.

3.5.3 Hydraulic Conductivity

The drawdown data collected during the MPE test from the associated monitoring points and nearby groundwater monitoring wells was used to graphically estimate the hydraulic conductivity. Drawdown versus distance was plotted on semi-log paper. The amount of drawdown over 1 log cycle is used with the groundwater extraction rate to estimate transmissivity. Hydraulic conductivity was then estimated from the transmissivity value by

4 Hyperventilate is a software guidance system for vapor extraction applications written by Paul C. Johnson, Ph.D., for the Shell Development Westhollow Research Center, Environmental Research and Development.

dividing by the aquifer thickness. The calculated hydraulic conductivity value of 0.3 ft/day is within the range of a fine to silty sand. The calculations and graph are provided in Appendix G.

3.6 ESTIMATED RECOVERY RATES

The average groundwater recovery rate throughout the test was less than 1 gpm. A contaminant recovery rate of 14.63 lb/day as BTEX was calculated based on a total BTEX concentration of 262,100 μg/L (Table 4). The BTEX concentration was obtained from the sample collected on MW-05 during MPE testing.

Contaminant recovery rates for the SVE portion of the MPE were calculated for the subtests. Vapor-phase contaminant recovery rates ranged from 1.4 lb/day during the SVE-only test on MW-03 to 17.4 lb/day during the MPE test on MW-05 (Table 5).

3.7 INVESTIGATIVE-DERIVED MATERIAL

Used personal protective equipment was double-bagged and disposed of onsite as general refuse. Extracted groundwater, LNAPL and spent carbon were contained onsite during the field activities and properly disposed of by Action Remediation, Inc., of Wantagh, New York. A total of seven drums were removed from the site on 19 September 2005, as listed below:

- One 30-gal drum of water/LNAPL mixture
- Four 30-gal drums of water/trace gasoline
- Two 30-gal drums of spent activated carbon

Manifests associated with the investigative-derived material are provided in Appendix H.

4. SUMMARY AND CONCLUSIONS

4.1 EVALUATION OF MPE AS A REMEDIAL TECHNOLOGY

The MPE optimization study was conducted at the AAFES station site to evaluate the technology as a potential component of the corrective measures to address petroleum-impacted soil and groundwater. The estimated radius-of-influence of the MPE system was assessed, with respect to induced subsurface vacuum and groundwater depression, using one of the existing monitoring wells at the site. In addition, the MPE technology was evaluated based on contaminant recovery rates.

4.1.1 Induced Vacuum in the Vadose Zone

The estimated radius-of-influence of the MPE system was assessed based on vacuum distribution measurements collected from existing monitoring wells and monitoring points that were installed radially from the MPE test well (MW-03). Based on the subsurface vacuum measurements, the estimated radius-of-influence for the AAFES station site ranged from 28 to 41 ft (average: 34 ft) during five independent tests conducted on MW-03.

4.1.2 Subsurface Permeability

The shallow monitoring point (TMP-04) was designed to evaluate the effect that a previously identified gravel layer, located approximately 20 ft bgs, would have on subsurface airflow. The air permeability calculations resulted in two different values. Data collected from the monitoring points installed through both the gravel and silty sand units (TMP-02 and TMP-03) resulted in an air permeability value corresponding to gravel, indicating that these two monitoring points were communicating with the extraction well (MW-03) via the gravel unit.

Data collected from TMP-01 and TMP-04 resulted in an air permeability value corresponding with a fine or silty sand. These data suggest that monitoring points TMP-01 and TMP-04 were communicating with the extraction well via the predominant surficial geologic unit. Although TMP-01 is screened across the gravel layer, it is possible that the gravel layer was submerged when the SVE subtest was initiated on MW-03. It is also possible that localized mounding of the groundwater in the immediate vicinity of the extraction well (i.e., during SVE) may have reduced the amount of air flow in the gravel layer at TMP-01.

The range of estimates of subsurface permeability is evidence that some preferential airflow occurred during the test through the gravel layer, and should be accounted for in full-scale design.

4.1.3 Surficial Aquifer Depression

Observed drawdown in nearby monitoring wells during the MPE test indicated that there was hydraulic connectivity between the extraction well and nearby monitoring wells within the measured vadose zone radius-of-influence. However, there appears to be a preferential direction of hydraulic influence between MW-03 and MW-05.

4.1.4 Contaminant Recovery Rates

Maximum estimates of contaminant recovery of 14.63 lb/day from the dissolved and 17.4 lb/day from the vapor phase were calculated. These estimates were based on samples collected during the MPE test on MW-05 where nearly 5 ft of LNAPL was observed. Significantly lower vapor phase recovery rates were calculated during the tests on MW-03 where LNAPL was not observed. The highest vapor phase contaminant recovery rate on MW-03 was observed while the drop-tube was positioned at the maximum depth (i.e., 5 ft below static groundwater table), with the maximum vacuum applied to the well.

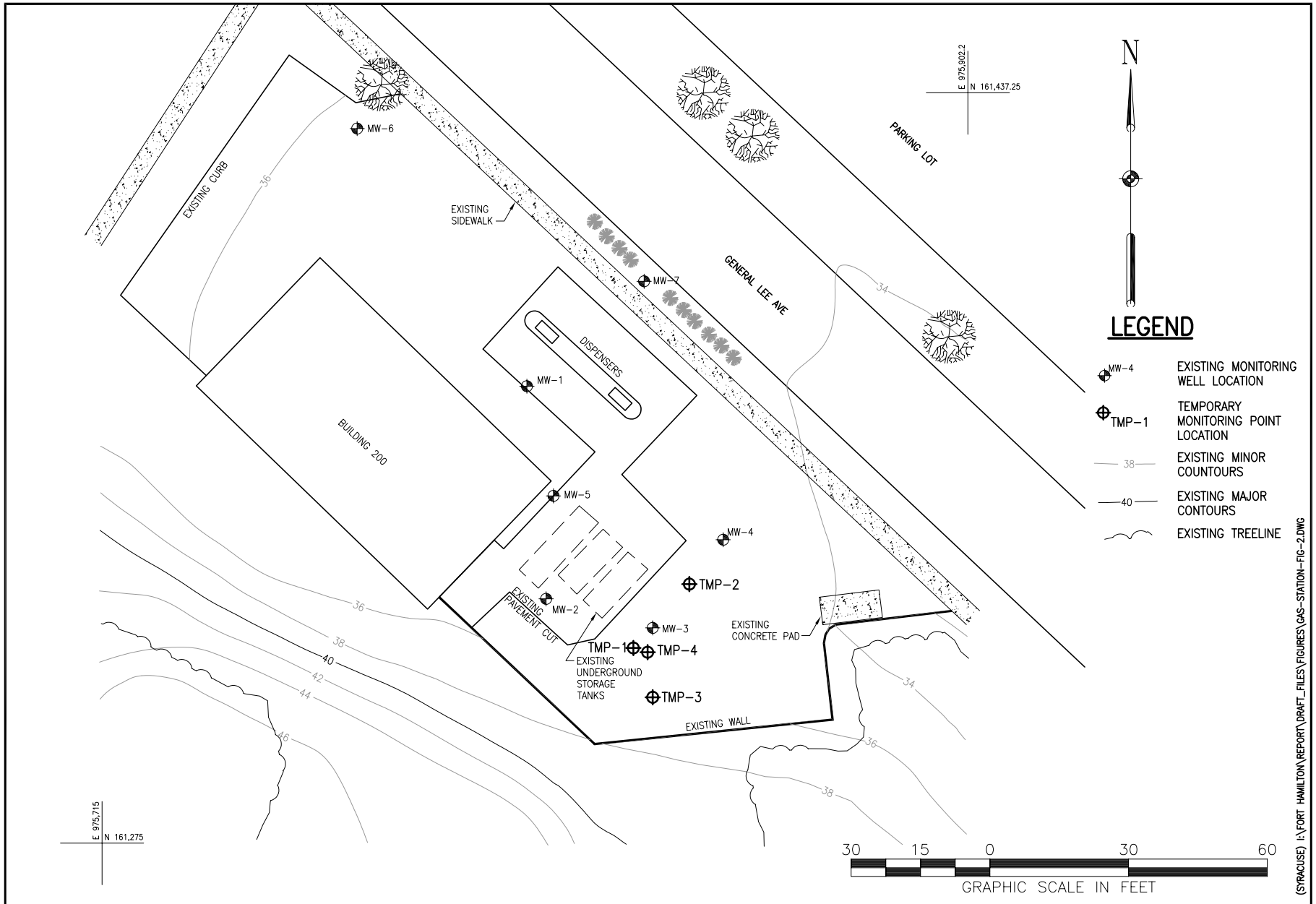
4.2 CONCLUSIONS

The results of the optimization study indicate that MPE is a viable remedial option for the AAFES station site. It is anticipated that further evaluation of vacuum influence, subsurface permeability, aquifer depression, and mass recovery rates will be required in conjunction with design of a full-scale MPE system.

0 345 690 1,380 2,070 2,760 Feet

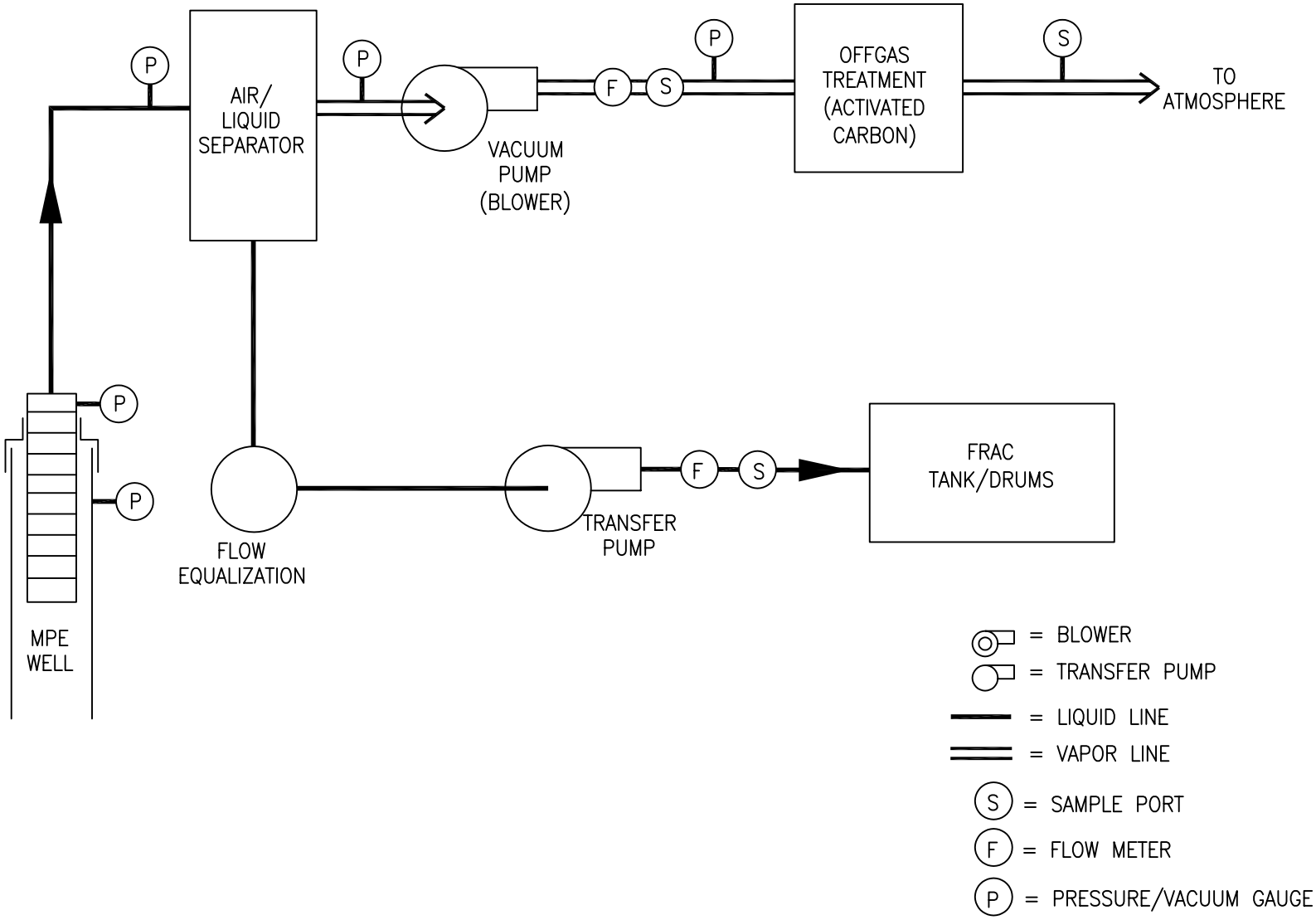
N

EA®	MULTI-PHASE EXTRACTION DESIGN OPTIMIZATION STUDY AAFES STATION FORT HAMILTON, NEW YORK					FIGURE 1 SITE LOCATION MAP	
PROJECT MGR: JH	DESIGNED BY: DC	CREATED BY: DC	CHECKED BY: JM	SCALE: AS SHOWN	DATE: SEPT. 2005	PROJECT NO: 6199006	FILE NO: I:\FORTHAMILTON\ SITELOCATION.MXD



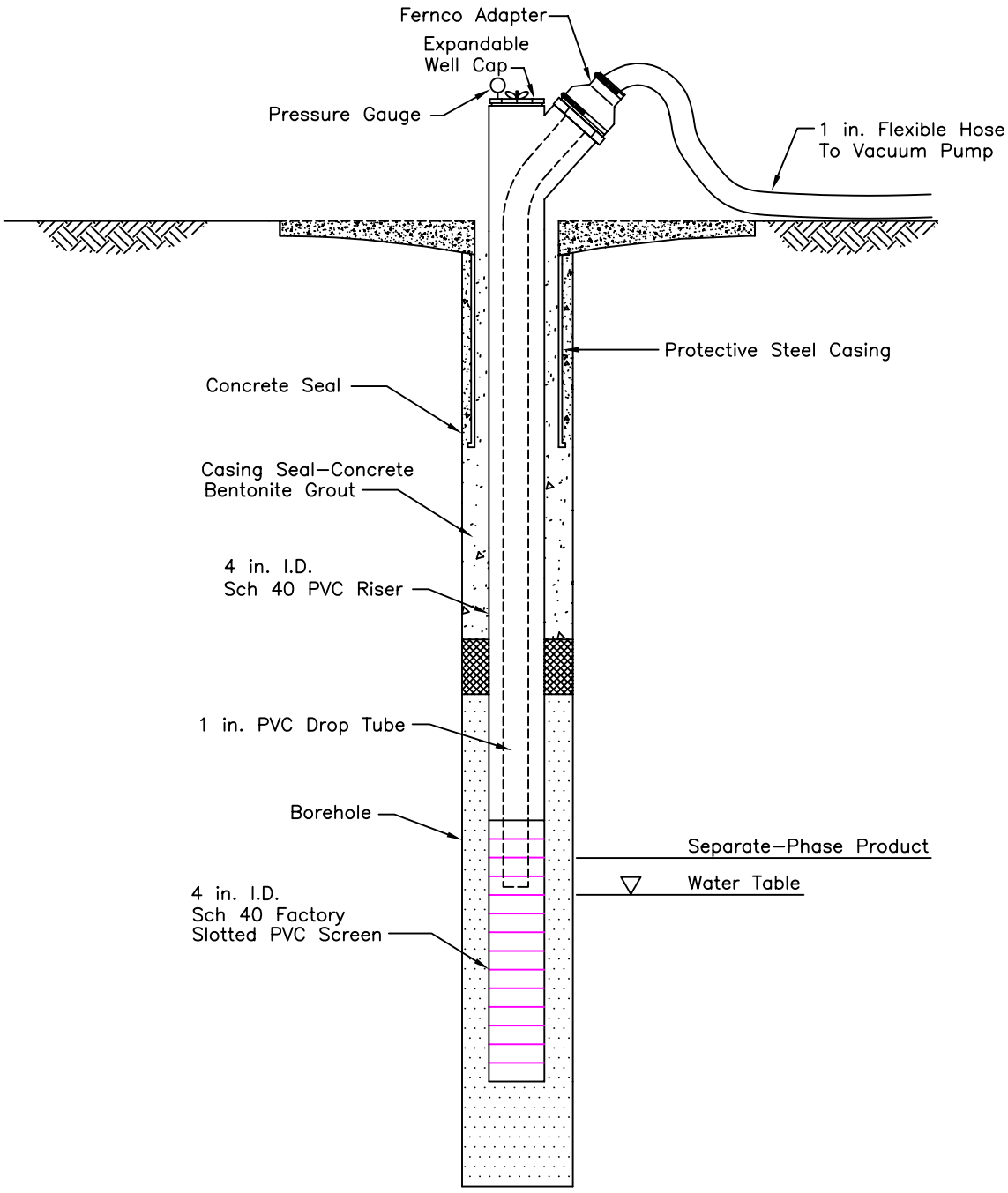
(SYRACUSE) I:\FORT HAMILTON\REPORT\DRAFT_FILES\FIGURES\GAS-STATION-FIG-2.DWG

	MULTI-PHASE EXTRACTION DESIGN OPTIMIZATION STUDY AAFES STATION FORT HAMILTON, NEW YORK	FIGURE 2 SITE MAP	DESIGNED BY JAM	DRAWN BY WEL	DATE SEPT. 2005	PROJECT NO. 61990.06
			CHECKED BY DFC	PROJECT MGR. JCH	SCALE AS NOTED	FIGURE 2



(SYRACUSE) I:\FORT HAMILTON\REPORT\DRAFT_FILES\FIGURES\MPE-FIG3.DWG

EA®	MULTI-PHASE EXTRACTION DESIGN OPTIMIZATION STUDY AAFES STATION FORT HAMILTON, NEW YORK	FIGURE 3 PROCESS FLOW DIAGRAM	DESIGNED BY JAM	DRAWN BY WEL	DATE SEPT. 2005	PROJECT NO. 61990.06
			CHECKED BY DFC	PROJECT MGR. JCH	SCALE AS NOTED	FIGURE 3



NOTE: All Features Not to Scale

(SYRACUSE) I:\FORT HAMILTON\REPORT\DRAFT_FILES\FIGURES\FTHAMILTON REPORT-FIG4.DWG

MULTI–PHASE EXTRACTION
DESIGN OPTIMIZATION STUDY
AAFES STATION
FORT HAMILTON, NEW YORK

FIGURE 4
DIAGRAM OF MPE WELL

PROJECT MGR	DESIGNED BY	DRAWN BY	CHECKED BY	SCALE	DATE	PROJECT NO	FIGURE
JCH	DFC	WEL	JCH	NONE	SEPT. 2005	61990.06	4

TABLE 1 SUMMARY OF PERFORMANCE MONITORING

Type of Monitoring	Location	Frequency	Method
Soil Gas Pressures	Monitoring points	Prior to startup (baseline), every 15 minutes for first hour, every hour for the first 8 hours, and every 4 hours thereafter	Magnehelic gauge
Soil Gas Concentration	Monitoring points	Prior to startup (baseline) and every 4 hours	Direct reading hydrocarbon analyzer
Extracted Groundwater Concentration	At liquid storage tank	End of optimization study	Offsite laboratory
System Offgas Concentration	Before carbon treatment	Every 6 hours	Direct reading hydrocarbon analyzer
System Offgas Concentration	After carbon treatment	Every 6 hours	Direct reading hydrocarbon analyzer
System Offgas Concentration	Before carbon treatment	Once during first subtest	Offsite laboratory
Groundwater Flow Rate	Oil/water separator discharge	End of each test	Flow meter
Volume of LNAPL Recovered	Product storage tank	End of each test	Gage tank
Vapor Flow Rate	After knock-out tank	Every hour	Flow meter
Vacuum	Wellhead	Every hour	Vacuum gauge
Groundwater/LNAPL Elevation	Temporary monitoring points, nearby monitoring wells, and extraction well	Prior to startup (baseline) and every hour	Interface probe

NOTE: LNAPL = Light, non-aqueous phase liquid.
Soil gas, groundwater, and offgas concentrations defined as total hydrocarbons.
Monitoring was performed between the daylight hours of 0800 and 1630 during the test.

TABLE 2 SUMMARY GROUNDWATER ANALYTICAL RESULTS BASELINE AND SYSTEM INFLUENT SAMPLING

Analyte	MW-02	MW-06	MW-07	System Influent (MW-05)	NYSDEC Class GA Value [(a)]
VOLATILE ORGANIC COMPOUNDS BY EPA METHOD 8260					
Benzene	**180 D**	(<0.39 U)	(<0.39 U)	**5,100**	1
Toluene	**160**	(<0.36 U)	(<0.36 U)	**79,000**	5
Ethyl Benzene	**150**	(<0.45 U)	0.63 J	**20,000**	5
m/p-Xylenes	**380**	(<1.20 U)	1.9 J	**110,000**	5
o-Xylene	**48**	(<0.46 U)	0.65 J	**48,000**	5
Total BTEX	918	ND	3	262,100	---
Methyl tert-butyl Ether	**350 D**	(<0.28 U)	0.96 J	**13,000**	10
Isopropylbenzene	**110**	(<0.44 U)	1.8 J	**2,800**	5
n-propylbenzene	**120**	(<0.49 U)	4.5 J	**6,400**	5
1,3,5-Trimethylbenzene	**170 D**	(<0.42 U)	0.94 J	**21,000**	5
tert-Butylbenzene	(<0.39 U)	(<0.39 U)	(<0.39 U)	(<200 U)	5
1,2,4-Trimethylbenzene	**250 D**	(<0.44 U)	10	**71,000**	5
sec-Butylbenzene	**21**	(<0.44 U)	3.4 J	(<220 U)	5
p-Isopropyltoluene	**27**	(<0.49 U)	1.2 J	**2,200 J**	5
n-Butylbenzene	(<0.49 U)	(<0.49 U)	1.4 J	**2,000 J**	5
Naphthalene	**160**	(<0.34 U)	(<0.34 U)	**10,000**	10

(a) New York State Department of Environmental Conservation (October 1998) Ambient Water Quality Standards and Guidance Values.

NOTE: NYSDEC = New York State Department of Environmental Conservation.
D = Indicates compound detected at a secondary dilution factor.
U = Not detected. Sample quantitation limits are shown as (<___U).
J = Estimated value. Less than the contract required detection limit, but greater than zero.
NTU = Nephelometric turbidity unit.
Results in bold exceed NYSDEC Ambient Water Quality Standards and Guidance Values.
Dashes (---) indicate that there is no NYSDEC Ambient Water Quality Standards and Guidance Value established for the analyte.

Analyte	MW-02	MW-06	MW-07	System Influent (MW-05)	NYSDEC Class GA Value [(a)]
NATURAL ATTENUATION PARAMETERS					
Iron	**4,940**	169	**2,350**	NA	1,000
Manganese	19,400	317	9,820	NA	1,000
Ferrous Iron	(<0.10 U)	(<0.10 U)	(<0.10 U)	NA	600
Nitrate	(<0.10 U)	1.71	(<0.10 U)	NA	20,000
Sulfate	9	89	43	NA	500,000
Dissoved Organic Carbon	4	5	29	NA	100
Total Organic Carbon	7	8	32	NA	100
FIELD PARAMETERS					
Temperature (°C)	17.90	18.50	17.90	NA	---
Conductivity (mS/cm)	86	0.21	0.75	NA	---
Dissolved Oxygen (mg/L)	0.0	0.0	0.0	NA	---
pH	6.24	6.24	6.02	NA	6-8.5
eH (mV)	-45.0	109	63	NA	---
Turbidity (NTU)	56.6	30.4	197	NA	---

TABLE 3 SUMMARY OF RADIUS-OF-INFLUENCE DATA COLLECTED
(MW-03)

Step	Flowrate (cfm)[a]	Wellhead Vacuum (in. water)	Induced Vacuum[b] (5 ft)	Induced Vacuum (10 ft)	Induced Vacuum (15 ft)	Induced Vacuum (24 ft)	Induced Vacuum (36 ft)	Drop Tube Location [c]
SVE	17	32	0.19	0.23	0.15	0.07	0.02	NA
1	5	53	0.22	0.28	0.17	0.11	0.04	0.5
2	17	61	0.30	0.32	0.35	0.17	0.03	0.5
3	25	90	0.54	0.42	0.50	0.22	0.06	0.5
4	8	27	0.28	0.21	0.30	0.10	0.04	5
5	15	87	0.58	0.40	0.50	0.21	0.07	5

(a) Air flow rate from extraction well, without dilution.
(b) Measured in inches of water.
(c) Measured in feet below the static groundwater table.

NOTE: NA = Not applicable.
cfm = Cubic feet per minute.

TABLE 4 SUMMARY OF DISSOLVED-PHASE CONTAMINANT RECOVERY

Parameter	Unit	Result
Total BTEX	(µg/L)	262,100
Groundwater flow rate	(gal/min)	0.79
Total BTEX	(lb/day)	2.49
Gasoline Equivalent[a]	(lb/day)	14.63

(a) Assumes 17% BTEX in gasoline.

CR = C x Q

Where

CR = Contaminant recovery
C = Contaminant concentration
Q = Flow rate

TABLE 5 SUMMARY OF VAPOR-PHASE CONTAMINANT RECOVERY

Sub-Test No.	Air Flow Rate[a] (cfm)	Organic Vapor Concentration Photoionization Detector (ppm_v)	Contaminant Recovery[b] Rate (lb/day gasoline)
MW-03			
(SVE only)	148	52	1.4
3	105	94	1.8
5	87	172	2.7
MW-05			
1	70	1,368	17.4

(a) Total flow rate was measured at the photoionization detector screening location and includes dilution air at wellhead and vacuum pump.

(b) Contaminant removal rate calculated using formula provided from "A Practical Approach to the Design, Operation, and Monitoring of In-Situ Soil-Venting Systems", P.C. Johnson et. al.

$$ER = Q \times C$$

where

ER = Emissions rate (lb/day)
Q = Flow rate (cfm)
C = Total volatile hydrocarbon concentration in influent (lb/ft3)

$$C\ (mg/l) = \frac{C\ (ppmv\ [C4H8]) * 56{,}107\ (mg\text{-}C4H8/mole\text{-}C4H8) * 10^{-6}}{(0.0821\ L\text{-}atm/^{o}K\text{-}mole) * (298\ K)}$$

$$C\ (lb/ft^3) = \frac{C\ (mg/L) * 1\ lb * 1\ L}{453{,}592\ mg * 0.035\ ft^3}$$

Appendix A

Soil Boring Log
TMP-03

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL BORING

Co-ordinates: _____

Surface Elevation: _____

Casing Above Surface: _____

Reference Elevation: _____

Reference Description: _____

MC = Macrocore

Job No.	Client	Location
6199006	USACE	Ft. Hamilton

Drilling Method: HSA for top foot, then direct push

Boring No. TMP-3

Sampling Method: 4' macrocore samplers w/ acetate liners

Sheet 1 of 2

Water Level	19.35	19.05
Time	1030	1230
Date	7/27/05	7/27/05
Reference	Bgs	Bgs

Drilling	Start	Finish
Time	0750	0950
Date	7/27/05	7/27/05

Surface Conditions: Asphalt parking lot

Drilling Contractor: EPI Lic.No. _____

Driller: Ron Higgins

By: Tom Biolsi Checked By: _____

Date: 7/27/05

Sampler Type	Inches Driven / Inches Recovered	Depth of Casing	Sample No. / Sample Depth	PID (ppm) (in macrocore)	Blows/6 in. Sampler	Depth in Feet	USCS Log	
						0		0-1': Drilled thru asphalt w/ HSAs.
MC	36/22		1-4	0		1		0-22": Reddish brn f-vf SAND trace(+) f. gravel, trace silt, trace mica, dry/s. moist, - Fill
						2		
						3		
MC	48/48		4-8	0		4		0-4": Same as above - Fill 4-8": Reddish brn vf SAND, some silt, trace(-) f. gravel, s.moist - Fill
						5		
						6		8-18": Blk SILTY SAND, moist
						7		18-48": Brn/reddish-brn CLAY, little silt, trace(-) med. gravel, wet. Lens of m-f lt. brn SAND from 24-26".
MC	48/42		8-12			8		0-6": Same as above
						9		6-12": Drk grey m(+)-vf SAND, and(-) f. gravel (subangular), dry.
				17 to 13		10		12-42": Reddish brn SANDY SILT, trace(+) f. gravel (subrounded-rounded), dry/s. moist.
						11		2" lens of greenish grey weathered rock (shale?) from 32-34" and from 40-41", dry.
MC	48/48		12-16	14 to 31 @ bottom		12		0-48": Reddish brn SANDY SILT, trace(-) f. gravel (subrounded), moist. Drk grey/blk c-f SAND, little f. gravel (subangular) from 7-10", moist. Some weathered rock frags @ 28". 2 large rock frags @ 23" and 38" - granite-like.
						13		
						14		
						15		
MC	48/48		16-20	40 ↓ 883 mid. ↓ 25 bottom		16		0-48": Reddish brn SILTY SAND, trace f. gravel (subangular), s. moist. grading to SANDY SILT from approx 35-48", moist.
						17		
						18		
						19		
						20		

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL BORING

Co-ordinates:

Surface Elevation:

Casing Above Surface:

Reference Elevation:

Reference Description:

Job No.	Client	Location
619906	USACE	Ft. Hamilton
Drilling Method:		Boring No. TMP-3
Sampling Method: See Pg 1		Sheet 2 of 2

Water Level			
Time			
Date			
Reference			

Drilling	Start	Finish
Time	0750	0950
Date	7/27/95	7/27/95

Surface Conditions:

Sampler Type	Inches Driven / Inches Recovered	Depth of Casing	Sample No. / Sample Depth	PID (ppm) (in headspace)	Blows/6 in Sampler	Depth in Feet	USCS Log	
MC	48/48		20-24	60		20		0-48": Reddish brn SILTY SAND, little (+) f. gravel (subangular to subrounded), s. moist - wet. Increased gravel content from 0-15". GW encountered at approx 21.5 ft bgs.
				517		21		
				270		22		
						23		
MC	48/48		24-28	32 to 48		24		0-48": Reddish brn SILTY SAND, little (-) c-f gravel from 28-48". Material very loose + wet from 0-28".
						25		
						26		
						27		
						28		End of boring at 28 ft bgs.
						29		
						30		
						1		
						2		
						3		
						4		
						5		
						6		
						7		
						8		
						9		
						0		

Drilling Contractor: Lic.No.

Driller:

Checked By:

By:

Date:

Appendix B

Field Records of Gauging, Purging, and Sampling

EA Engineering, Science, and Technology
6731 Collamer Rd, Suite 2
E. Syracuse NY 13057-9808
TEL: (315) 431-4610

FIELD RECORD OF GAUGING, PURGING, AND SAMPLING

WELL I.D.:	MW-02	**SITE NAME:**	AAFES Station
WELL CONDITION:	Good	**WEATHER:**	Sunny, 80's
GAUGE DATE:	8/8/2005	**GAUGE TIME:**	15:00
SOUNDING METHOD:	Water level indicator	**MEASUREMENT REF:**	TOC
STICK UP/DOWN (ft):	Flush	**WELL DIAMETER (in):**	4-in
PURGE DATE:	8/8/2005	**PURGE TIME:**	15:05
PURGE METHOD:	Bladder pump	**FIELD TECHNICIAN:**	JM

WELL GAUGING DATA

A. WELL DEPTH (ft): 32.16
B. DEPTH TO WATER (ft): 21.34

Parameter	Beginning	1st Reading	2nd Reading	3rd Reading	4th Reading	5th Reading
Time (min)	15:05	15:10	15:15	15:20	15:25	15:30
Depth To Water	21.34	21.5	21.75	21.91	---	---
Purge Rate (mL/min)	375	300	300	200	200	200
Temperature (^oC)	15.60	15.40	15.40	15.30	15.80	15.80
Conductivity (mS/cm)	89	88	88	88	87	87
Dissolved Oxygen (mg/l)	0.0	0.0	0.0	0.0	0.0	0.0
pH	6.18	6.21	6.22	6.22	6.23	6.22
eh (mV)	-2.0	-11.0	-17.0	-23.0	-27.0	-30.0
Turbidity (NTU)	18.8	15.0	17.0	17.0	18.7	21.7
Parameter	**6th Reading**	**7th Reading**	**8th Reading**	**9th Reading**	**10th Reading**	**11th Reading**
Time (min)	15:35	15:40	15:45	15:50	15:55	16:00
Depth To Water	22.22	22.35	---	22.45	22.46	22.47
Purge Rate (mL/min)	200	150	150	200	75	75
Temperature (^oC)	15.80	15.80	16.40	16.00	16.50	17.20
Conductivity (mmhos/cm)	87	87	87	87	86	86
Dissolved Oxygen (mg/l)	0.0	0.0	0.0	0.0	0.0	0.0
pH	6.22	6.22	6.23	6.24	6.25	6.24
eh (mV)	-33.0	-35.0	-38.0	-39.0	-40.0	-41.0
Turbidity (NTU)	24.8	26.8	29.3	30.6	33.1	37.2

TOTAL QUANTITY OF WATER REMOVED (I 13.6
SAMPLERS: JM

SAMPLING DATE:	8/8/2005	**SAMPLING TIME:**	16:45
SAMPLE TYPE:	Grab	**SPLIT SAMPLE WITH:**	N/A

COMMENTS AND OBSERVATIONS:

C:Forms/ProjectForms/PurgingLog.LFlow.xls

EA Engineering, Science, and Technology
6731 Collamer Rd, Suite 2
E. Syracuse NY 13057-9808
TEL: (315) 431-4610

FIELD RECORD OF GAUGING, PURGING, AND SAMPLING

WELL I.D.:	MW-02	**SITE NAME:**	AAFES Station
WELL CONDITION:	Good	**WEATHER:**	Sunny, 80's
GAUGE DATE:	8/8/2005	**GAUGE TIME:**	15:00
SOUNDING METHOD:	Water level indicator	**MEASUREMENT REF:**	TOC
STICK UP/DOWN (ft):	Flush	**WELL DIAMETER (in):**	4-in
PURGE DATE:	8/8/2005	**PURGE TIME:**	15:05
PURGE METHOD:	Bladder pump	**FIELD TECHNICIAN:**	JM

WELL GAUGING DATA

A. WELL DEPTH (ft): 32.16
B. DEPTH TO WATER (ft): 21.34

Parameter	12th Reading	13th Reading	14th Reading	End		
Time (min)	16:05	16:10	16:15	16:20		
Depth To Water	22.5	22.52	22.54	22.55		
Purge Rate (mL/min)	75	75	75	75		
Temperature (^oC)	17.50	17.70	17.90	17.90		
Conductivity (mS/cm)	86	86	86	86		
Dissolved Oxygen (mg/l)	0.0	0.0	0.0	0.0		
pH	6.24	6.24	6.24	6.24		
eh (mV)	-42.0	-43.0	-44.0	-45.0		
Turbidity (NTU)	38.6	44.8	50.2	56.6		
Parameter						
Time (min)						
Depth To Water						
Purge Rate (mL/min)						
Temperature (^oC)						
Conductivity (mmhos/cm)						
Dissolved Oxygen (mg/l)						
pH						
eh (mv)						
Turbidity (NTU)						

TOTAL QUANTITY OF WATER REMOVED (I 13.6
SAMPLERS: JM
SAMPLING DATE: 8/8/2005 **SAMPLING TIME:** 16:45
SAMPLE TYPE: Grab **SPLIT SAMPLE WITH:** N/A

COMMENTS AND OBSERVATIONS:

EA Engineering, Science, and Technology
6731 Collamer Rd, Suite 2
E. Syracuse NY 13057-9808
TEL: (315) 431-4610

FIELD RECORD OF GAUGING, PURGING, AND SAMPLING

WELL I.D.:	MW-06	**SITE NAME:**	AAFES Station
WELL CONDITION:	Good	**WEATHER:**	Sunny, 80's
GAUGE DATE:	8/8/2005	**GAUGE TIME:**	13:15
SOUNDING METHOD:	Water level indicator	**MEASUREMENT REF:**	TOC
STICK UP/DOWN (ft):	Flush	**WELL DIAMETER (in):**	4-in
PURGE DATE:	8/9/2005	**PURGE TIME:**	13:20
PURGE METHOD:	Bladder pump	**FIELD TECHNICIAN:**	JM

WELL GAUGING DATA

A. WELL DEPTH (ft): 32.25
B. DEPTH TO WATER (ft): 24.99

Parameter	Beginning	1st Reading	2nd Reading	3rd Reading	4th Reading	5th Reading
Time (min)	13:20	13:25	13:30	13:35	13:40	13:45
Depth To Water	24.99	25.11	25.13	25.22	25.28	25.34
Purge Rate (mL/min)	250	75	75	150	150	150
Temperature (^oC)	18.10	17.70	18.60	19.10	18.70	18.60
Conductivity (mS/cm)	0.22	0.22	0.22	0.22	0.21	0.21
Dissolved Oxygen (mg/l)	0.63	0.03	0.00	0.01	0.00	0.00
pH	6.42	6.37	6.31	6.26	6.25	6.25
eh (mV)	130	125	119	113	112	110
Turbidity (NTU)	71.2	43.4	37.9	27.8	25.4	27.7
Parameter	**End**					
Time (min)	13:50					
Depth To Water	25.4					
Purge Rate (mL/min)	150					
Temperature (^oC)	18.50					
Conductivity (mmhos/cm)	0.21					
Dissolved Oxygen (mg/l)	0.0					
pH	6.24					
eh (mv)	109					
Turbidity (NTU)	30.4					

TOTAL QUANTITY OF WATER REMOVED (L 5
SAMPLERS: JM

SAMPLING DATE:	8/9/2005	**SAMPLING TIME:**	14:10
SAMPLE TYPE:	Grab	**SPLIT SAMPLE WITH:**	N/A

COMMENTS AND OBSERVATIONS:

EA Engineering, Science, and Technology
6731 Collamer Rd, Suite 2
E. Syracuse NY 13057-9808
TEL: (315) 431-4610

FIELD RECORD OF GAUGING, PURGING, AND SAMPLING

WELL I.D.:	MW-07	**SITE NAME:**	AAFES Station
WELL CONDITION:	Good	**WEATHER:**	Sunny, 80's
GAUGE DATE:	8/8/2005	**GAUGE TIME:**	11:25
SOUNDING METHOD:	Water level indicator	**MEASUREMENT REF:**	TOC
STICK UP/DOWN (ft):	Flush	**WELL DIAMETER (in):**	4-in
PURGE DATE:	8/9/2005	**PURGE TIME:**	11:30
PURGE METHOD:	Bladder pump	**FIELD TECHNICIAN:**	JM

WELL GAUGING DATA

A. WELL DEPTH (ft): 32.42
B. DEPTH TO WATER (ft): 20.45

Parameter	Beginning	1st Reading	2nd Reading	3rd Reading	4th Reading	5th Reading
Time (min)	11:30	11:35	11:40	11:45	11:50	11:55
Depth To Water	20.45	20.69	20.78	20.84	20.92	21
Purge Rate (mL/min)	350	300	150	150	150	150
Temperature (^oC)	16.70	16.70	17.60	17.80	17.90	17.80
Conductivity (mS/cm)	0.77	0.75	0.73	0.73	0.74	0.75
Dissolved Oxygen (mg/l)	0.23	0.02	0.15	0.08	0.00	0.00
pH	5.68	5.77	5.85	5.90	5.93	5.97
eh (mV)	113	105	97	89	81	73
Turbidity (NTU)	293.0	286.0	271.0	273.0	253.0	228.0
Parameter	**6th Reading**	**End**				
Time (min)	12:00	12:05				
Depth To Water	21.12	21.19				
Purge Rate (mL/min)	150	150				
Temperature (^oC)	17.90	17.90				
Conductivity (mmhos/cm)	0.75	0.75				
Dissolved Oxygen (mg/l)	0.0	0.0				
pH	6.00	6.02				
eh (mv)	68	63				
Turbidity (NTU)	214.0	197.0				

TOTAL QUANTITY OF WATER REMOVED (I 7.75
SAMPLERS: JM
SAMPLING DATE: 8/9/2005 **SAMPLING TIME:** 12:20
SAMPLE TYPE: Grab **SPLIT SAMPLE WITH:** N/A

COMMENTS AND OBSERVATIONS:

Appendix C

Photographs

Photograph 1 Equipment Trailer, MW-03, and temporary points within the study area.

Photograph 2 MW-03 wellhead with fittings.

Appendix D

Analytical Results

CHEMTECH

CASE NARRATIVE

EA Engineering, Science, & Technology, Inc.
Project Name: Pilot Pump Test-Fort Hamilton
Project # N/A
Chemtech Project # T4129

A. Number of Samples and Date of Receipt:
3 Water samples were received on 8/9/05.

B. Parameters:
According to the Chain of Custody document, the following analyses were requested: 8260 Stars List Volatiles, Anions, Dissolved Organic Carbon, Ferrous Iron, Metals Group4, and Total Organic Carbon. This data package contains results for Anions, Dissolved Organic Carbon, Ferrous Iron and Total Organic Carbon.

C. Analytical Techniques:
The analysis of Anions was based on method 300.0, Dissolved Organic Carbon was based on method 415.1, Ferrous Iron was based on method HACH 8146 and Total Organic Carbon was based on method 9060.

D. QA/ QC Samples:
The Holding Times were met for all analysis.
The Blank Spike met requirements for all samples.
The Duplicate analysis met criteria for all samples.
The Matrix Spike analysis met criteria for all samples except Nitrate.
The Blank analysis did not indicate the presence of lab contamination.
The Calibration met the requirements.

E. Additional Comments:
Sample # 2 was diluted for TOC & DOC because of bad matrix.

I certify that the data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. The laboratory manager or his designee, as verified by the following signature has authorized release of the data contained in this hard copy data package.

Signature_____ Name: Krupa Dubey

Date: 8/29/05 Title: QA/QC

CHEMTECH
CHAIN OF CUSTODY RECORD

284 Sheffield Street, Mountainside, NJ 07092
(908) 789-8900 Fax (908) 789-8922
www.chemtech.net

CHEMTECH PROJECT NO. T4129
COC Number 053895

CLIENT INFORMATION

REPORT TO BE SENT TO:
COMPANY: EA Science and Technology
ADDRESS: 6731 Collamer Road
CITY: East Syracuse STATE: NY ZIP: 13057
ATTENTION: Jen Martin
PHONE: 315-431-4610 FAX: 315-431-4280

CLIENT PROJECT INFORMATION

PROJECT NAME: Ft Hamilton MPE
PROJECT NO.: 6199006.0002 LOCATION: Brooklyn, NY
PROJECT MANAGER: Jim Hayward
e-mail: jch@eaest.com
PHONE: (315) 431-4610 FAX: (315) 431-4280

CLIENT BILLING INFORMATION

BILL TO: SAME AS PO#:
ADDRESS: PREVIOUS
CITY: STATE: ZIP:
ATTENTION: PHONE:

DATA TURNAROUND INFORMATION

FAX: _____ DAYS *
HARD COPY: _____ DAYS *
EDD: _____ DAYS *
* TO BE APPROVED BY CHEMTECH
STANDARD TURNAROUND TIME IS 10 BUSINESS DAYS

DATA DELIVERABLE INFORMATION

- ☐ RESULTS ONLY
- ☐ RESULTS + QC
- ☐ New Jersey REDUCED
- ☐ New Jersey CLP
- ☐ EDD FORMAT
- ☐ USEPA CLP
- ☒ New York State ASP "B"
- ☐ New York State ASP "A"
- ☐ Other _____

ANALYSIS

1 VOCs + MTBE (8260)
2 Anions ferrous iron
3 Metals Group 4
4 Total Organic Carbon
5 Dissolved Organ Carbon *
6
7
8
9

CHEMTECH SAMPLE ID	PROJECT SAMPLE IDENTIFICATION	SAMPLE MATRIX	SAMPLE TYPE COMP	SAMPLE TYPE GRAB	SAMPLE COLLECTION DATE	SAMPLE COLLECTION TIME	# OF BOTTLES	PRESERVATIVES 1 (A)	2 (/)	3 (B)	4 (C)	5 (/)	6	7	8	9	COMMENTS
1.	MW-02-0805	Wa		✓	8/8/05	1645	6	2	1	1	1	1					
2.	MW-07-0805	Wa		✓	8/9/05	1220	6	2	1	1	1	1					
3.	MW-06-0805	Wa		✓	8/9/05	1410	6	2	1	1	1	1					
4.																	
5.																	
6.																	
7.																	
8.																	
9.																	
10.																	

← Specify Preservatives
A – HCl B – HNO_3
C – H_2SO_4 D – NaOH
E – ICE F – Other

SAMPLE CUSTODY MUST BE DOCUMENTED BELOW EACH TIME SAMPLES CHANGE POSSESSION INCLUDING COURIER DELIVERY

RELINQUISHED BY SAMPLER:	DATE/TIME:	RECEIVED BY:
1. [signature]	8/9/05 1425	1. L. Carter
RELINQUISHED BY:	DATE/TIME:	RECEIVED BY:
2.		2.
RELINQUISHED BY:	DATE/TIME: 13:45	RECEIVED FOR LAB BY:
3. L. Carter	8.9.05	3. SNEHAL MEHTA

Conditions of bottles or coolers at receipt: ☒ Compliant ☐ Non Compliant
MeOH extraction requires an additional 4 oz jar for percent solid.
Comments:
* lab filtered

Cooler Temp. 4°C
Ice in Cooler?: YES

Page 1 of 1

SHIPPED VIA: CLIENT: ☐ HAND DELIVERED ☐ OVERNIGHT
CHEMTECH: ☒ PICKED UP ☐ OVERNIGHT

Shipment Complete: ☒ YES ☐ NO

Revision 4/2005

WHITE - CHEMTECH COPY FOR RETURN TO CLIENT YELLOW - CHEMTECH COPY PINK - SAMPLER COPY

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908-789-8900 Fax: 908-789-8922

Report of Analysis

Client:	EA Engineering, Science, & Technology, Inc.	Date Collected:	8/8/05
Project:	Pilot Pump Test-Fort Hamilton	Date Received:	8/9/05
Client Sample ID:	MW-02-0805	SDG No.:	T4129
Lab Sample ID:	T4129-01	Matrix:	WATER
Analytical Method:	8260	% Moisture:	100
Sample Wt/Wol:	5.0 Units: mL	Soil Extract Vol:	uL
Soil Aliquot Vol:	uL		

File ID:	Dilution:	Date Analyzed	Analytical Batch ID
VI081058.D	1	8/11/05	VI080605

CAS Number	Parameter	Conc.	Qualifier	RL	MDL	Units
TARGETS						
1634-04-4	Methyl tert-butyl Ether	450	E	5.0	0.28	ug/L
71-43-2	Benzene	260	E	5.0	0.39	ug/L
108-88-3	Toluene	160		5.0	0.36	ug/L
100-41-4	Ethyl Benzene	150		5.0	0.45	ug/L
126777-61-2	m/p-Xylenes	380		5.0	1.2	ug/L
95-47-6	o-Xylene	48		5.0	0.46	ug/L
98-82-8	Isopropylbenzene	110		5.0	0.44	ug/L
103-65-1	N-propylbenzene	120		5.0	0.49	ug/L
108-67-8	1,3,5-Trimethylbenzene	250	E	5.0	0.42	ug/L
98-06-6	tert-Butylbenzene	0.39	U	5.0	0.39	ug/L
95-63-6	1,2,4-Trimethylbenzene	320	E	5.0	0.44	ug/L
135-98-8	Sec-butylbenzene	21		5.0	0.44	ug/L
99-87-6	p-Isopropyltoluene	27		5.0	0.49	ug/L
104-51-8	n-Butylbenzene	0.49	U	5.0	0.49	ug/L
91-20-3	Naphthalene	160		5.0	0.34	ug/L
SURROGATES						
17060-07-0	1,2-Dichloroethane-d4	60.58	121 %	72 - 119		SPK: 50
1868-53-7	Dibromofluoromethane	49.69	99 %	85 - 115		SPK: 50
2037-26-5	Toluene-d8	48.88	98 %	81 - 120		SPK: 50
460-00-4	4-Bromofluorobenzene	51.88	104 %	76 - 119		SPK: 50
INTERNAL STANDARDS						
363-72-4	Pentafluorobenzene	529338	3.85			
540-36-3	1,4-Difluorobenzene	1051155	4.30			
3114-55-4	Chlorobenzene-d5	865416	7.36			
3855-82-1	1,4-Dichlorobenzene-d4	410458	9.65			

U = Not Detected
RL = Reporting Limit
MDL = Method Detection Limit
E = Value Exceeds Calibration Range
J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908-789-8900 Fax: 908-789-8922

Report of Analysis

Client:	EA Engineering, Science, & Technology, Inc.	Date Collected:	8/8/05
Project:	Pilot Pump Test-Fort Hamilton	Date Received:	8/9/05
Client Sample ID:	MW-02-0805DL	SDG No.:	T4129
Lab Sample ID:	T4129-01DL	Matrix:	WATER
Analytical Method:	8260	% Moisture:	100
Sample Wt/Wol:	5.0 Units: mL	Soil Extract Vol:	uL
Soil Aliquot Vol:	uL		

File ID:	Dilution:	Date Analyzed	Analytical Batch ID
VI081246.D	5	8/13/05	VI080605

CAS Number	Parameter	Conc.	Qualifier	RL	MDL	Units
TARGETS						
1634-04-4	Methyl tert-butyl Ether	350	D	25	1.4	ug/L
71-43-2	Benzene	180	D	25	1.9	ug/L
108-88-3	Toluene	100	D	25	1.8	ug/L
100-41-4	Ethyl Benzene	91	D	25	2.3	ug/L
126777-61-2	m/p-Xylenes	260	D	25	5.9	ug/L
95-47-6	o-Xylene	32	D	25	2.3	ug/L
98-82-8	Isopropylbenzene	73	D	25	2.2	ug/L
103-65-1	N-propylbenzene	79	D	25	2.5	ug/L
108-67-8	1,3,5-Trimethylbenzene	170	D	25	2.1	ug/L
98-06-6	tert-Butylbenzene	2.0	UD	25	2.0	ug/L
95-63-6	1,2,4-Trimethylbenzene	250	D	25	2.2	ug/L
135-98-8	Sec-butylbenzene	12	JD	25	2.2	ug/L
99-87-6	p-Isopropyltoluene	15	JD	25	2.4	ug/L
104-51-8	n-Butylbenzene	2.5	UD	25	2.5	ug/L
91-20-3	Naphthalene	150	D	25	1.7	ug/L
SURROGATES						
17060-07-0	1,2-Dichloroethane-d4	47.9	96 %	72 - 119		SPK: 50
1868-53-7	Dibromofluoromethane	48.03	96 %	85 - 115		SPK: 50
2037-26-5	Toluene-d8	48.42	97 %	81 - 120		SPK: 50
460-00-4	4-Bromofluorobenzene	46.83	94 %	76 - 119		SPK: 50
INTERNAL STANDARDS						
363-72-4	Pentafluorobenzene	582554	3.86			
540-36-3	1,4-Difluorobenzene	1116093	4.31			
3114-55-4	Chlorobenzene-d5	947370	7.36			
3855-82-1	1,4-Dichlorobenzene-d4	433199	9.65			

U = Not Detected
RL = Reporting Limit
MDL = Method Detection Limit
E = Value Exceeds Calibration Range

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908-789-8900 Fax: 908-789-8922

Report of Analysis

Client:	EA Engineering, Science, & Technology, Inc.	Date Collected:	8/9/05
Project:	Pilot Pump Test-Fort Hamilton	Date Received:	8/9/05
Client Sample ID:	MW-07-0805	SDG No.:	T4129
Lab Sample ID:	T4129-02	Matrix:	WATER
Analytical Method:	8260	% Moisture:	100
Sample Wt/Wol:	5.0 Units: mL	Soil Extract Vol:	uL
Soil Aliquot Vol:	uL		

File ID:	Dilution:	Date Analyzed	Analytical Batch ID
VI081060.D	1	8/11/05	VI080605

CAS Number	Parameter	Conc.	Qualifier	RL	MDL	Units
TARGETS						
1634-04-4	Methyl tert-butyl Ether	0.96	J	5.0	0.28	ug/L
71-43-2	Benzene	0.39	U	5.0	0.39	ug/L
108-88-3	Toluene	0.36	U	5.0	0.36	ug/L
100-41-4	Ethyl Benzene	0.63	J	5.0	0.45	ug/L
126777-61-2	m/p-Xylenes	1.9	J	5.0	1.2	ug/L
95-47-6	o-Xylene	0.65	J	5.0	0.46	ug/L
98-82-8	Isopropylbenzene	1.8	J	5.0	0.44	ug/L
103-65-1	N-propylbenzene	4.5	J	5.0	0.49	ug/L
108-67-8	1,3,5-Trimethylbenzene	0.94	J	5.0	0.42	ug/L
98-06-6	tert-Butylbenzene	0.39	U	5.0	0.39	ug/L
95-63-6	1,2,4-Trimethylbenzene	10		5.0	0.44	ug/L
135-98-8	Sec-butylbenzene	3.4	J	5.0	0.44	ug/L
99-87-6	p-Isopropyltoluene	1.2	J	5.0	0.49	ug/L
104-51-8	n-Butylbenzene	1.4	J	5.0	0.49	ug/L
91-20-3	Naphthalene	0.34	U	5.0	0.34	ug/L
SURROGATES						
17060-07-0	1,2-Dichloroethane-d4	50.58	101 %	72 - 119		SPK: 50
1868-53-7	Dibromofluoromethane	47.36	95 %	85 - 115		SPK: 50
2037-26-5	Toluene-d8	49.95	100 %	81 - 120		SPK: 50
460-00-4	4-Bromofluorobenzene	52.09	104 %	76 - 119		SPK: 50
INTERNAL STANDARDS						
363-72-4	Pentafluorobenzene	543053	3.86			
540-36-3	1,4-Difluorobenzene	1121164	4.31			
3114-55-4	Chlorobenzene-d5	889326	7.36			
3855-82-1	1,4-Dichlorobenzene-d4	411600	9.65			

U = Not Detected
RL = Reporting Limit
MDL = Method Detection Limit
E = Value Exceeds Calibration Range

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908-789-8900 Fax: 908-789-8922

Report of Analysis

Client:	EA Engineering, Science, & Technology, Inc.	Date Collected:	8/9/05
Project:	Pilot Pump Test-Fort Hamilton	Date Received:	8/9/05
Client Sample ID:	MW-06-0805	SDG No.:	T4129
Lab Sample ID:	T4129-03	Matrix:	WATER
Analytical Method:	8260	% Moisture:	100
Sample Wt/Wol:	5.0 Units: mL	Soil Extract Vol:	uL
Soil Aliquot Vol:	uL		

File ID:	Dilution:	Date Analyzed	Analytical Batch ID
VI081245.D	1	8/13/05	VI080605

CAS Number	Parameter	Conc.	Qualifier	RL	MDL	Units
TARGETS						
1634-04-4	Methyl tert-butyl Ether	0.28	U	5.0	0.28	ug/L
71-43-2	Benzene	0.39	U	5.0	0.39	ug/L
108-88-3	Toluene	0.36	U	5.0	0.36	ug/L
100-41-4	Ethyl Benzene	0.45	U	5.0	0.45	ug/L
126777-61-2	m/p-Xylenes	1.2	U	5.0	1.2	ug/L
95-47-6	o-Xylene	0.46	U	5.0	0.46	ug/L
98-82-8	Isopropylbenzene	0.44	U	5.0	0.44	ug/L
103-65-1	N-propylbenzene	0.49	U	5.0	0.49	ug/L
108-67-8	1,3,5-Trimethylbenzene	0.42	U	5.0	0.42	ug/L
98-06-6	tert-Butylbenzene	0.39	U	5.0	0.39	ug/L
95-63-6	1,2,4-Trimethylbenzene	0.44	U	5.0	0.44	ug/L
135-98-8	Sec-butylbenzene	0.44	U	5.0	0.44	ug/L
99-87-6	p-Isopropyltoluene	0.49	U	5.0	0.49	ug/L
104-51-8	n-Butylbenzene	0.49	U	5.0	0.49	ug/L
91-20-3	Naphthalene	0.34	U	5.0	0.34	ug/L
SURROGATES						
17060-07-0	1,2-Dichloroethane-d4	47.33	95 %	72 - 119		SPK: 50
1868-53-7	Dibromofluoromethane	49.41	99 %	85 - 115		SPK: 50
2037-26-5	Toluene-d8	47.59	95 %	81 - 120		SPK: 50
460-00-4	4-Bromofluorobenzene	49.77	100 %	76 - 119		SPK: 50
INTERNAL STANDARDS						
363-72-4	Pentafluorobenzene	590243	3.86			
540-36-3	1,4-Difluorobenzene	1120518	4.30			
3114-55-4	Chlorobenzene-d5	935214	7.36			
3855-82-1	1,4-Dichlorobenzene-d4	415682	9.65			

U = Not Detected
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E = Value Exceeds Calibration Range
J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908-789-8900 Fax: 908-789-8922

Report of Analysis

Client:	**EA Engineering, Science, & Technology, Inc.**	**Date Collected:**	**8/8/2005**
Project:	**Pilot Pump Test-Fort Hamilton**	**Date Received:**	**8/9/2005**
Client Sample ID:	**MW-02-0805**	**SDG No.:**	**T4129**
Lab Sample ID:	**T4129-01**	**Matrix:**	**WATER**
% Solids:	**0.00**		

Analyte	Result	Qualifier	RL	Units	DF	Date Analyzed	Method
Ferrous Iron	0.10	U	0.10	mg/L	1	8/11/2005	HACH 8146 Ferrous Iron
Nitrate	0.100	U	0.100	mg/L	1	8/10/2005	300.0 Anions
Sulfate	8.600		0.500	mg/L	1	8/10/2005	300.0 Anions
DOC	4.480		0.400	mg/L	1	8/12/2005	415.1 Dissolved Organic Ca
TOC	7.400		0.400	mg/L	1	8/12/2005	9060 TOC

Comment

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908-789-8900 Fax: 908-789-8922

Report of Analysis

Client:	**EA Engineering, Science, & Technology, Inc.**	**Date Collected:**	**8/9/2005**
Project:	**Pilot Pump Test-Fort Hamilton**	**Date Received:**	**8/9/2005**
Client Sample ID:	**MW-07-0805**	**SDG No.:**	**T4129**
Lab Sample ID:	**T4129-02**	**Matrix:**	**WATER**
% Solids:	**0.00**		

Analyte	Result	Qualifier	RL	Units	DF	Date Analyzed	Method
Ferrous Iron	0.10	U	0.10	mg/L	1	8/11/2005	HACH 8146 Ferrous Iron
Nitrate	0.100	U	0.100	mg/L	1	8/10/2005	300.0 Anions
Sulfate	43		0.500	mg/L	2	8/11/2005	300.0 Anions
DOC	29.0		0.400	mg/L	2	8/12/2005	415.1 Dissolved Organic Ca
TOC	32		0.400	mg/L	2	8/12/2005	9060 TOC

Comment

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908-789-8900 Fax: 908-789-8922

Report of Analysis

Client:	**EA Engineering, Science, & Technology, Inc.**	**Date Collected:**	**8/9/2005**
Project:	**Pilot Pump Test-Fort Hamilton**	**Date Received:**	**8/9/2005**
Client Sample ID:	**MW-06-0805**	**SDG No.:**	**T4129**
Lab Sample ID:	**T4129-03**	**Matrix:**	**WATER**
% Solids:	**0.00**		

Analyte	Result	Qualifier	RL	Units	DF	Date Analyzed	Method
Ferrous Iron	0.10	U	0.10	mg/L	1	8/11/2005	HACH 8146 Ferrous Iron
Nitrate	1.710		0.100	mg/L	1	8/10/2005	300.0 Anions
Sulfate	89		0.500	mg/L	5	8/11/2005	300.0 Anions
DOC	5.030		0.400	mg/L	1	8/12/2005	415.1 Dissolved Organic Ca
TOC	7.580		0.400	mg/L	1	8/12/2005	9060 TOC

Comment

Chain of Custody Record

SEVERN TRENT **STL**

Severn Trent Laboratories, Inc.

STL-4124 (0901)

Client: EA Engineering	Project Manager: Jim Hayward	Date: 8/11/05	Chain of Custody Number: 221152
Address: 6731 Collamer Road	Telephone Number (Area Code)/Fax Number: 315-431-4610	Lab Number: ESH150158	Page 1 of 1
City: East Syracuse; State: NY; Zip Code: 13057	Site Contact: Jen Martin	Lab Contact: M. Tabirara	
Project Name and Location (State): Fort Hamilton MPE, NY	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.: 6199006.0002			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH		Analysis (Attach list if more space is needed): TO-3 (BTEX, MTBE, TPH)	Special Instructions/ Conditions of Receipt
MW05-Influent	8/11/05	1115	X					X								

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal: ☐ Return To Client ☒ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other Standard

QC Requirements (Specify):

1. Relinquished By: [signature]	Date: 8/11/05	Time: 1125	1. Received By: [signature]	Date: 8/12/05	Time: 1030
2. Relinquished By:	Date:	Time:	2. Received By:	Date:	Time:
3. Relinquished By:	Date:	Time:	3. Received By:	Date:	Time:

Comments:

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

000003

SEVERN TRENT STL

CANISTER FIELD DATA RECORD

CLIENT: EA SCIENCE + TECH
CANISTER SERIAL #: DL 102
DATE CLEANED: 7-27-05A
CLIENT SAMPLE #: MW05-INFLUENT
SITE LOCATION: Ft Hamilton, NY

VFR ID: _____
Duration of comp. : _____ hrs. / mins.
Flow setting: _____ ml/min
Initials: _____

READING	TIME	Vac. (inches Hg) Or PRESS. (psig)	DATE	INITIALS
INITIAL VACUUM CHECK		30"	8/6/05	[illegible]
INITIAL FIELD VACUUM	1110	30"	8/11/05	gam
FINAL FIELD READING	11:15	0.0	8/11/05	gam

LABORATORY CANISTER PRESSURIZATION			
INITIAL VACUUM (PSIA)	14.18	8.16.05	GIC
FINAL PRESSURE (PSIA)	24.75	↓	↓

Pressurization Gas: N_2

COMMENTS:

COMPOSITE TIME (HOURS)	FLOW RATE RANGE (ml/min)
15 Min.	316 – 333
30 Min.	158 – 166.7
1	79.2 – 83.3
2	39.6 – 41.7
4	19.8 – 20.8
6	13.2 – 13.9
8	9.9 – 10.4
10	7.92 – 8.3
12	6.6 – 6.9
24	3.5 – 4.0

N:\COI\DOCS\CANISTER FIELD DATA RECORD(012103).doc

SEVERN TRENT LABORATORIES, INC.

PRELIMINARY DATA SUMMARY

The results shown below may still require additional laboratory review and are subject to change. Actions taken based on these results are the responsibility of the data user.

EA Engineering, Science and Technology

Lot #: E5H150158 Fort Hamilton MPE, NY **Date Reported:** 8/22/05

Client Sample ID: MW05-INFLUENT

Sample #: 001 Date Sampled: 08/11/05 11:15 Date Received: 08/12/05 Matrix: AIR

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
BTEX by TO-3					Reviewed
Benzene	**27**	**2.0**	**ppm(v/v)**	**EPA-19 TO-3**	
Toluene	**190**	**2.0**	**ppm(v/v)**	**EPA-19 TO-3**	
Ethylbenzene	**22**	**2.0**	**ppm(v/v)**	**EPA-19 TO-3**	
Xylenes (total)	**130**	**2.0**	**ppm(v/v)**	**EPA-19 TO-3**	
Methyl tert-butyl ether (MTBE)	**37**	**2.0**	**ppm(v/v)**	**EPA-19 TO-3**	
TPH by TO-3					Reviewed
TPH (as Gasoline)	**2900**	**100**	**ppm(v/v)**	**EPA-19 TO-3**	

This sample has GC/FID characteristics for which reliable identification of a product could not be achieved.

CHEMTECH

CASE NARRATIVE

EA Engineering, Science, & Technology, Inc.
Project Name: Pilot Pump Test-Fort Hamilton
Project # 6199006.0002
Chemtech Project # T4180

A. Number of Samples and Date of Receipt:
1 Water sample was received on 8/12/05.

B. Parameters
According to the Chain of Custody document, the following analyses were requested: 8260 Stars List Volatiles. This data package contains results for 8260 Stars List Volatiles.

C. Analytical Techniques:
The analysis performed on instrument MSVOA H were done using GC column RTX624, which is 75 meters, 0.53 ID, 3.0 df, Restek Cat. #10974. The Trap was supplied BY OI Analytical, OI #10 Trap, OI Eclipse 4660 Concentrator.

D. QA/ QC Samples:
The Holding Times were met for all analysis.
The Surrogate recoveries met the acceptable criteria.
The Internal Standards Areas met the acceptable requirements.
The Retention Times were acceptable for all samples.
The MS recoveries met the requirements for all compounds.
The MSD recoveries met the acceptable requirements.
The RPD recoveries met criteria.
The Blank Spike met requirements for all samples.
The Blank analysis did not indicate the presence of lab contamination.
The Calibration met the requirements.
The Tuning criteria met requirements.
Sample MW05-IN was diluted due to bad matrices.

I certify that the data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. The laboratory manager or his designee, as verified by the following signature has authorized release of the data contained in this hard copy data package.

Signature_____ Name: Krupa Dubey

Date: 8/25/05 Title: QA/QC

CHEMTECH
CHAIN OF CUSTODY RECORD

284 Sheffield Street, Mountainside, NJ 07092
(908) 789-8900 Fax (908) 789-8922
www.chemtech.net

CHEMTECH PROJECT NO. T4180

COC Number 053981

CLIENT INFORMATION

REPORT TO BE SENT TO:

COMPANY: EA Engineering
ADDRESS: 6731 Collamer Road
CITY: East Syracuse STATE: NY ZIP: 13057
ATTENTION: J. Martin
PHONE: 315-431-4610 FAX: 315-431-4280

CLIENT PROJECT INFORMATION

PROJECT NAME: Ft Hamilton MPE
PROJECT NO.: 6199006.0002 LOCATION: Ft Hamilton NY
PROJECT MANAGER: J. Hayward
e-mail: jch@eacst.com
PHONE: 315-431-4610 FAX: 315-431-4280

CLIENT BILLING INFORMATION

BILL TO: SAME PO#:
ADDRESS:
CITY: STATE: ZIP:
ATTENTION: PHONE:

DATA TURNAROUND INFORMATION

FAX: _____ DAYS *
HARD COPY: _____ DAYS *
EDD: _____ DAYS *
* TO BE APPROVED BY CHEMTECH
STANDARD TURNAROUND TIME IS 10 BUSINESS DAYS

DATA DELIVERABLE INFORMATION

☐ RESULTS ONLY ☐ USEPA CLP
☐ RESULTS + QC ☒ New York State ASP "B"
☐ New Jersey REDUCED ☐ New York State ASP "A"
☐ New Jersey CLP ☐ Other _____
☐ EDD FORMAT _____

ANALYSIS

1 8260 (VOC + MTBE) 2 3 4 5 6 7 8 9

CHEMTECH SAMPLE ID	PROJECT SAMPLE IDENTIFICATION	SAMPLE MATRIX	SAMPLE TYPE COMP	SAMPLE TYPE GRAB	SAMPLE COLLECTION DATE	SAMPLE COLLECTION TIME	# OF BOTTLES	PRESERVATIVES 1	2	3	4	5	6	7	8	9	COMMENTS
1.	MW05-Inf	Wa		X	8/11/05	1200	2	A									
2.																	
3.																	
4.																	
5.																	
6.																	
7.																	
8.																	
9.																	
10.																	

← Specify Preservatives
A–HCl B–HNO_3
C–H_2SO_4 D–NaOH
E–ICE F–Other

SAMPLE CUSTODY MUST BE DOCUMENTED BELOW EACH TIME SAMPLES CHANGE POSSESSION INCLUDING COURIER DELIVERY

RELINQUISHED BY SAMPLER:	DATE/TIME:	RECEIVED BY:
1. [signature]	8/11/05 1700	1.
RELINQUISHED BY: 2. [signature]	DATE/TIME:	RECEIVED BY: 2.
RELINQUISHED BY: 3. Fed-Ex	DATE/TIME: 9140 8-12-05	RECEIVED FOR LAB BY: 3. R. Ortiz

Conditions of bottles or coolers at receipt: ☒ Compliant ☐ Non Compliant
MeOH extraction requires an additional 4 oz jar for percent solid.
Comments:

Cooler Temp. 17 °C
Ice in Cooler?: NO

Page 1 of 1

SHIPPED VIA: CLIENT: ☐ HAND DELIVERED ☒ OVERNIGHT
CHEMTECH: ☐ PICKED UP ☐ OVERNIGHT

Shipment Complete: ☒ YES ☐ NO

Revision 4/2005

WHITE - CHEMTECH COPY FOR RETURN TO CLIENT YELLOW - CHEMTECH COPY PINK - SAMPLER COPY

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908-789-8900 Fax: 908-789-8922

Report of Analysis

Client:	EA Engineering, Science, & Technology, Inc.	Date Collected:	8/11/2005
Project:	Pilot Pump Test-Fort Hamilton	Date Received:	8/12/2005
Client Sample ID:	MW05-INF	SDG No.:	T4180
Lab Sample ID:	T4180-01	Matrix:	WATER
Analytical Method:	8260	% Moisture:	100
Sample Wt/Wol:	5.0 Units: mL	Soil Extract Vol:	uL
Soil Aliquot Vol:	uL		

File ID:	Dilution:	Date Analyzed	Analytical Batch ID
VH081708.D	500	8/17/2005	VH081505

CAS Number	Parameter	Conc.	Qualifier	RL	MDL	Units
TARGETS						
1634-04-4	Methyl tert-butyl Ether	13000		2500	140	ug/L
71-43-2	Benzene	5100		2500	190	ug/L
108-88-3	Toluene	79000		2500	180	ug/L
100-41-4	Ethyl Benzene	20000		2500	230	ug/L
126777-61-2	m/p-Xylenes	110000		2500	590	ug/L
95-47-6	o-Xylene	48000		2500	230	ug/L
98-82-8	Isopropylbenzene	2800		2500	220	ug/L
103-65-1	N-propylbenzene	6400		2500	250	ug/L
108-67-8	1,3,5-Trimethylbenzene	21000		2500	210	ug/L
98-06-6	tert-Butylbenzene	200	U	2500	200	ug/L
95-63-6	1,2,4-Trimethylbenzene	71000		2500	220	ug/L
135-98-8	Sec-butylbenzene	220	U	2500	220	ug/L
99-87-6	p-Isopropyltoluene	2200	J	2500	240	ug/L
104-51-8	n-Butylbenzene	2000	J	2500	250	ug/L
91-20-3	Naphthalene	10000		2500	170	ug/L
SURROGATES						
17060-07-0	1,2-Dichloroethane-d4	49.29	99 %	72 - 119		SPK: 50
1868-53-7	Dibromofluoromethane	46.96	94 %	85 - 115		SPK: 50
2037-26-5	Toluene-d8	49.08	98 %	81 - 120		SPK: 50
460-00-4	4-Bromofluorobenzene	47.69	95 %	76 - 119		SPK: 50
INTERNAL STANDARDS						
363-72-4	Pentafluorobenzene	229940	6.30			
540-36-3	1,4-Difluorobenzene	406029	6.95			
3114-55-4	Chlorobenzene-d5	351847	10.63			
3855-82-1	1,4-Dichlorobenzene-d4	145428	12.90			

U = Not Detected
RL = Reporting Limit
MDL = Method Detection Limit
E = Value Exceeds Calibration Range

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound

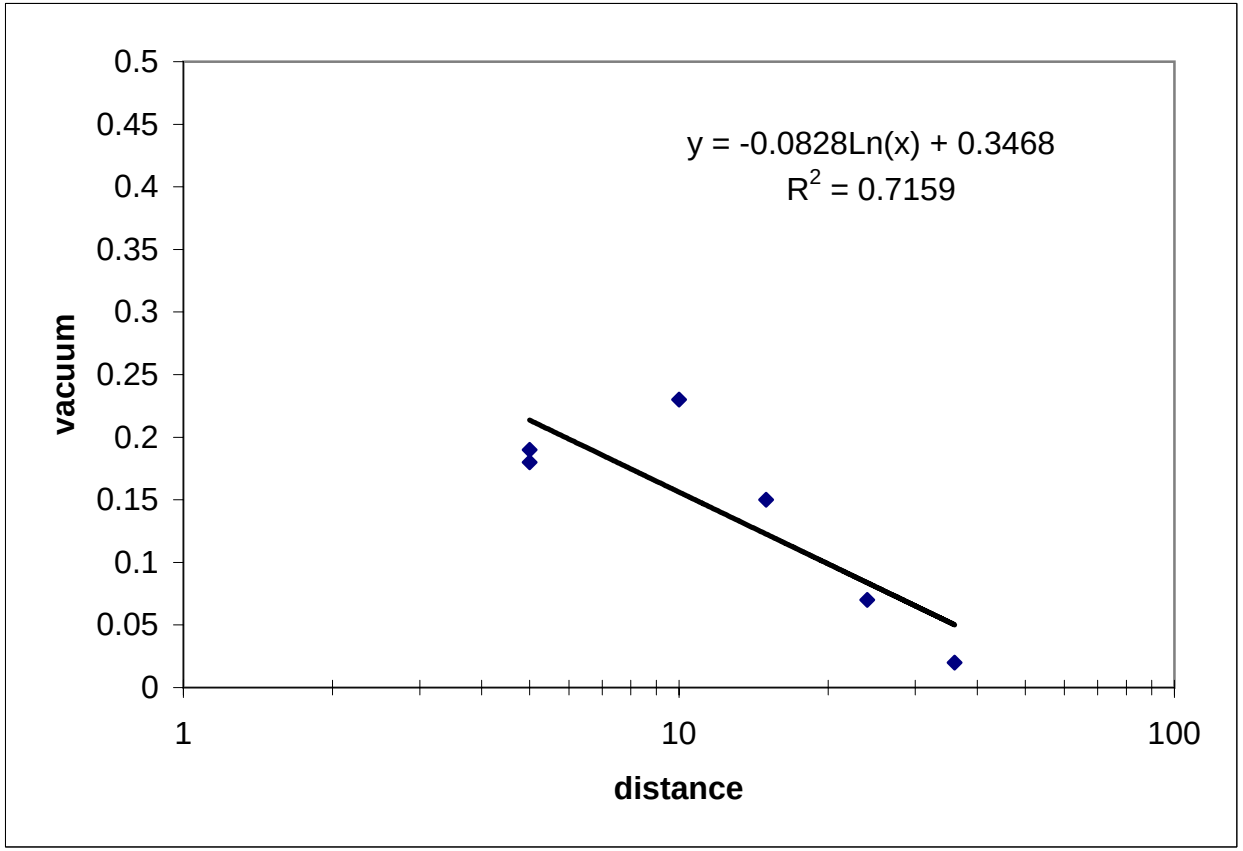
Appendix E

Radius-of-Influence Calculations

Baseline-MW3-SVE-17 cfm

distance (ft)	vacuum (in. H_20)
5	0.19
10	0.23
15	0.15
5	0.18
24	0.07
36	0.02

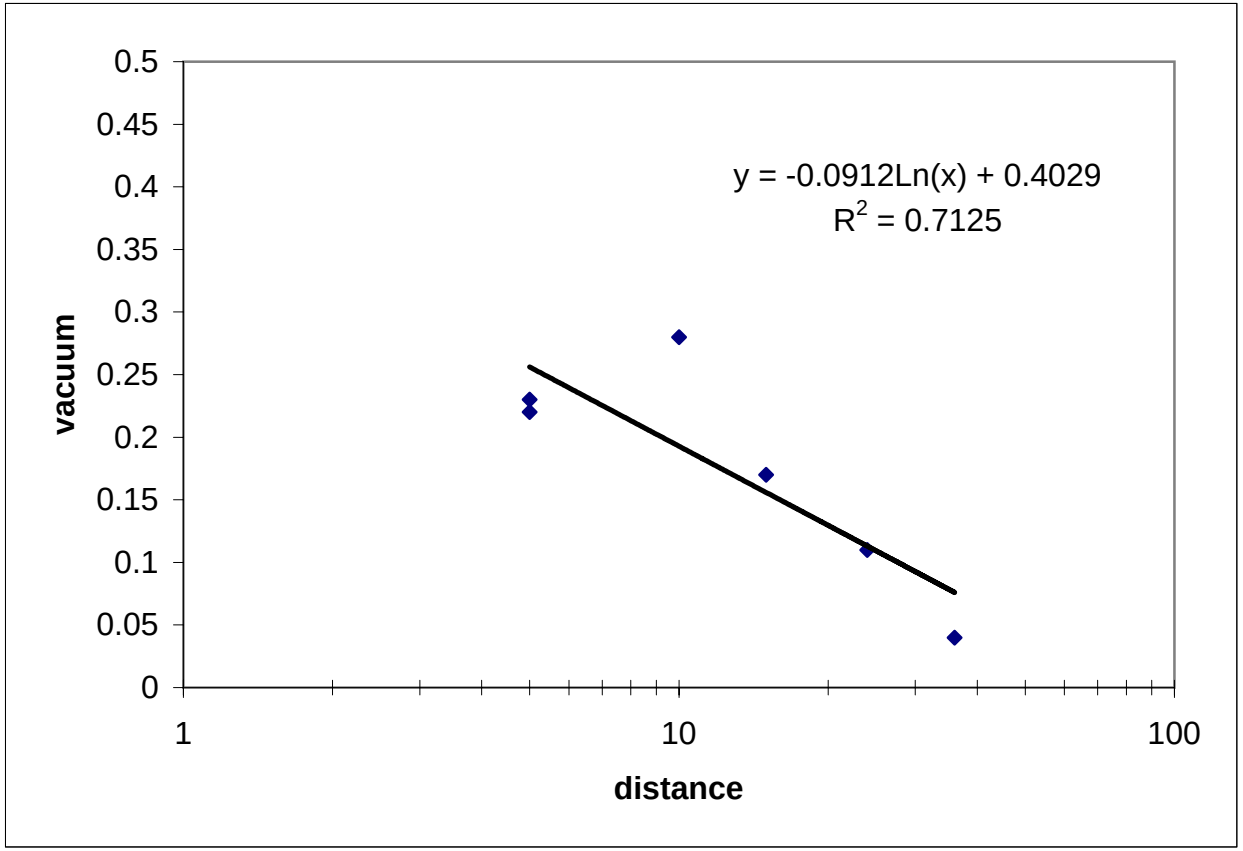
Y values	distance (ft)
0.1	19.701137
0.2	5.8881795
0.3	1.7598303
0.4	0.5259695
0.5	0.1571992



Step1-MW3-MPE-5 cfm

distance (ft)	vacuum (in. H_20)
5	0.22
10	0.28
15	0.17
5	0.23
24	0.11
36	0.04

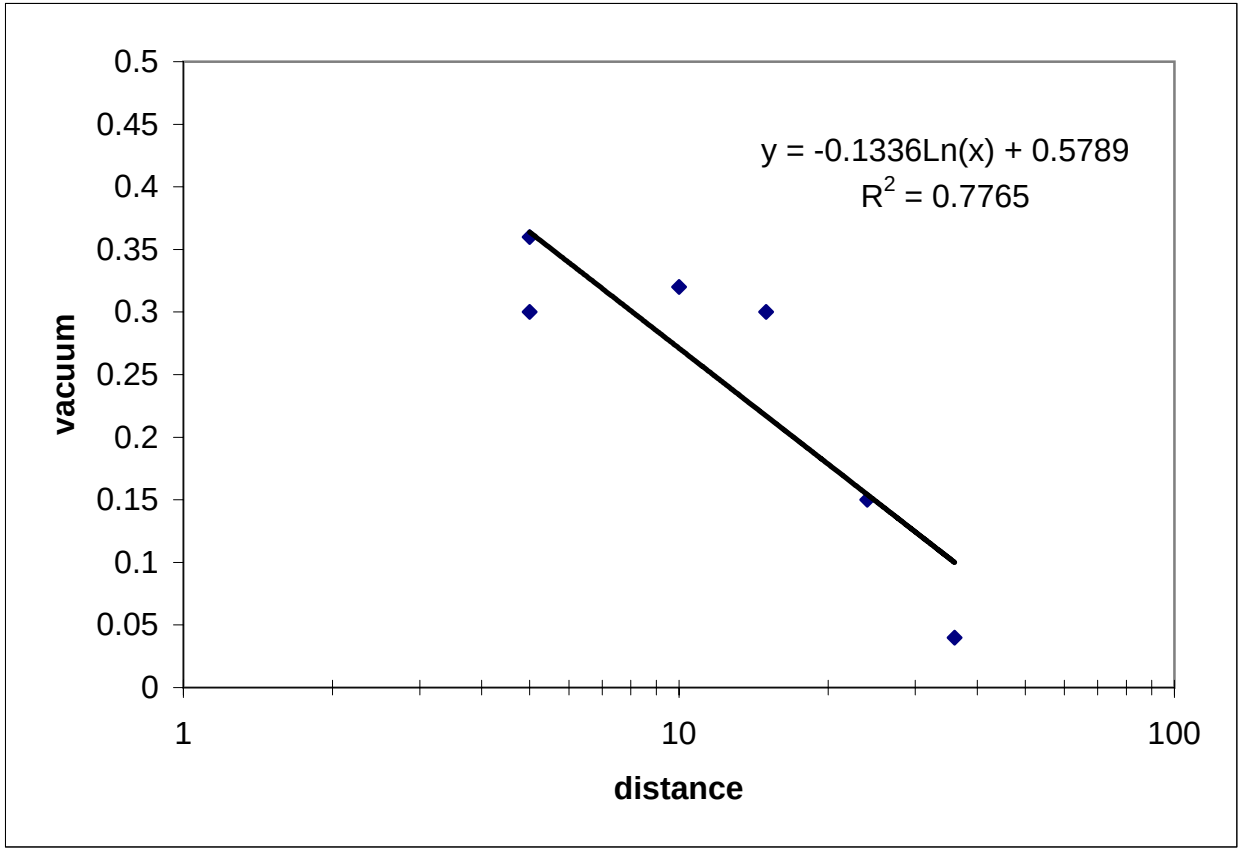
Y values	distance (ft)
0.1	27.695555
0.2	9.2514538
0.3	3.0903658
0.4	1.0323092
0.5	0.3448337



Step2-MW3-MPE-17 cfm

distance (ft)	vacuum (in. H_20)
5	0.3
10	0.32
15	0.3
5	0.36
24	0.15
36	0.04

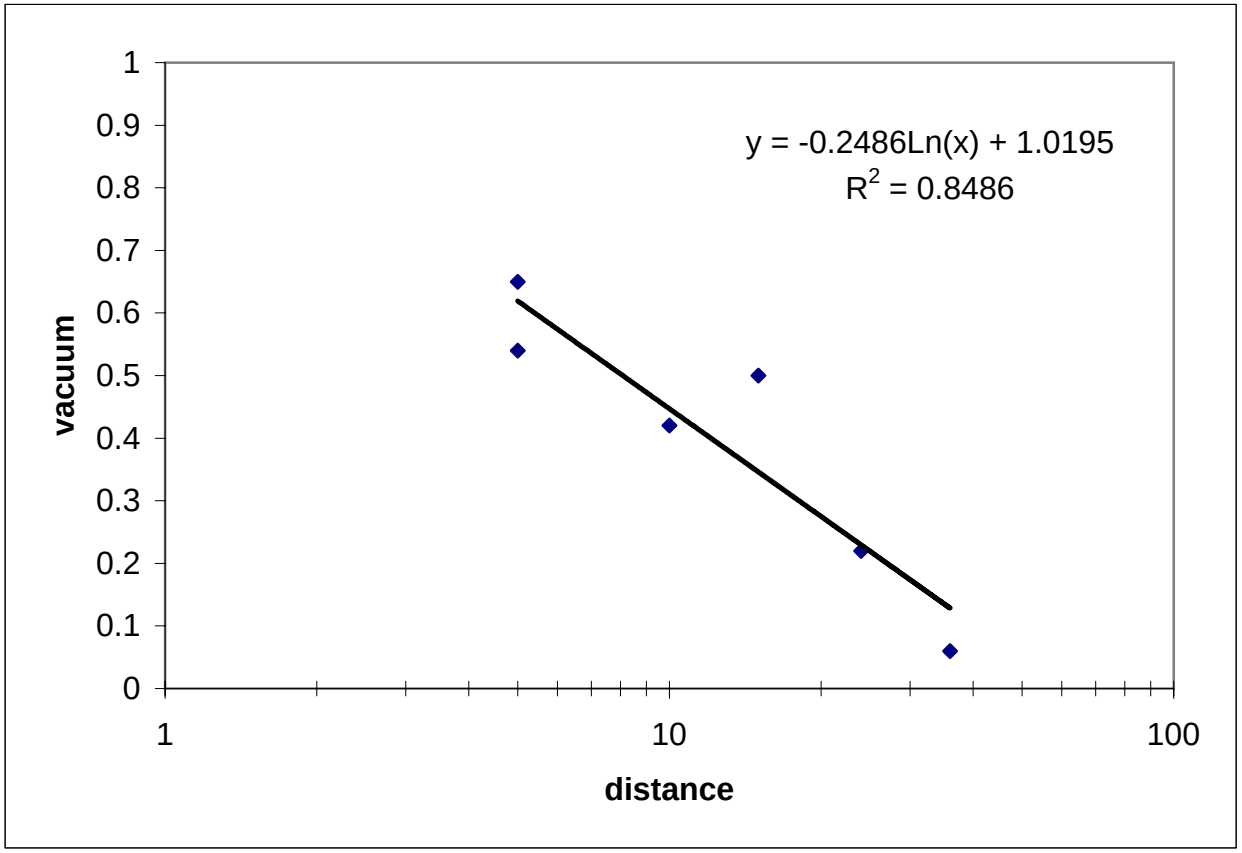
Y values	distance (ft)
0.1	36.038249
0.2	17.048766
0.3	8.0653318
0.4	3.8155005
0.5	1.8050149



Step3-MW3-MPE-25 cfm

distance (ft)	vacuum (in. H_20)
5	0.54
10	0.42
15	0.5
5	0.65
24	0.22
36	0.06

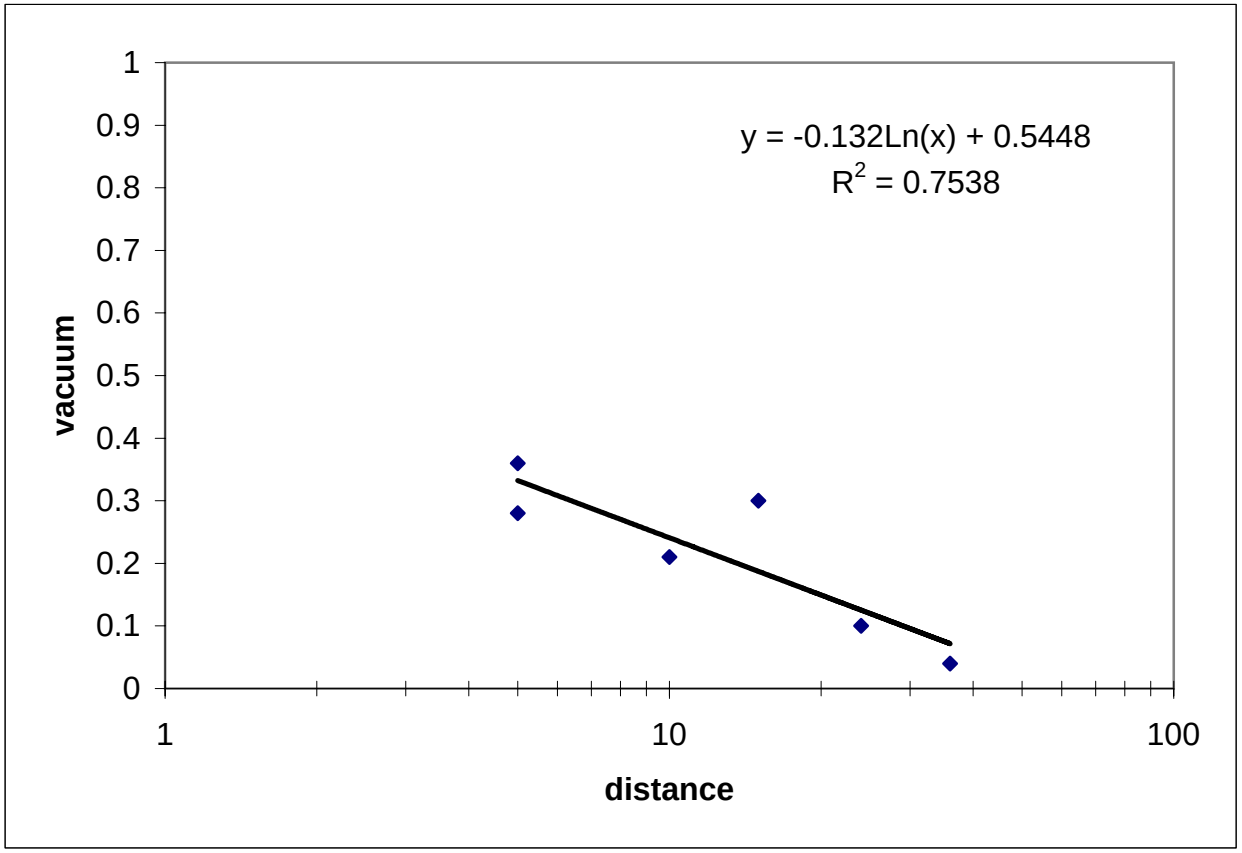
Y values	distance (ft)
0.1	40.395274
0.2	27.016835
0.3	18.069177
0.4	12.084878
0.5	8.0825089



Step4-MW3-MPE-8 cfm

distance (ft)	vacuum (in. H_20)
5	0.28
10	0.21
15	0.3
5	0.36
24	0.1
36	0.04

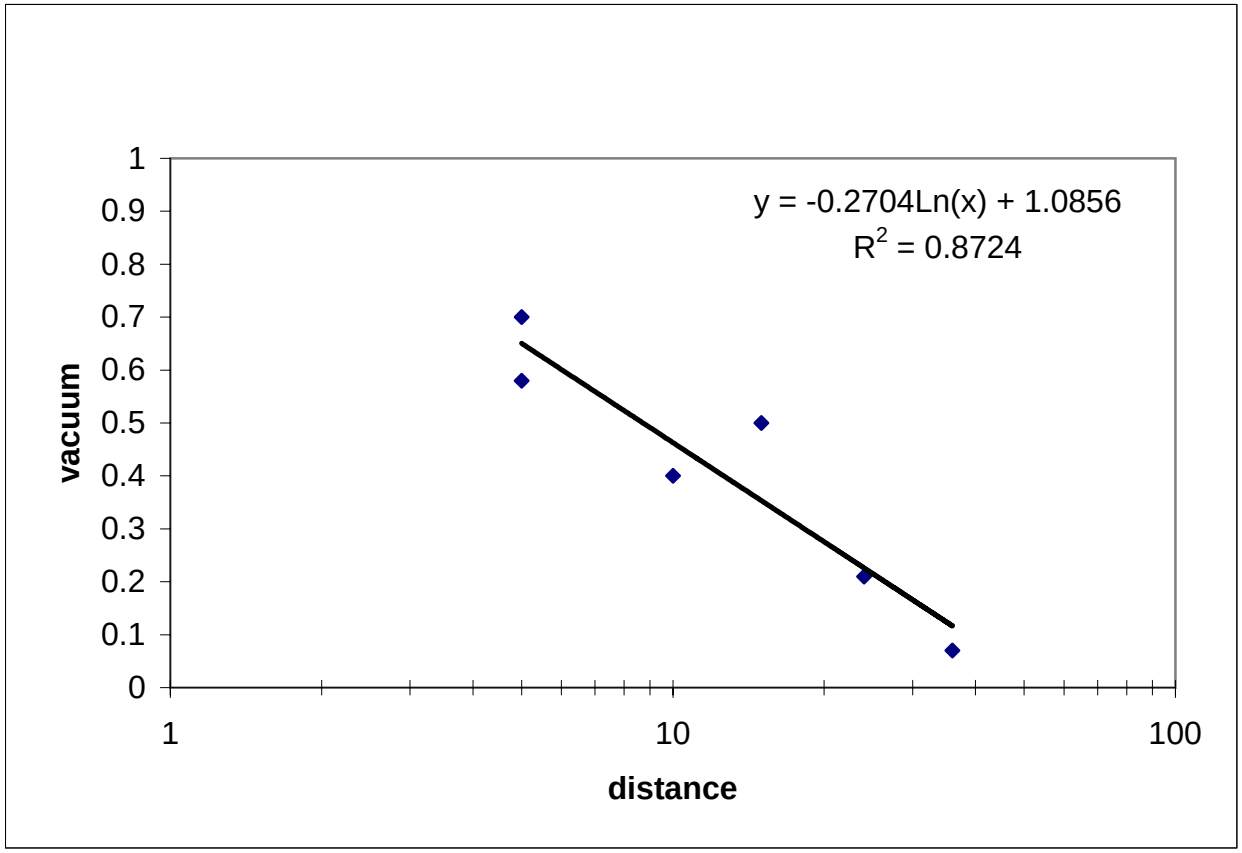
Y values	distance (ft)
0.1	29.069717
0.2	13.627928
0.3	6.3887936
0.4	2.9950763
0.5	1.4040964



Step5-MW3-MPE-15 cfm

distance (ft)	vacuum (in. H_20)
5	0.58
10	0.4
15	0.5
5	0.7
24	0.21
36	0.07

Y values	distance (ft)
0.1	38.28164024
0.2	26.44713749
0.3	18.27118893
0.4	12.62277799
0.5	8.720533989

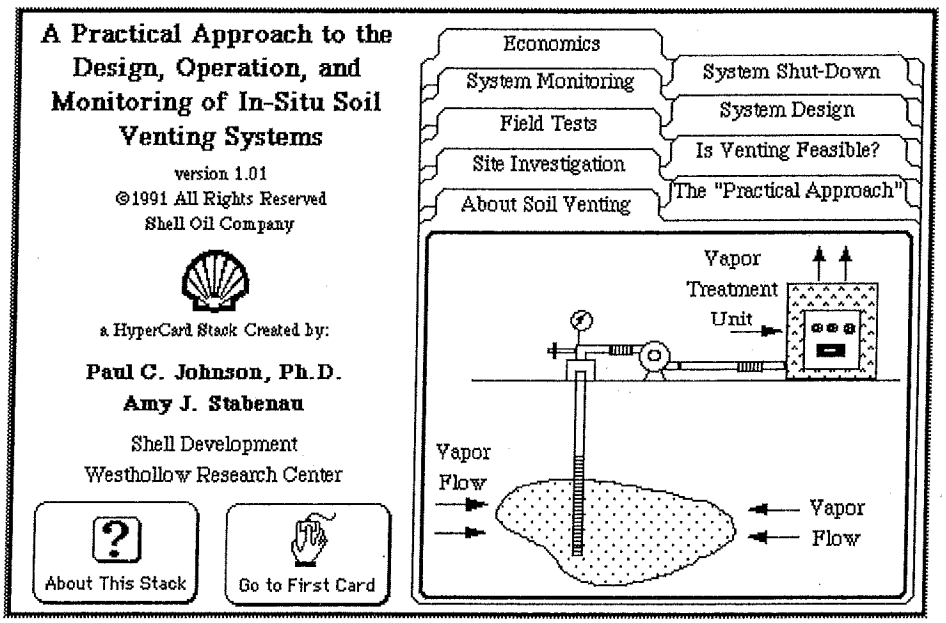


Appendix F

HyperVentilate Output

HyperVentilate
Users Manual

A Software Guidance System Created for Vapor Extraction Applications



by

Paul C. Johnson, Ph.D.

/

Shell Development
Westhollow Research Center
Environmental R&D
P. O. Box 1380
Houston, TX 77251

Apple® Macintosh™ HyperCard™
compatible version 1.01

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Air Permeability Test - Data Analysis

The expected decrease in subsurface pressure (increase in gauge vacuum) P' is predicted by:

(see Johnson et al [1990] for derivation)

$$P'(r,t) = \frac{Q}{4\pi m(k/\mu)} \int_{\frac{r^2 \varepsilon \mu}{4 k P_{Atm} t}}^{\infty} \frac{e^{-x}}{x} dx$$

P' = gauge vacuum
m = stratum thickness
r = radial distance from extraction well
k = soil permeability
μ = air viscosity = 0.018 centipoise
ε = air-filled void fraction
t = time
Q = volumetric flowrate from extraction well
P_{Atm} = ambient atmospheric pressure

Skip the Explanation | Return | AP5

Air Permeability Test - Data Analysis (cont.)

For $(r^2 \varepsilon \mu / 4 k P_{Atm} t) < 0.1$ the governing equation can be approximated by the expression:

$$P' = \frac{Q}{4\pi m(k/\mu)} [-0.5772 - \ln(\frac{r^2 \varepsilon \mu}{4 k P_{Atm}}) + \ln(t)]$$

This Equation predicts that a plot of P' -vs- ln(t) should be a straight line with slope A and y-intercept B equal to:

$$A = \frac{Q}{4\pi m(k/\mu)} \qquad B = \frac{Q}{4\pi m(k/\mu)} [-0.5772 - \ln(\frac{r^2 \varepsilon \mu}{4 k P_{Atm}})]$$

Return | AP6

Air Permeability Test - Data Analysis (cont.)

The permeability, k, can then be calculated by one of two methods:

1. The first is applicable when both Q (flowrate) and m (well screen interval) are known accurately. The calculated slope A is used:

$$k = \frac{Q \mu}{4 A \pi m}$$

2. The second approach is used whenever Q or m are not known with confidence. In this case, both the slope, A, and intercept, B, are used:

$$k = \frac{r^2 \varepsilon \mu}{4 P_{Atm}} \exp[0.5772 + \frac{B}{A})]$$

Return | AP7

HYPERVENTILATE - AIR PERMEABILITY TEST RESULTS

Air Permeability Test - Data Analysis (cont.)

① Enter radial distances of monitoring points → r= 5 (ft) r= 10 (ft) r= 15 (ft)

② Enter measured times and gauge vacuums →

(min)	(in H2O)	(min)	(in H2O)	(min)	(in H2O)
5	0	5	0.1	5	0.02
25	0.04	25	0.1	25	0.05
50	0.08	50	0.13	50	0.06
70	0.05	70	0.13	70	0.06
75	0.06	75	0.2	75	0.11
95	0.15	95	0.2	95	0.12
115	0.19	115	0.23	115	0.15

clear clear clear

③ Enter (optional):

a) flowrate ____ (SCFM)

b) screened interval thickness ____ (ft)

-->Calculate<--

k= ____ darcy (A) k= ____ darcy (A) k= ____ darcy (A)

k= 0.118471 darcy (B) k= 5.206318 darcy (B) k= 1.887577 darcy (B)

Return Explanation & Statistics AP8

ANALYSIS FOR:

TMP-1 (5ft)

TMP-2 (10ft)

TMP-3 (15ft)

Air Permeability Test - Data Analysis (cont.)

① Enter radial distances of monitoring points → r= 5 (ft) r= ____ (ft) r= ____ (ft)

② Enter measured times and gauge vacuums →

(min)	(in H2O)	(min)	(in H2O)	(min)	(in H2O)
5	0				
25	0.08				
50	0.10				
70	0.08				
75	0.14				
95	0.14				
115	0.18				

clear clear clear

③ Enter (optional):

a) flowrate ____ (SCFM)

b) screened interval thickness ____ (ft)

-->Calculate<--

k= ____ darcy (A) k= ____ darcy (A) k= ____ darcy (A)

k= 0.168459 darcy (B) k= ____ darcy (B) k= ____ darcy (B)

Return Explanation & Statistics AP8

ANALYSIS FOR:

TMP-4 (5ft)

* "shallow" point

Appendix G

Hydraulic Conductivity Calculations

Project FORT HAMILTON Project No.
Subject MPE PILOT TEST Sheet No. of
ESTIMATE HYDRAULIC COND. Drawing No.
Computed by DJC Date Checked by Date

OBJECTIVE: ESTIMATE HYDRAULIC CONDUCTIVITY

FIRST: CALCULATE TRASMISSIVITY

$$T = \frac{528 \cdot Q}{\Delta S}$$

Q = 0.13 gpm from pilot test data

Note: GW extracted from MW-03 via MPE on 8/10/05.

ΔS = 3.1 feet [see attached plot of distance vs. drawdown]

$$T = \frac{528 \cdot (0.13)}{3.1} = 22.1 \text{ gal/day-ft}$$

SECOND: CALCULATE HYDRAULIC CONDUCTIVITY FROM TRANSMISSIVITY

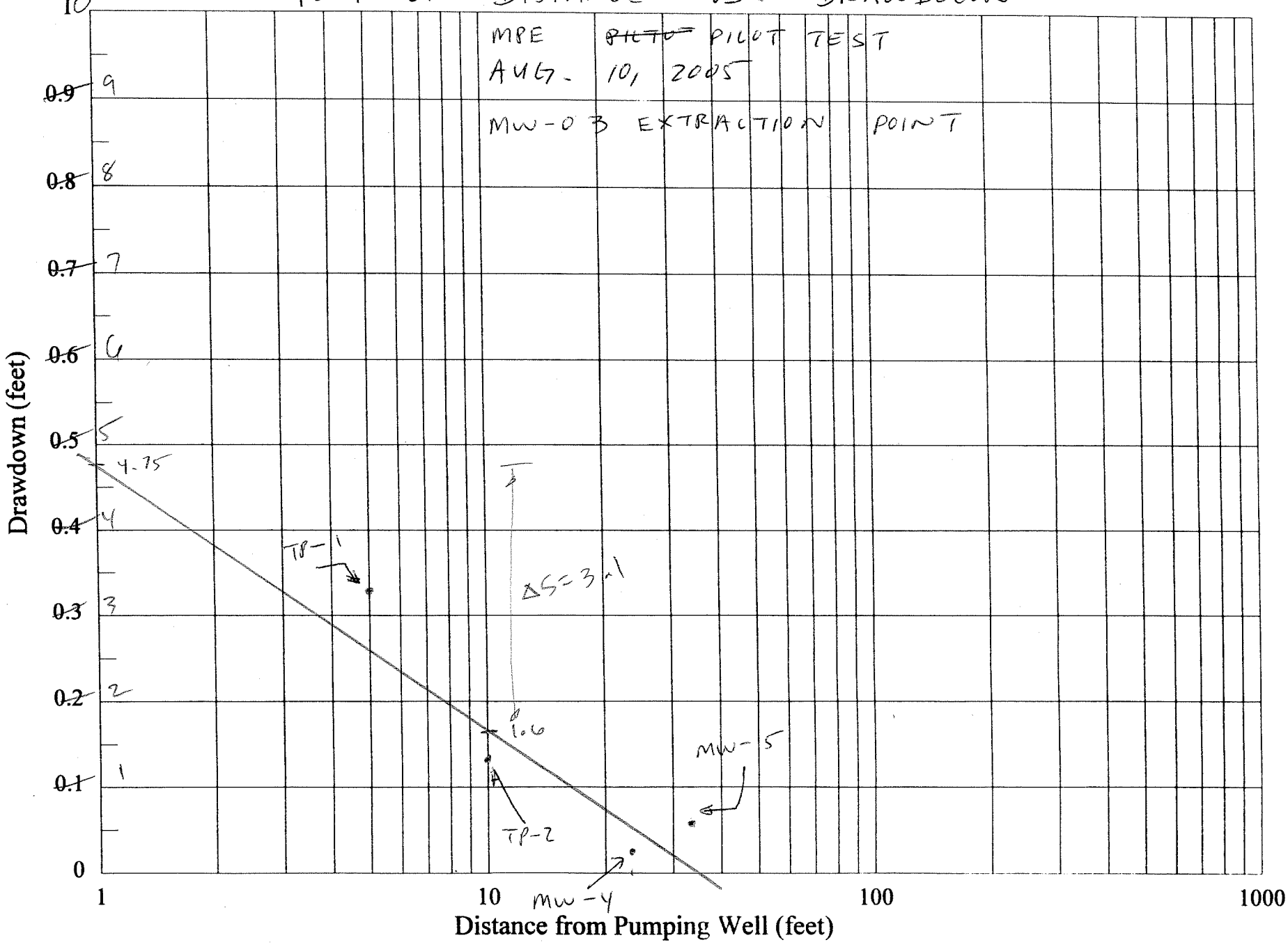
$$K = \frac{T}{b} \times \frac{1 ft^3}{7.48 gal}$$

where: b = aquifer thickness = 10'

$$K = \frac{22.1}{10} \cdot \frac{1}{7.48} = 0.30 \text{ ft/day}$$

FORT HAMILTON

PLOT OF DISTANCE VS. DRAWDOWN



Appendix H

Waste Manifest

FSAG02

NON-HAZARDOUS WASTE MANIFEST	1. Generator's US EPA ID No.	Manifest Document No. FSAG02	2. Page 1 of

3. Generator's Name and Mailing Address: FORT HAMILTON ARMY GARRISON, BUILDING #200, BROOKLYN NY

5) TRUCK 112 26676 JB NY

4. Generator's Phone ( )

5. Transporter 1 Company Name	6. US EPA ID Number	A. Transporter's Phone
Action Trucking, Inc	NYD064748304	(516) 781-3000
7. Transporter 2 Company Name	8. US EPA ID Number	B. Transporter's Phone
Action Trucking, Inc	NYD064748304	(516) 781-3000
9. Designated Facility Name and Site Address	10. US EPA ID Number	C. Facility's Phone
TRIUMVIRATE ENVIRONMENTAL, 42-14 19TH AVENUE, ASTORIA NY 11105	NYD077444283	(718) 274-3339

11. Waste Shipping Name and Description	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol
a. NON HAZARDOUS, NON RCRA REGULATED SOLIDS (SPENT ACTIVATED CHARCOAL)	1	DM	60	P
b. NON HAZARDOUS, NON RCRA Regulated Solids (Spent Activated Charcoal)	1	DF	60	P
c.				
d.				

D. Additional Descriptions for Materials Listed Above

a. #2 OIL SOAKED SOIL

b.

c.

d.

E. Handling Codes for Wastes Listed Above

a. b. c. d.

15. Special Handling Instructions and Additional Information

a. PROFILE# [redacted] NYC007A01

16. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Printed/Typed Name	Signature	Month Day Year
John S. Rhoe	[signature]	09 19 05

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month Day Year
Keith Gambino	[signature]	09 19 05

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month Day Year

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month Day Year

GENERATOR'S COPY

NON-HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.:
Manifest Document No.:
2. Page 1 of 1

3. Generator's Name and Mailing Address: FORT HAMILTON ARMY GARRISON, BUILDING #200, BROOKLYN NY

5) TRUCK 112 26067 GATE NY

4. Generator's Phone ( )

5. Transporter 1 Company Name: Action Trucking, Inc.
6. US EPA ID Number: NYD064749304
A. Transporter's Phone: (516) 781-3000

7. Transporter 2 Company Name: Terrace Transportation
8. US EPA ID Number: NYR000090549
B. Transporter's Phone: (718) 981-4600

9. Designated Facility Name and Site Address: Clean Water, 3249 Richmond Terrace, Staten Island NY 10303
10. US EPA ID Number: XX000
C. Facility's Phone: (718) 981-4600

11. Waste Shipping Name and Description	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol
a. NON HAZARDOUS, NON RCRA REGULATED ~~SOLIDS~~ LIQUID (GROUNDWATER TRACE GASOLINE)	04	DM	120	G
b.	0			
c.	0			
d.	0			

D. Additional Descriptions for Materials Listed Above
a. WELL DEVELOPMENT WATER
b.
c.
d.

E. Handling Codes for Wastes Listed Above
a.
b.
c.
d.

15. Special Handling Instructions and Additional Information

16. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Printed/Typed Name: John Ryan
Signature:
Month Day Year: 09 19 05

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Keith Gambino
Signature:
Month Day Year: 09 19 05

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name:
Signature:
Month Day Year:

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in Item 19.

Printed/Typed Name:
Signature:
Month Day Year:

GENERATOR'S COPY

STRAIGHT BILL OF LADING
ORIGINAL–NOT NEGOTIABLE

Shipper No.

Carrier No.

Page 1 of 1

ACTION TRUCKING, INC.
(Name of carrier) (SCAC)

Date 9/19/05

C.O.D. on Delivery shipments, the letters "COD" must appear before consignee's name or as otherwise provided in Item 430, Sec. 1.

TO: Consignee CHEMICAL POLLUTION CONTROL.
Street 120 SOUTH 4TH STREET.
City BAY SHORE State N.Y. Zip Code 11708

FROM: Shipper FORT HAMILTON ARMY GARRISON
Street BUILDING #200
City BROOKLYN State NY. Zip Code
24 hr. Emergency Contact Tel. No.

Route

Vehicle Number

No. of Units & Container Type	HM	BASIC DESCRIPTION Proper Shipping Name, Hazard Class, Identification Number (UN or NA), Packing Group, per 172.101, 172.202, 172.203	TOTAL QUANTITY (Weight, Volume, Gallons, etc.)	WEIGHT (Subject to Correction)	RATE	CHARGES (For Carrier Use Only)
1 DM.	X	WASTE, GASOLINE, 3, UN1203	Gallons	30		
		, PG II (SPENT GASOLINE)				
		WASTE NO.'S D001				
		D018				

PLACARDS TENDERED: YES ☐ NO ☐

Note – (1) Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property, as follows: "The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding _____ per _____."
(2) Where the applicable tariff provisions specify a limitation of the carrier's liability absent a release or a value declaration by the shipper and the shipper does not release the carrier's liability or declare a value, the carrier's liability shall be limited to the extent provided by such provisions. See NMFC Item 172.
(3)Commodities requiring special or additional care or attention in handling or stowing must be so marked and packaged as to ensure safe transportation. See section 2(e) of Item 360, Bills of Lading, Freight Bills and Statements of Charges and Section 1(k) of the Contract Terms and Conditions for a list of such articles.

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name and are classified, packed, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

_____ Signature

REMIT C.O.D. TO: ADDRESS

COD Amt: $

Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:
The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

(Signature of Consignee)

C.O.D. FEE: PREPAID ☐ COLLECT ☐ $

TOTAL CHARGES: $

FREIGHT CHARGES
FREIGHT PREPAID (except where box at right is checked) ☐ Check here if charges are to be collected

RECEIVED, subject to classifications and tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and condition of contents of packages unknown), marked consigned, and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of this property under contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any portion of said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.
Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

SHIPPER JOHN KHOF
PER

CARRIER ACTION TRUCKING, INC
PER
DATE 9/19/05.

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