Aztech Technologies, Inc.

DRAFT
Pre-Remedial Design Investigation Report

Jack's Drycleaners Site

Site No. 734112

Village of Brewerton
Town of Cicero
Onondaga County
New York

April 26, 2013

Prepared for:
New York State Department of Environmental Conservation
615 Erie Boulevard West
Syracuse, NY 13204-2400
Attn.: Tara M. Blum, P.E.

REMEDIATION SOLUTIONS

ENVIRONMENTAL CONSULTING

DRILLING APPLICATIONS

5 McCrea Hill Road
Ballston Spa, NY 12020
p 518.885.5383
f 518.885.5385

aztechtech.com

TABLE OF CONTENTS

APPENDICES

- **A - *Figures***
  1. Site Location Map
  2. Site Map
  3. Overburden Groundwater Elevation Map
  4. Bedrock Groundwater Elevation Map
  5. Selected Chlorinated Solvents in Groundwater

- **B - *Tables***
  1. Groundwater Elevation Summary Table
  2. Monitoring Well Headspace Field Analysis
  3. Low- Flow Sampling Final Water Quality Parameters
  4. Groundwater Analytical Summary Table
  5. Soil Analytical Summary Table
  6. Slug Test Results Summary
  7. Monitored Natural Attenuation (MNA) Scoring Table

- **C - *Field Work Documentation***
  1. Field Photographic Log
  2. Groundwater Quality Parameters – Field Logs
  3. Sample Collection Log

- **D - *Boring Logs***
  1. AZSB-1
  2. AZSB-2

- **E - *Slug Test Curves***
  1. MW-1R
  2. MW-09
  3. MW-13
  4. MW-14BR
  5. MW-15BR

- **G - *Analytical Data***
  1. Groundwater
  2. Soil
  3. MI – CENSUS

1.0 Introduction

Aztech Technologies, Inc. (Aztech) was contacted by the New York State Department of Environmental Conservation (NYSDEC) to perform a pre-remedial design investigation at the Jack's DryCleaners site under Aztech's NYSDEC Standby Remedial Services Contract number C100904. Previous investigations at the site identified a chlorinated volatile organic compound (CVOC) groundwater contamination plume originating from a septic system located behind the drycleaner building and extending approximately 500 feet to the southeast.

The purpose of the investigation is to assess the potential effectiveness of an enhanced anaerobic bioremediation alternative recommended in a feasibility study previously performed at the site by EA Engineering, P.C. of Syracuse, New York. The investigation is to determine if natural attenuation processes are occurring under current conditions and to evaluate hydrogeologic, geochemical and microbial characteristics to define parameters for possible implementation of enhanced anaerobic bioremediation. The remedial goals and objectives of the enhanced anaerobic bioremediation would be to restore the site to pre-disposal/pre-release conditions to the extent practical and legal. Remedial action objectives (RAOs) are based on contaminant-specific standards, criteria and guidance (SCG). For groundwater remediation at this site, Ambient Water Quality Standards (AWQSs) will be the RAO.

2.0 Background

The site is located at 9628 Brewerton Road in the Village of Brewerton, Town of Cicero, Onondaga County, New York (**FIGURE 1 – Site Location Map**). The general topography is flat with a slight downward gradient to the east-southeast. The Oneida River is located approximately 1,000 feet northeast of the site.

Surrounding site use along Brewerton Road is primarily commercial. The immediate area east and southeast of Jack's Drycleaners consists of low-lying wet areas, open grassy areas and wooded land. A residential area is located further to the east and southeast.

In 2006, a petroleum spill resulting from a leaking underground storage tank (UST) system at the property adjacent to the south of Jack's Drycleaners was reported. Following the excavation of impacted soils, a subsequent subsurface investigation was performed at the property in 2007. Analysis of groundwater samples collected in close proximity the rear of the Jack's Drycleaners building indicated the presence of CVOCs.

The Jack's Drycleaner property was reportedly utilized as a gasoline station in the 1950s and as a dry cleaning facility since at least 1972. The site building was connected to a septic system which was located adjacent to the east side of the site building. After determining that the

septic system was the potential source area of CVOCs detected at the site, the septic system and impacted soils were removed in 2009 as an interim remedial measure (IRM).

Site characterization and remediation investigations included the installation of 22 monitoring wells, three (3) test pits, and the analysis of soil gas samples. Investigations performed by EA Engineering, P.C. concluded the following:

- The site is underlain by silt and clay with alternating layers of fine to coarse sand.
- Bedrock is encountered at depths ranging from approximately 14 feet to 25 feet below grade (fbg) and consists of highly weathered gray shale. The bedrock surface reportedly dips to the southeast and a trough feature is located southeast of the site.
- Shallow/overburden groundwater is generally encountered at 2 to 13 fbg. Overburden and bedrock groundwater are part of the same aquifer.
- Groundwater flow at the site is toward the southeast at a gradient of approximately 0.01 ft/ft
- A soil vapor intrusion (SVI) investigation indicated that none of the contaminants of concern were detected in the buildings adjacent to Jack's Drycleaners. A SVI investigation performed at eight (8) structures located downgradient of the groundwater plume indicated that CVOCs were present in these structures but at concentrations less than applicable New York State Department of Health air guidelines and at concentrations where monitoring and/or mitigation was not required. Analysis of sub-slab soil gas from beneath the Jack's Drycleaner building indicated elevated concentrations of perchloroethene/tetrachloroethene (PCE).
- Post-excavation soil analysis of sidewall and bottom samples retrieved following the IRM excavation of the septic system behind the Jack's Drycleaners building showed CVOCs present but at concentrations less than Part 375 Unrestricted Use and Protection of Groundwater SCGs. CVOCs in soil are not considered a media of concern at the site.
- CVOC impacts have been documented at monitoring well MW-15, approximately 500 feet from the former septic system location. The selection of contaminants of concern (COC) in groundwater at the site is based upon the frequency of detection exceeding standards and concentrations in groundwater. The COC are PCE and it's breakdown compounds; trichloroethene (TCE); cis-1,2,-dichloroethene; trans-1,2-dichloroethene, and; vinyl chloride (VC). PCE has reportedly been detected at concentrations as high as 41,300 ug/L. Groundwater monitoring data collected from 2009 to 2011 reportedly suggests that total VOC concentrations are decreasing.

Background information and data was obtained from the following:

- *Feasibility Study (734112)*, prepared by EA Engineering, P.C., May 2012.

- *Pre-Remedial Design Investigation Work Plan (version: draft)*, prepared by EA Engineering, P.C., July 2012.

3.0 Scope of Work

The purpose of the pre-remedial design investigation is to determine if natural attenuation processes are occurring under current conditions and to evaluate hydrogeologic, geochemical and microbial characteristics to define parameters for possible implementation of enhanced anaerobic bioremediation. Tasks performed during this investigation included:

- Gauging of the site monitoring wells and development of groundwater elevation maps;
- Low-flow groundwater sampling and analysis of fifteen (15) monitoring wells, data collected included:
    - Monitoring well headspace analysis of total volatile organic compounds (VOCs) utilizing a photo ionization detector (PID);
    - Dissolved oxygen, pH, specific conductivity, oxidation-reduction potential, temperature, turbidity;
    - Total organic carbon, alkalinity, mercury, methane, ethane, ethene, sulfate, nitrate, target analyte list (TAL) metals and VOCs by EPA Method 8260;
- The installation of two (2) soil borings and analysis of soil samples from the soil borings for in-situ fraction organic carbon (f_{oc}), soil bulk density and grain size analysis;
- Slug testing of five (5) monitoring wells to determine hydraulic conductivity;
- Microbial sampling and analysis of nine (9) monitoring wells to determine specific microbial species and populations;
- A site survey to update data on an existing site map, and;
- A report of findings.

4.0 Methodologies and Results

4.1 Monitoring Well Gauging

On September 17, 2012, an Aztech environmental scientist mobilized to the site (**FIGURE 2 – Site Map**) to gauge, purge and to conduct low-flow sampling on fifteen (15) monitoring wells. Prior to sample collection, selected monitoring wells were gauged to determine the depth to groundwater. Gauging was conducted utilizing a Solonist® water level probe capable of readings to one one-hundredth of a foot (0.01'). Gauging included nine (9) overburden monitoring wells (MW-1R, MW-2, MW-5, MW-6, MW-7, MW-9, MW-10, MW-12 and MW-14) and six (6) bedrock wells (MW-10BR, MW-13, MW-14BR, MW-15BR, MW-16BR and MW-17BR).

Overburden depths to groundwater ranged from 5.28 (MW-1R) feet below grade (fbg) to 9.62 fbg (MW-6). Overburden depth to water averaged 7.86 fbg. Bedrock depths to water ranged from 7.41 fbg (MW-13) to 15.74 fbg (MW-16BR). Bedrock groundwater averaged 10.78 fbg.

Groundwater elevations were subsequently calculated by subtracting the depth to water from the respective top of casing elevation. The overburden and bedrock groundwater flow on September 17, 2012 was southeast in direction, which is consistent with historical data. Monitoring well gauging data is presented in the **Table 1 - Appendix B**. Groundwater elevation maps for bedrock and overburden wells are attached as **Figures 3 & 4**.

4.2 Low-Flow Groundwater Sampling

Prior to purging or sampling activities, the headspace in each monitoring well was field analyzed for total VOCs with a calibrated PID (10.6 eV). A vinyl chloride correction factor (2.0) was applied to all PID readings. Monitoring well headspace field analysis results are detailed below in **Table 2**.

Table 2 – Monitoring Well Headspace Field Analysis

MW ID	Total VOCs (ppm)	MW ID	Total VOCs (ppm)
MW – 1R	37	MW – 12	4.0
MW – 2	8.0	MW – 13	357
MW – 5	10	MW – 14	1.1
MW – 6	1.6	MW – 14BR	4.6
MW – 7	81	MW – 15BR	6.1
MW – 9	1.7	MW – 16BR	3.8
MW – 10	7.9	MW – 17BR	2.7
MW – 10BR	1.8	-	-

All groundwater sampling was conducted in accordance with EA's Pre-Remedial Investigation Work Plan and USEPA low-flow guidelines. Purging occurred at a sustainable rate that minimized drawdown and stabilized the water table. According to EA's Pre-Remedial Investigation Work Plan, purging could not exceed 250 mL/min and drawdown could not exceed more than 0.3 feet throughout the purge. Each monitoring well was purged using a peristaltic pump with dedicated polyethylene and silicone tubing until water quality parameters stabilized and groundwater turbidity reached less than 50 nephelometric turbidity units (NTU's). This occurred at all monitoring wells in less than tree well volumes, with the exception of MW-2. MW-2 exhibited turbidity readings ranging from greater than 800 NTU's to 129 NTU's. Approximately 4.5 gallons were purged from MW-2 (4.5 gallons equals ~ approximately

4 well volumes), at which point, a sample was collected. Field sampling record and water quality parameters collected during purging are included as part of **Appendix C**.

Purge water was field analyzed using a Horiba U52 water quality meter, outfitted with a flow thru cell. Water quality parameters (temperature, pH, specific conductivity, oxidation reduction potential [ORP], dissolved oxygen and turbidity) were measured in real time and recorded throughout the well purging process and immediately prior to sample collection. The final water quality parameter readings of each well, prior to sample collection are detailed below in **Table 3**.

Table 3 – Low- Flow Sampling Final Water Quality Parameters

MW ID	Temperature (Celsius)	pH	Specific Conductivity (mS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Turbidity (NTU)
MW-1R	18.41	6.48	0.48	-26	0.75	4.0
MW-2	20.02	7.51	1.03	130	0.00	130
MW-5	20.73	7.36	0.32	-75	0.00	18.3
MW-6	16.22	7.01	0.87	-81	0.00	21.6
MW-7	14.80	7.04	0.94	-1	0.00	23.5
MW-9	18.69	7.46	1.12	107	0.02	47
MW-10	14.64	7.11	1.31	-4	0.00	47.3
MW-10BR	14.30	7.11	4.31	-33	0.00	5.2
MW-12	16.56	7.47	0.84	-23	0.00	45.3
MW-13	19.68	7.09	8.94	70	0.00	0.7
MW-14	16.14	7.13	1.04	-38	0.20	12.4
MW-14BR	14.98	7.26	0.98	-97	0.00	1.6
MW-15BR	13.66	7.51	0.88	-57	0.00	32.2
MW-16BR	14.22	7.51	0.62	62	0.00	6.4
MW-17BR	13.99	7.77	0.48	-14	0.08	4.7

Groundwater samples were collected subsequent to purging. Samples were transferred into laboratory provided containers and stored on ice. On a daily basis, samples were delivered to a Test America sub-office located in Syracuse, New York. Subsequently, the samples were sent to and analyzed at Test America Laboratory, located in Buffalo, New York (NELAC – NY455). The samples were analyzed for:

- VOCs via EPA Method 8260;

- TAL metals via EPA 6010;
- Mercury via EPA method 7470;
- Methane, ethane and ethene via RSK-175;
- Total alkalinity via EPA 310.2.
- Total organic carbon via EPA 9060;
- Sulfate via ASTM D-516, and;
- Nitrate as N via EPA 353.2;

A summary of laboratory analytical results is presented below, refer to the Ground Water Analytical Summary Table (**Table 4 - Appendix B**) for details on individual monitoring wells and analysis results.

- Volatile organic compounds were detected within all groundwater samples. Furthermore, chlorinated solvents were detected in all groundwater samples.
- Tetrachloroethene was detected in all submitted groundwater samples, with the exception of MW-9 and MW-14. These concentrations ranged from 1.8 ppb at MW-6 to 10,000 ppb at MW-13.
- Trichloroethene was detected at MW-2, MW-5, MW-7, MW-9, MW-10, MW-12, MW-13, MW-14, MW-14BR, MW-15BR and MW-17BR. These concentrations ranged from 0.7 ppb at MW-10 to 2,000 ppb at MW-13.
- Vinyl Chloride was detected in five (5) overburden wells (MW-2, MW-7, MW-14, MW-12 and MW-14) and (3) bedrock wells (MW-13, MW-14BR and MW-16). Vinyl chloride concentrations ranged from 1.1 ppb (MW-2) to 270 ppb at (MW-13).
- Target Analyte List (TAL) metals were detected in all groundwater samples. Additionally, calcium and magnesium were detected above standards set forth by the NYSDEC in all groundwater samples. Aluminum, arsenic, barium, iron, manganese and sodium were also detected above standards in selected groundwater samples.
- Ethene, ethane and methane were analyzed via RSK-175. Ethene and ethane were detected in MW-13 at concentrations of 38 and 62 ppb, respectively. Methane was detected in all monitoring wells, with the exception of MW-15BR and MW-17BR. Methane ranged from 6.5 ppb at MW-10 to 1,700 ppb at MW-13.
- Total alkalinity was analyzed in all submitted groundwater samples. Alkalinity ranged from 142 ppb ant MW-1R to 562 ppb at MW-16BR.
- Total organic content (TOC) was analyzed at each sampling location via EPA method 9060. TOC was detected in all sampled monitoring wells with the exception of MW-17BR. TOC ranged from 0.6 ppm at MW-12BR to 6.3 parts per million (PPM) at MW-1R.

- Sulfate was analyzed via ASTM method D-516-90.02 and was detected within all analyzed groundwater samples. Sulfate ranged from 31 ppm at MW-1R to 236 ppm at MW-5. All sulfate detections were below standards set forth by the NYSDEC (250 ppm).
- Nitrate as N was analyzed via EPA method 353.2. Nitrate was detected in eight (8) (MW-1R, MW-2, MW-5, MW-9, MW-12, MW-13, MW-14BR and MW-17BR) of the submitted fifteen (15) soil samples.

4.3 Soil Boring Installation and Soil Sample Analysis

On October 2, 2012, two (2) soil borings (AZ-SB-1 and AZ-SB-2) were sampled at the site by Aztech under the supervision of an Aztech environmental scientist. The soil borings were located and sampled in accordance with EA's Pre-Remedial Work Plan, dated July 2012. Soil boring AZ-SB-1 was located within a wooded area approximately 315 feet east of Jacks Dry cleaners. Soil Boring AZ-SB-2 was located within the grass lawn area, approximately 115 feet east of the dry cleaners. Soil boring locations are depicted on **Figure 2**.

Soil boring installations were completed utilizing hydraulically driven direct-push soil core (Geoprobe 2.25 inch Macrocore) sample techniques to terminal depths of 16.7 and 18.7 fbg at AZ-SB-1 and AZ-SB-2, respectively. The terminal depths represent the soil-bedrock interface as expressed by sampler refusal. The initial groundwater table was observed at depths of approximately 6.5 and 8 fbg in AZ-SB-1 and AZ-SB-2, respectively.

During soil boring operations, soil samples were classified and logged by an environmental scientist and screened for total VOCs using a PID. The maximum total VOC concentration by PID analysis for AZ-SB-1 and AZ-SB-2 was 33.4 ppm and 28.8 ppm, respectively. Refer to the soil boring logs (**Appendix D**) for further details of soil descriptions and PID results.

Two (2) soil samples from each boring were collected for grain size analysis and determination of total organic carbon in soil via ATSM Method D422 and the Lloyd Kahn method, respectively. These soil samples targeted the interval of seven (7) feet through twelve (12) feet below grade (fbg) and the interval of fifteen (15) feet to the top of observed bedrock (16.7 fbg at AZ-SB-1 and 18.7 fbg at AZ-SB-2). Soil samples were transferred into laboratory provided glassware and stored on ice. Subsequently, the soil samples were submitted to Test America Laboratory (NELAC – NY455), located in Buffalo NY. It should be noted that a transcription error was recorded on the chain of custody. The chain of custody indicates that the second AZ-SB-2 soil sample was collected from a depth of 12.0 – 18.7 fbg. In reality, the second AZ-SB-2 sample was collected from a depth of 15.0 to 18.7 fbg.

Laboratory analytical results indicate that total organic carbon was detected in three of the four collected soil samples; AZ-SB-1 (7' – 12'), AZ-SB-1 (15' - 16.7') and AZ-SB-2 (15' – 18.7')

exhibited organic carbon readings of 1,780 ppm, 4,740 ppm and 2,510 ppm, respectively. Organic carbon was not detected (<1290 ppm) within soil sample AZ-SB-2 (7' – 12').

Sieve and hydrometer analysis was conducted (via ASTM D422) on all soil samples. Analysis showed that AZ-SB-1 averaged 20.6% gravel, 42.9% sand, 23.7% silt and 13.6% clay. AZ-SB-2 averaged 14.3% gravel, 22% sand, 33.2% silt and 30.5% clay. Additionally, each soil sample was analyzed for percentage of solids; AZ-SB-1 averaged 89.5% solids and AZ-SB-2 averaged 78.5% solids. Refer to the Soil Sample Analytical Summary (**Table 5 - Attachment C**) for further details.

4.4 Hydraulic Conductivity Slug Testing

On October 3rd through October 5th, 2012, an Aztech environmental scientist conducted slug testing on five (5) monitoring wells across the site to determine hydraulic conductivity (K) values. As stated in the Pre-Remedial Work Plan, "both rising head and falling head (slug) tests will be conducted in wells where the screen does not bridge the water table". After a complete round of groundwater gauging and consulting historical boring logs, five (5) monitoring wells that met the given criteria were selected. MW-1R, MW-9, MW-13, MW-14BR, and MW-15BR were selected based on field measurements collected on October 3rd, 2012.

After selection of slug testing wells, a Level Troll transducer was used to collect depth to water information throughout the duration of the rising and falling head slug tests. The transducer was connected to a laptop computer and used in conjunction with Win-Situ 5 software to track water level changes at a pre-designated time interval. Once the transducer was in-place, a pre-constructed slug (four (4) foot slug) was inserted into the well, while software tracked the changes on water depth (rising head).

Once the monitoring well recharged to 85% of its original volume, the slug was removed while software tracked the changes to the hydraulic head. This process was repeated at the four (4) remaining wells.

The slug testing data were analyzed by the Bouwer-Rice method to determine approximate hydraulic conductivities. Resulting hydraulic conductivity values are present in **Table 6**.

Table 6 – Slug Test Results Summary				
MW ID	**Slug Type**	**Hydraulic Conductivity (cm/sec)**	**Average K (cm/sec)**	**Overall Average K (cm/sec)**
MW-1R	Slug In Slug Out	1.88x10-4 1.66x10-4	1.77x10-4	8.40x10-4
MW-9	Slug In Slug Out	1.5x10-3 1.947x10-3	1.72x10-3	
MW-13	Slug In Slug Out	2.36x10-3 2.056x10-3	2.21x10-3	
MW-14BR	Slug In Slug Out	3.8x10-5 4.3x10-5	4.05x10-5	
MW-15BR	Slug In Slug Out	4.5x10-5 6.5x10-5	5.35x10-5	

The data shows an average hydraulic conductivity (overburden & bedrock) of $8.40x10^{-4}$ cm/sec. The overburden/soil results from monitoring wells MW-1R and MW-9 indicated an average K value of $9.50x10^{-4}$ cm/sec which is typical of silty sand. The bedrock (shale) monitoring well's (MW-13, MW-14BR & MW-15BR) average K value was calculated at $7.68x10^{-4}$ cm/sec. Additional slug test data is presented in **Appendix E**.

4.5 In-Situ Microbial Analysis

To assess the potential for reductive dechlorination and to determine if natural attenuation may be occurring at the site, non-baited Microbial Insights (MI) Bio Traps® were installed in nine (9) monitoring wells at the site The Bio Traps® were installed in monitoring wells MW-5, MW-7, MW-9, MW-12, MW-13, MW-14BR, MW-15BR, MW-17 and MW-17BR for a period of 35 days commencing on October 22, 2012. The Bio Traps® were then recovered and submitted to MI of Rockford, Tennessee for CENSUS quantification analysis of Dehalococcoides, Dehalobacter and Desulfuromonas (halorespiring bacteria) species. These analyses indentify microbial populations and assess the potential for reductive dechlorination of tetrachloroethene (PCE) and its daughter products.

Dehalococcoides species were detected in two (2) of the five (5) analyzed overburden wells (MW-5 and MW-7) at concentrations near the minimum laboratory detection limit. The low concentrations indicate that current conditions at the site are not likely to completely reduce PCE or TCE to ethene. Dehalococcoides were not detected within any bedrock well.

Dehalobacter species were detected at MW-9 and MW-12. Desulfuromonas species were detected at MW-5. The concentrations of these halorespiring bacteria species were recorded at low concentrations, indicating that the potential for complete reductive dechlorination is

limited under current site conditions. Desulfuromonas and Dehalobacter species were not detected in any bedrock wells.

Although the current conditions at the site are not conducive to complete reductive dechlorination, the presence of cis-DCE and vinyl chloride at significant concentrations indicate that limited reductive dechlorination has occurred. As stated in the attached MI report (**Appendix F**), "the septic system that was present until 2009 likely provided additional organic materials that could have served as electron donors generating reducing conditions in the source zone and initially supporting reductive dechlorination". Furthermore, the report states "Currently however, growth of halorespiring populations may be hindered by the presence of competing electron acceptors and low electron donor availability". Methogens, which compete for available hydrogen, were detected in all of the samples.

MI concluded that complete reductive dechlorination is unlikely under monitored natural attenuation (MNA) conditions. In order to promote the growth of halorespiring bacteria species and reductive dechlorination, an electron donor and bioaugmentation should be considered. Please refer to Appendix F for the complete MI comprehensive report.

5.0 Conclusions/Discussion

5.1 Pre-Design Remedial Investigation Observations

Data collected during the Pre-design Remedial Investigation indicate that current site conditions and characteristics are moderately conducive to the application of enhanced reductive dechlorination by anaerobic bioremediation. The successful application of this remedial strategy may be challenging without further understanding of the mechanisms required to promote microbial growth. This assessment is based upon the following data collected during the investigation:

- Dissolved oxygen (DO) concentrations are very low or zero at the site monitoring wells. This is a good indicator that the reductive conditions are favorable, however, the oxidation-reduction potential (ORP) at several impacted monitoring wells (i.e. MW-13) indicates a less than optimal reducing condition;
- pH close to neutral is favorable for microbial growth;
- Relatively high sulfate concentrations (>20 mg/L) indicate potential competition with reductive pathways and consumption of electron donor substrate;
- The detection of ethane, ethene and methane and the presence of vinyl chloride at monitoring well MW-13 suggest limited dechlorination is occurring.

- Total organic carbon is relatively low, <1%. This condition indicates a lack of adequate naturally occurring electron donors.
- The site's hydraulic conductivity is moderate to low. A relatively dense injection grid may be required to adequately distribute electron donor substrate.
- Favorable microbial species were detected at low populations in only four (4) of nine (9) monitoring wells. Dehalococcides function genes for TCE and vinyl chloride reductase were not detected.

The recorded parameters can be used in conjunction with analytical data to quantitatively determine the amount of natural attenuation that has occurred at that particular monitoring point. The EPA guidance document, "Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater", has derived a scoring system to measure natural attenuation. Value points are awarded or deducted based water quality measurements (alkalinity, temperature, pH, oxidation reduction potential), and concentrations of analyzed compounds (nitrate, sulfate, methane, ethene, ethane, total organic carbon and various volatile organic compounds). MW-2, MW-13 and MW-17 were compared to this set of criteria. MW-13 exhibited a total value of 15 points, indicating that natural attenuation has, at one point, occurred at this location. MW-11 totaled 11 points and MW-17 totaled 4 point. A total value of less than 15 points indicates that natural attenuation is unlikely to occur without an electron donor or bioaugmentation. A score of 6 though 14 points indicate that limited evidence for anaerobic biodegradation. A score of 4 or less indicates that anaerobic biodegradation is unlikely to occur. See **Appendix B** for a complete record of all water quality parameters. See Appendix C – MNA Scoring Table for details and criteria regarding scoring system.

5.2 Dissolved VOC Plume Observations

Dissolved phase VOC's from overburden and bedrock wells from July, 2011 (as described in Figures 4A and 4B within "*Feasibility Study (734112))*, prepared by EA Engineering, P.C., May 2012" were compared to the September 2012 dissolved phase VOC concentrations.

- Dissolved phase VOC concentrations have increased in seven (7) of the nine (9) sampled overburden wells. MW-1R, MW-2, MW-5, MW-6, MW-7, MW-10 and MW-12 increased from July 2011 to September 2012. The largest increase was observed at MW-1R. MW-1R increased from 745 ppb in July 2011 to 12,024 ppb in September 2012.
- MW-9 and MW-14 dissolved phase VOC concentrations decreased from 5,675 and 130 ppb to 533 and 104 ppb, respectively.

- Dissolved phase VOC concentrations have increased in four (4) (MW-10BR, MW-13, MW-16BR and MW-17BR) of the six (6) sampled bedrock monitoring wells. The largest increase was observed at MW-13. MW-13 increased from 8,424 ppb in July 2011 to 12,356 ppb in September 2012.
- MW-16BR and MW-17BR dissolved phase VOC's increased from non-detect levels in July 2011 to 732 and 16 ppb, respectively.
- Dissolved phase VOC's at MW-14BR and MW-15BR decreased from 269 ppb and 1,376 ppb to 94 and 732 ppb, respectively.

6.0 Recommendations

Based on the collected information, Aztech recommends the following:

- That the department should consider a baited Bio-Trap Insitu Microcosm study to determine the effects of electron donor addition, to determine if electron donor substrate addition to the subsurface may stimulate microbiological activity (halorespiring bacteria) to promote reductive dechlorination. The study would include the deployment and analysis of several Bio-Traps in select monitoring wells baited with electron donor substrate suitable for site conditions.
- That the department considers the installation of additional monitoring wells in the area north/northeast of MW-16BR and east of MW-17BR. As described in Figures 4A and 4B within "*Feasibility Study (734112)*, prepared by EA Engineering, P.C., May 2012", MW-17 and MW-17BR were void of any detected VOC's. When sampled in September, 2012, MW-17BR laboratory results showed a PCE and TCE concentrations of 15 ppb and 1.6 ppb, respectively. Furthermore, dissolved phase VOC levels MW-16BR increased from non-detect concentrations in July, 2011 to 732 ppb in September, 2012. The increase in VOC concentrations at MW-16BR and MW-17BR indicate that the plume is migrating to the east, at a minimum.
- That a supplemental Soil Vapor Intrusion study be conducted at selected residences along Kathan Road and Tagus Lane. The data presented herein indicates that the contaminant plume is migrating to the east and northeast. Aztech recommends that indoor air be monitored in the areas north of MW-16BR and east of MW-17BR.

7.0 References

Feasibility Study (734112), prepared by EA Engineering, P.C., May 2012.

Pre-Remedial Design Investigation Work Plan (version: draft), prepared by EA Engineering, P.C., July 2012.

Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water, U.S. Environmental Protection Agency (USEPA). September 1998

Principles and Practices of Enhanced Anaerobic Bioremediation of Chlorinated Solvents, Parsons Corporation, August 2004

Aztech appreciates the opportunity to conduct work for the NYSDEC. If you have any questions regarding the information described herein, please contact me at (518) 885-5383 at your convenience.

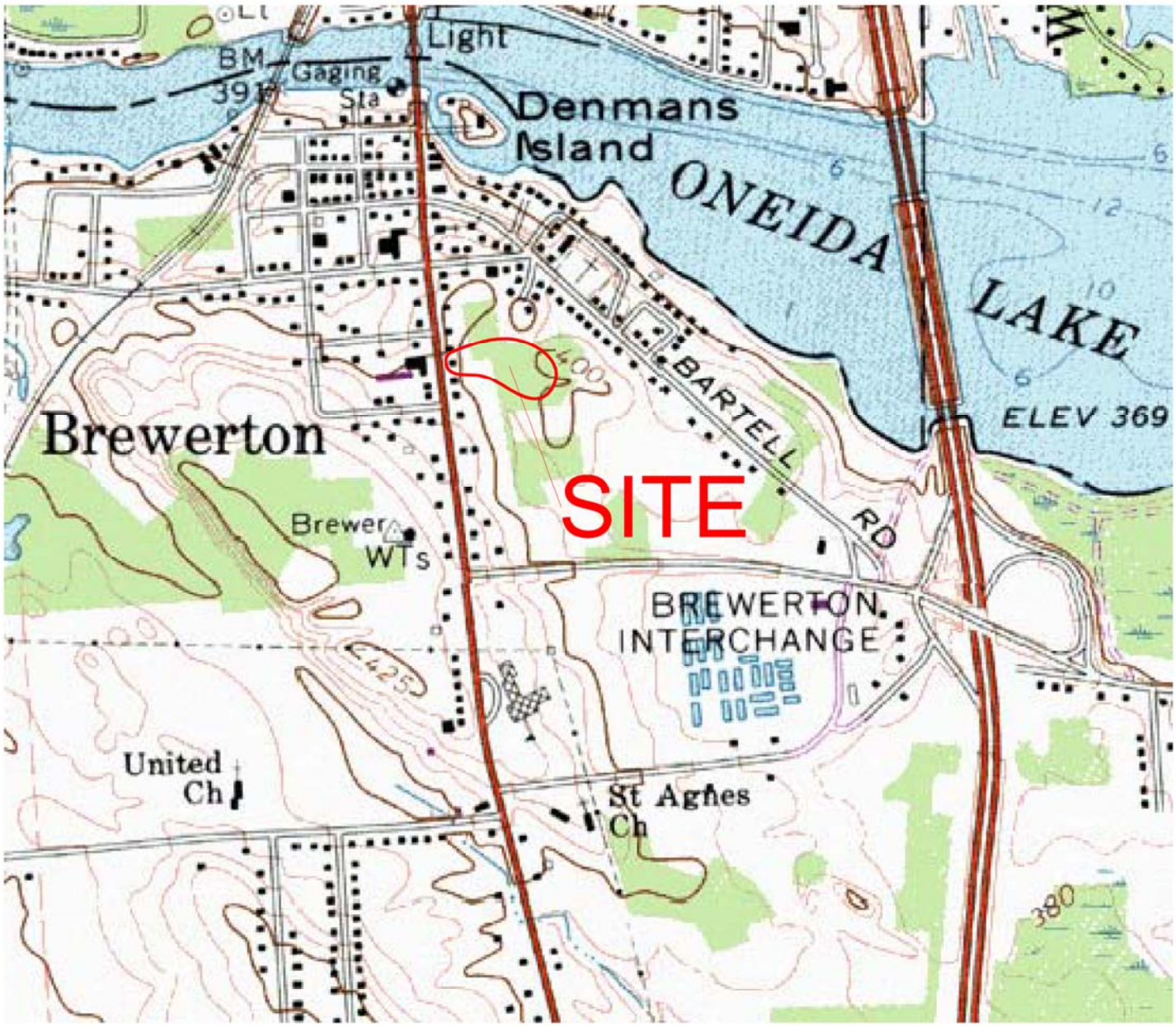
Sincerely
AZTECH TECHNOLOGIES, INC.

DRAFT - 4.26.12

Brian Baulsir
Project Scientist

APPENDIX A

Figures



Aztech Technologies, Inc.
Woman Owned Business

- Remediation Solutions
- Environmental Consulting
- Drilling Applications

5 McCrea Hill Road
Ballston Spa, NY 12020
p 518.885.5383 f 518.885.5385
info@aztechtech.com www.aztechtech.com

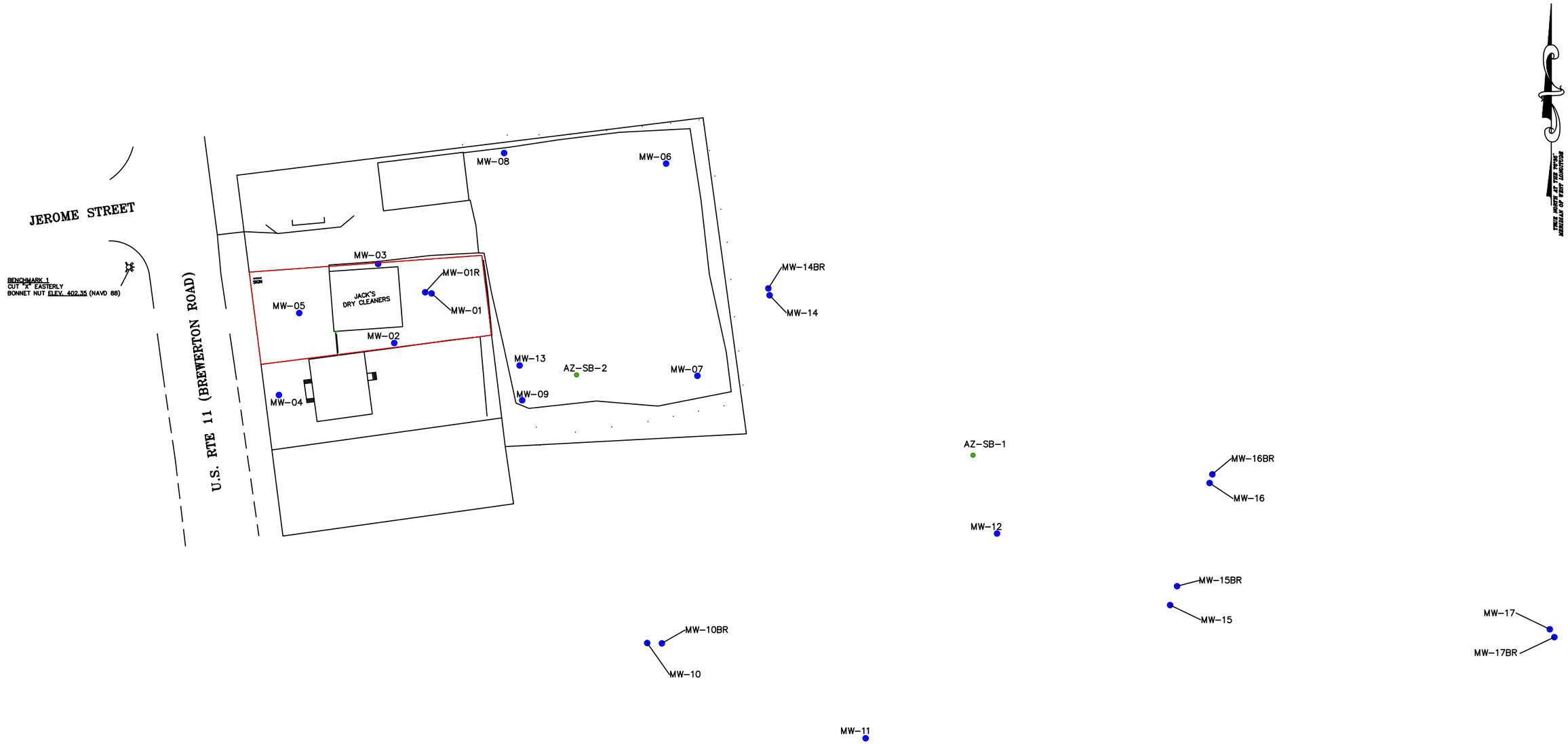
SITE: Jacks Dry Cleaners
9628 NYS Route 11
Brewerton, NY

FIGURE 1

DATE: September 2012 | NOT TO SCALE

LEGEND

- Site Boundaries



SITE MAP

Aztech Technologies, Inc.
Woman Owned Business

Remediation Solutions ● Environmental Consulting ● Drilling Applications
5 McCrea Hill Road
Ballston Spa, NY 12020
p 518.885.5383 I f 518.885.5385
info@aztechtech.com I www.aztechtech.com

SITE: Jack's Dry Cleaners
9628 NYS Route 11
Brewerton, NY
NYSDEC Site No. 734112

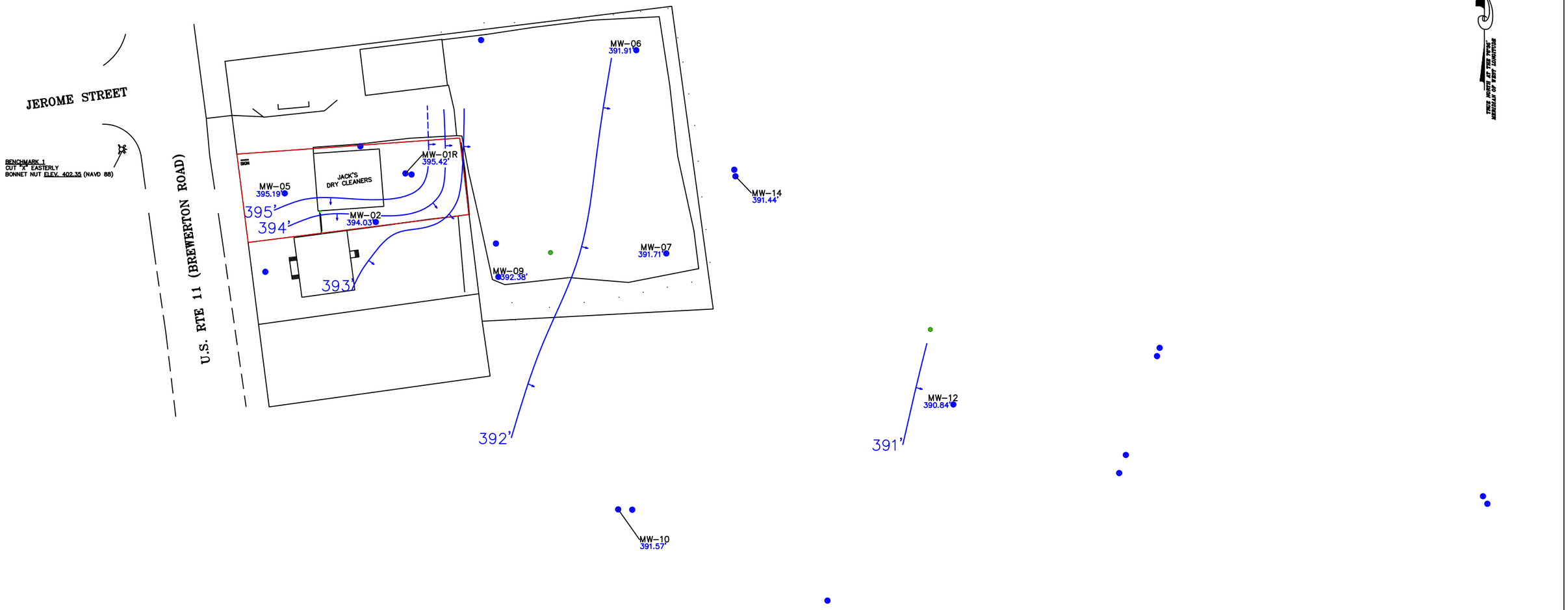
FIGURE 2

DATE: Sept., 2012

Scale (feet) 0 30 60 120 180

LEGEND

MW-12 - Monitoring Well ID
- Monitoring Well Symbol
- Soil Boring Symbol
- Site Boundary



Overburden Groundwater Elevation Map

Aztech Technologies, Inc.
Woman Owned Business

Remediation Solutions ● Environmental Consulting ● Drilling Applications
5 McCrea Hill Road
Ballston Spa, NY 12020
p 518.885.5383 I f 518.885.5385
info@aztechtech.com I www.aztechtech.com

SITE: Jack's Dry Cleaners
9628 NYS Route 11
Brewerton, NY
NYSDEC Site No. 734112

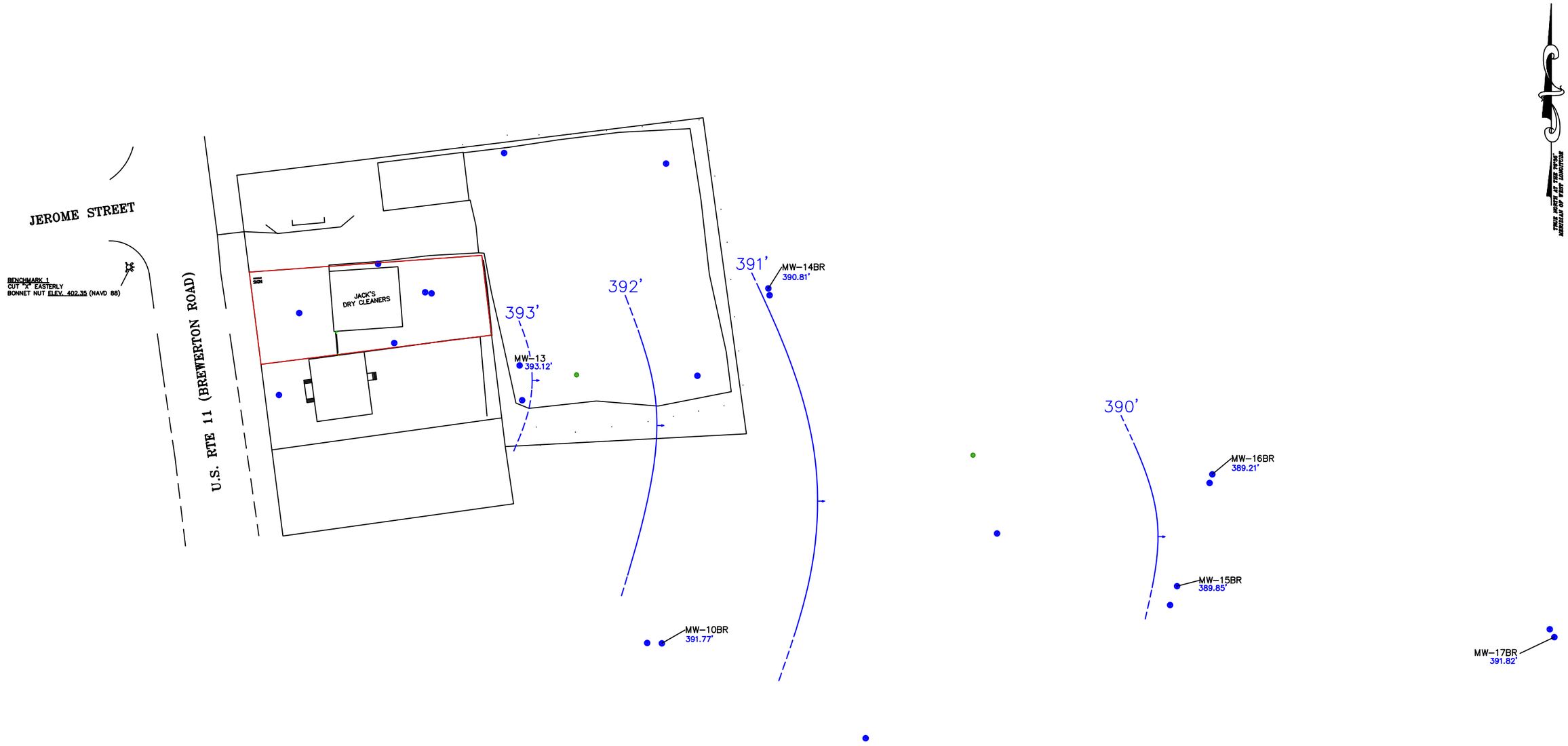
FIGURE 3

DATE: 9/17/2013

Scale (feet) 0 30 60 120 180

LEGEND

- MW-12 - Monitoring Well ID
- ● - Monitoring Well Symbol
- 395.19' - Groundwater Elevation
- ▭ - Site Boundary
- → - Direction of Groundwater Flow
- 395' - Calculated Groundwater Contour
- 395' - Inferred Groundwater Contour



Bedrock Groundwater Elevation Map

Aztech Technologies, Inc.
Woman Owned Business

Remediation Solutions ● Environmental Consulting ● Drilling Applications
5 McCrea Hill Road
Ballston Spa, NY 12020
p 518.885.5383 I f 518.885.5385
info@aztechtech.com I www.aztechtech.com

SITE: Jack's Dry Cleaners
9628 NYS Route 11
Brewerton, NY
NYSDEC Site No. 734112

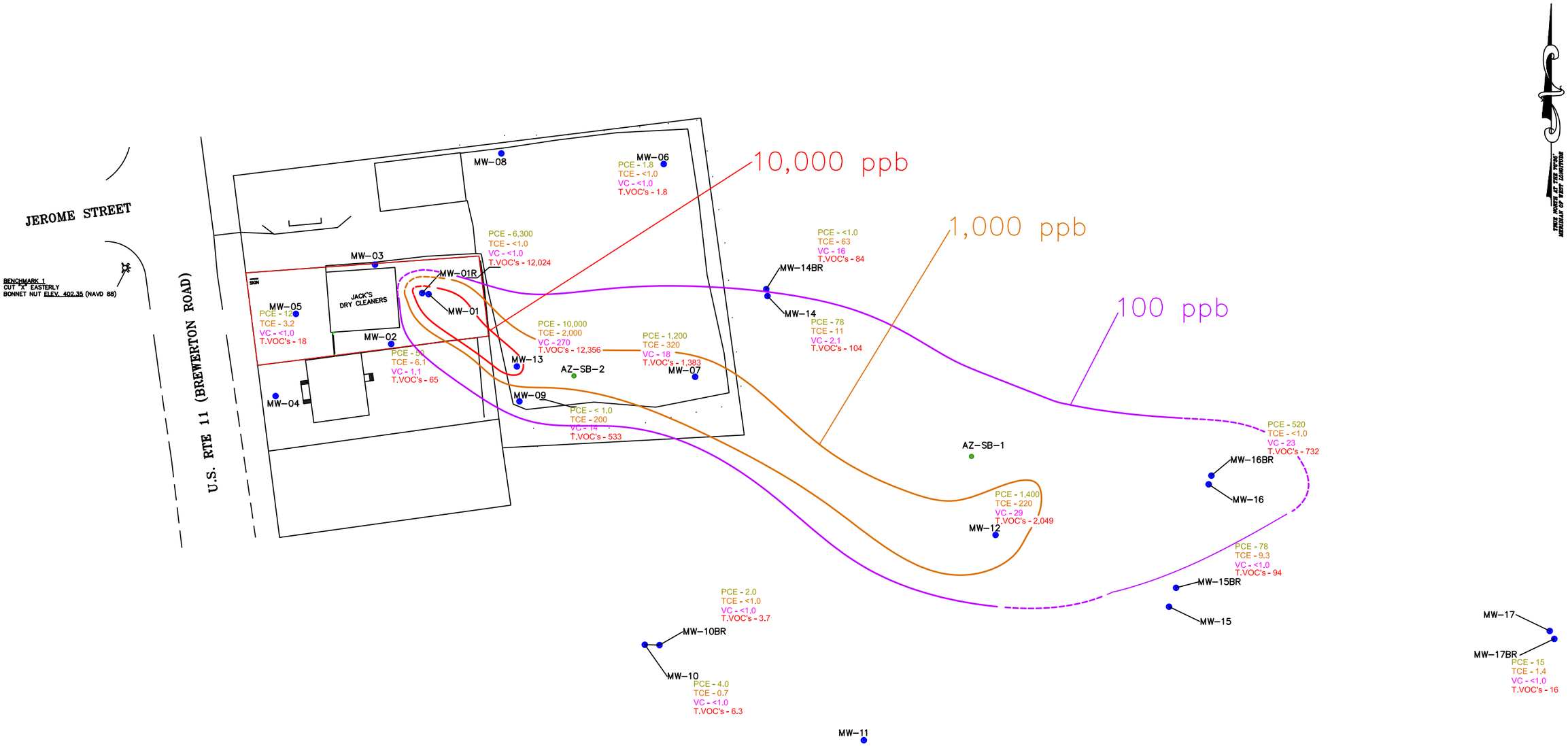
FIGURE 3

DATE: 9/17/2012

Scale (feet) 0 30 60 120 180

LEGEND

- MW-12 - Monitoring Well ID
- Monitoring Well Symbol
- 395.19' - Groundwater Elevation
- Site Boundary
- Direction of Groundwater Flow
- 395' - Calculated Groundwater Contour
- 395' - Inferred Groundwater Contour



Selected Chlorinated Solvents in Groundwater

LEGEND

- VOC Contour
- MW-12 - Monitoring Well ID
- Monitoring Well Symbol
- Monitoring Well Symbol
- Site Boundary
- Inferred VOC Contour

Tetrachlorothene (PCE) 30.3
Trichlorothene (TCE) 30.3
Vinyl Chloride (VC) 30.3
Total VOC's (T.VOC's) 30.3

All results reported in parts per billion

Aztec Technologies, Inc.
Woman Owned Business

Remediation Solutions ● Environmental Consulting ● Drilling Applications
5 McCrea Hill Road
Ballston Spa, NY 12020
p 518.885.5383 I f 518.885.5385
info@aztechtech.com I www.aztechtech.com

SITE: Jack's Dry Cleaners
9628 NYS Route 11
Brewerton, NY
NYSDEC Site No. 734112

FIGURE 4

DATE: Sept. 17 - 21, 2012

Scale (feet) 0 30 60 120 180

APPENDIX B

Tables

TABLE 1

Groundwater Elevations Summary

Jack's Dry Cleaners
NYS Route 11,
Brewerton, New York
NYSDEC Site No. 734112

MONITORING WELL IDENTIFICATION		MW-1R	MW-2	MW-5	MW-6	MW-7	MW-9	MW-10	MW-10BR
TOP OF PVC CASING		400.70	401.10	402.12	401.53	399.98	399.80	400.36	400.39
BOTTOM OF MONITORING WELL		383.05	387.08	387.47	382.73	380.92	382.05	382.83	369.89
		GROUNDWATER ELEVATIONS							
9/17/2012	DTW	5.28	7.07	6.93	9.62	8.27	7.42	8.79	8.62
	GW Elev	395.42	394.03	395.19	391.91	391.71	392.38	391.57	391.77

Notes:
GW Elev = Groundwater Elevation (ft.)
DTW = Depth to water (ft.)
Survey elevations provided by Prudent Engineering of Syracuse NY
* - Readings taken at static conditions and are measured in hundredth's of feet

MONITORING WELL IDENTIFICATION		MW-12	MW-13	MW-14	MW-14BR	MW-15BR	MW-16BR	MW-17BR	-
TOP OF PVC CASING		399.84	400.53	399.79	399.69	402.04	404.95	403.65	-
BOTTOM OF MONITORING WELL		388.49	372.19	374.04	360.71	369.87	364.91	373.91	-
		GROUNDWATER ELEVATIONS							
9/17/2012	DTW	9.00	7.41	8.35	8.88	12.19	15.74	11.83	-
	GW Elev	390.84	393.12	391.44	390.81	389.85	389.21	391.82	-

Notes:
GW Elev = Groundwater Elevation (ft.)
DTW = Depth to water (ft.)
Survey elevations provided by Prudent Engineering of Syracuse NY
* - Readings taken at static conditions and are measured in hundredth's of feet

TABLE 4
Groundwater Analytical Summary Table
Jack's Dry Cleaners
NYS Route 11, Brewerton, NY

Parameter	Sample Location																		NYSDEC Part 703: Groundwater Quality Standards
	MW-1R	MS (MW-1R)	MSD (MW-1R)	MW-2	MW-5	MW-6	MW-7	MW-9	MW-10	MW-10BR	MW-12	MW-13	MW-14	MW-14BR	Duplicate (MW-14BR)	MW-15BR	MW-16BR	MW-17BR	
EPA Method 8260B (results reported in parts per billion (ppb))																			
1,1,1-Trichloroethane	1.9	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.7	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	5.0
1,1-Dichloroethane	1.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.9 (J)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	5.0
1,1-Dichloroethene	1.3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.6 (J)	< 1.0	< 1.0	< 1.0	< 1.0	8.0	< 1.0	< 1.0	< 1.0	< 1.0	0.5 (J)	< 1.0	5.0
1,1,2-Trichloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	28	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.0
1,2-Dichlorobenzene	0.9 (J)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	3.0
Benzene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.1	1.6	< 1.0	3.1	< 1.0	1.0
Chloroethane	4.3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.8	1.2	< 1.0	< 1.0	< 1.0	21	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	5.0
Chloroform	< 1.0	< 1.0	< 1.0	0.4 (J)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	7.0
cis-1,2-Dichloroethene	5,700	5,700	5,700	7.4	2.3	< 1.0	290	280	< 1.0	< 1.0	400	< 1.0	13	< 1.0	93	6.5	180	< 1.0	5.0
Cyclohexane	< 1.0	< 1.0	< 1.0	< 1.0	0.6 (J)	< 1.0	0.5 (J)	2.7	< 1.0	< 1.0	< 1.0	1.0	< 1.0	1.5	1.0	< 1.0	2.6	< 1.0	N/A
Ethylbenzene	2.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	5.0
Methylcyclohexane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.5 (J)	< 1.0	< 1.0	< 1.0	1.3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	N/A
Methy tert-butyl ether	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.6	1.7	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.4 (J)	< 1.0	10 [1]
Tetrachloroethene	6,300	6,300 (B)	6,300 (B)	50	12	1.8	1,200	< 1.0	4.0	2.0	1,400 (B)	10,000 (B)	78 (B)	< 1.0	150 (B)	78 (B)	520 (B)	15 (B)	5.0
trans-1,2-Dichloroethene	< 1.0	130	130	< 1.0	< 1.0	< 1.0	6.6	6.7	< 1.0	< 1.0	< 1.0	51.0	< 1.0	1.7	< 1.0	< 1.0	1.9	< 1.0	5.0
Trichloroethene	< 1.0	1,700	1,700	6.1	3.2	< 1.0	320	200	0.7 (J)	< 1.0	220	2,000	11	63	58	9.3	< 1.0	1.4	5.0
Toluene	3.6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	5.0
Total Xylenes	8.5	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	0.8 (J)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	5.0
Vinyl Chloride	< 1.0	< 1.0	< 1.0	1.1	< 1.0	< 1.0	18	14	< 1.0	< 1.0	29	270	2.1	16	11	< 1.0	23	< 1.0	2.0
EPA 8260B Totals	**12,024**	**13,830**	**13,830**	**65**	**18**	**1.8**	**1,838**	**533**	**6.3**	**3.7**	**2,049**	**12,356**	**104**	**84**	**315**	**94**	**732**	**16**	-
EPA Method 6010B (results reported in ppb)																			
Aluminum	< 200	<200	< 200	410	150 (J)	75 (J)	130 (J)	77 (J)	940	73 (J)	960	< 200	170 (J)	< 200	< 200	230	480	< 200	50 [2]
Arsenic	17	17	17	58 (J)	< 10	10	< 10	< 10	< 10	< 10	< 10	< 10	11	9.8 (J)	7.4 (J)	5.7 (J)	6.7 (J)	< 10	25
Barium	47	47	47	270	140	17	130	230	170	320	180	17	130	170	170	94	290	66	100
Calcium	61,300	61,300	61,300	97,300	122,000	126,000	141,000	203,000	201,000	281,000	91,900	122,000	122,000	107,000	104,000	76,500	137,000	46,000	50 [2]
Chromium	1.7 (J)	1.7 (J)	1.7 (J)	1.9 (J)	< 4.0	< 4.0	< 4.0	1.6 (J)	2.1 (J)	0.7 (J)	1.7 (J)	< 4.0	1.2 (J)	< 4.0	< 4.0	1.4 (J)	1.9 (J)	< 4.0	50
Cobalt	3.2 (J)	3.2 (J)	3.2 (J)	1.7 (J)	0.9 (J)	2.9 (J)	1.4 (J)	4.0 (J)	1.3 (J)	< 4.0	1.1 (J)	3.5 (J)	< 4.0	< 4.0	< 4.0	1.0 (J)	0.8 (J)	< 4.0	50 [2]
Copper	< 10	< 10	< 10	3.1 (J)	< 10	< 10	< 10	2.2 (J)	< 10	< 10	2.6 (J)	3.2 (J)	< 10	< 10	< 10	< 10	< 10	< 10	200
Iron	5,000	5,000	5,000	320	700	5,600	610	640	1,400	730	1,000	< 50	2,000	1,200	1,500	590	1,500	46 (J)	300
Magnesium	10,100	10,100	10,100	17,500	28,100	39,300	42,600	31,600	55,700	154,000	72,600	37,800	79,900	72,100	70,600	34,100	80,900	41,000	35,000 [1]
Manganese	4,800	4,800	4,800	24	340	1,100	570	3,100	560	190	77	340	55	55	57	390	120	57	300
Nickel	1.5 (J)	1.5 (J)	1.5 (J)	2.6 (J)	3.0 (J)	3.1 (J)	2.6 (J)	6.2 (J)	1.9 (J)	< 10	3.0 (J)	2.4 (J)	2.3 (J)	2.1 (J)	2.1 (J)	2.7 (J)	2.4 (J)	2.1 (J)	100
Potassium	5,500	5,500	5,500	4300	5,400	17,800	4,900	10,100	3,200	4,700	1,800	9,100	3,500	5,900	6,300	21,100	11	6,700	N/A
Sodium	17,300	17,300	17,300	122,000	305,000	35,500	39,100	65,400	101,000	348,000	17,800	36,400	31,000	37,400	41,300	18,600	69,100	5,900	20,000
Vanadium	3.9 (J)	3.9 (J)	3.9 (J)	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	1.9 (J)	< 5.0	2.7 (J)	< 5.0	< 5.0	< 5.0	1.6 (J)	1.6 (J)	1.7 (J)	< 5.0	50 [2]
Zinc	< 10	< 10	< 10	3.4 (J)	1.9 (J)	1.7 (J)	3.1 (J)	< 10	2.9 (J)	< 10	2.7 (J)	< 10	< 10	< 10	< 10	5.6 (J)	2.4 (J)	1.5 (J)	2,000
EPA 6010B Totals	**104,074**	**104,074**	**104,074**	**242,137**	**461,836**	**225,410**	**229,047**	**314,161**	**363,980**	**789,014**	**186,331**	**205,666**	**238,770**	**223,837**	**223,938**	**151,622**	**289,417**	**99,773**	-
RSK - 175 (results reported in ppb)																			
Ethane	< 7.5	< 7.5	< 7.5	< 7.5	< 7.5	< 7.5	< 7.5	< 7.5	< 7.5	< 7.5	< 7.5	62	< 7.5	< 7.5	< 7.5	< 7.5	< 7.5	< 7.5	N/A
Ethene	< 7.0	< 7.0	< 7.0	< 7.0	< 7.0	<7.0	< 7.0	< 7.0	< 7.0	< 7.0	< 7.0	38	< 7.0	< 7.0	< 7.0	< 7.0	< 7.0	< 7.0	N/A
Methane	270	270	270	76	220	400	150	120	6.5	< 4.0	56	1,700	40	120	110	< 4.0	41	< 4.0	N/A
EPA RSK-175 Totals	**270**	**270**	**270**	**76**	**220**	**400**	**150**	**120**	**6.5**	< 4.0	**56**	**1,800**	**40**	**120**	**110**	< 4.0	**41**	< 4.0	-
EPA Method 310.2 (results reported in parts per million (ppm))																			
Total Alkalinity	142	142	142	247	373 (B)	484	425	299	430 (B)	389 (B)	377	414 (B)	292	435	420	291	562	282	N/A
EPA Method 9060 (results reported in ppm)																			
Total Organic Carbon	6.3	6.3	6.3	3.5	3.0	2.9	2.3	2.4	1.4	1.0 (J)	1.0	2.3	1.8	1.2	1.1	1.0 (J)	0.6 (J)	< 1.0	N/A
ASTM Method D-516-90, 02 (results reported in ppm)																			
Sulfate	31	31	31	88 (B)	236 (B)	56 (B)	55 (B)	71 (B)	98	61 (B)	41	51 (B)	53	49	71	75	33	51	250 [1]
EPA 353.2 (results reported in ppm)																			
Nitrate as N	0.7	NA	NA	0.6 (H)	0.4 (J)	< 0.05	< 0.05	0.4	< 0.05	< 0.05	0.02 (J)	0.3	< 0.05	0.05	< 0.05	< 0.05	< 0.05	0.15	10,000 [2]

(J) = Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
(B) = Compound was found in the blank and sample.
(H) = Sample was prepped or analyzed beyond the specified holding time
[1] - Standards listed in T.O.G.S. 1.1.1
[2] - Standards dervied from NYCRR part 702.15
N/A - Non Applicable

TABLE 5 - Soil Analytical Summary Table
October 2, 2012
Jack's Dry Cleaners
Brewerton, NY

				Sample Location							
				AZ-SB-1 7.0' - 12.0'		**AZ-SB-1** 15.0' - 16.7'		**AZ-SB-2** 7.0' - 12.0'		**AZ-SB-2** 15.0' - 18.7'	
		Parameter	**PID**	14.3 - 33.4 ppm		22.4 - 23.1 ppm		0.8 - 1.2 ppm		27.3 - 28.8 ppm	
		Loyd Kahn Method									
		Total Organic Carbon (ppm)	-	1,780		4,740		ND		2,510	
		Percent Solids	-	88%		91%		78%		79%	
		D422 - Grain Size									
		-		*	**	*	**	*	**	*	**
GRAVEL	Coarse	Seive Size 3 inch - Percent Finer	-	100%		100%		100%		100%	
		Seive Size 2 inch - Percent Finer	-	100%		100%		100%		100%	
		Seive Size 1.5 inch - Percent Finer	-	100%		100%		100%		100%	
		Seive Size 1 inch - Percent Finer	-	100%		100%		100%		100%	
	Medium	Seive Size 0.75 inch - Percent Finer	-	100%	Gravel 12.6%	85.6%	Gravel 28.5%	100%	Gravel 0.0%	100%	Gravel 28.6%
		Seive Size 0.375 inch - Percent Finer	-	94.7%		80.4%		100%		84.0%	
	Fine	Seive #4 - Percent Finer	-	87.4%		71.5%		100%		71.4%	
		Seive #10- Percent Finer	-	77.6%		62.6%		100%		60.6%	
SAND	Coarse	Seive #20 - Percent Finer	-	71.3%		57.1%		100%		51.6%	
	Medium	Seive #40 - Percent Finer	-	67.1%		53.2%		99.8%		46.3%	
		Seive #60 - Percent Finer	-	61.6%		49.1%		99.4%		41.9%	
	Fine	Seive #80- Percent Finer	-	56.2%	Sand 46.9%	45.1%	Sand 38.8%	99.1%	Sand 2.1%	38.7%	Sand 41.9%
		Seive #100 - Percent Finer	-	52.1%		42.0%		98.9%		36.4%	
		Seive #200 - Percent Finer	-	40.5%		32.7%		97.9%		29.5%	
SILT		Hydrometer Reading 1	-	27.9%		20.6%		92.9%		23.0%	
		Hydrometer Reading 1 - Particle Size	-	31.2 µm		30.3 µm		26.9 µm		29.9 µm	
		Hydrometer Reading 2	-	24.6%		18.1%		81.3%		20.3%	
		Hydrometer Reading 2 - Particle Size	-	20.2 µm		19.8 µm		18.0 µm		19.5 µm	
		Hydrometer Reading 3	-	22.9%		15.5%		69.8%		15.9%	
		Hydrometer Reading 3 - Particle Size	-	11.8 µm	Silt 26.6%	11.8 µm	Silt 20.8%	10.9 µm	Silt 47.9%	11.8 µm	Silt 18.5%
		Hydrometer Reading 4	-	17.9%		13.0%		59.9%		13.2%	
		Hydrometer Reading 4 - Particle Size	-	8.5 µm		8.5 µm		8.2 µm		8.7 µm	
		Hydrometer Reading 5	-	15.3%		11.9%		50.0%		11.0%	
		Hydrometer Reading 5 - Particle Size	-	6.4 µm		6.2 µm		6.0 µm		6.1 µm	
Clay		Hydrometer Reading 6	-	9.4%		7.8%		36.8%		6.2%	
		Hydrometer Reading 6 - Particle Size	-	3.3 µm		3.1 µm		3.0 µm		3.2 µm	
		Hydrometer Reading 7	-	6.9%	Clay 15.3%	5.3%	Clay 11.9%	26.9%	Clay 50.0%	4.0%	Clay 11.0%
		Hydrometer Reading 7 - Particle Size	-	1.4 µm		1.3 µm		1.3 µm		1.4 µm	

Soil Samples collected on 10.2.12
All PID results are reported in parts per million (ppm)
ND = Not Detected (<PQL).
µm = Micrometers

PID = Photo-Ionization Detector
ppm = parts per million
VOC's measured by PID calibrated to Vinyl Chloride standards

*- Percentage passing seive

**- Percentage found in sample

TABLE 7

Criteria For Measuring Natural Attenuation within Chlorinated Solvent Plumes[1]
Jack's Dry Cleaners
NYS Route 11,Brewerton, NY

Analysis	Concentration in Most Contaminated Zone	Interpretation	Value	MW-2		MW-13		MW-16BR	
				Concentration	Value	Concentration	Value	Concentration	Value
Nitrate	< 1.0 ppm	At higher concentrations may compete with reductive pathway	2	0.6 ppm	2	0.3 ppm	2	< 0.05 ppb	-
Sulfate	< 20 ppm	At higher concentrations may compete with reductive pathway	2	88 ppm	-	51 ppm	-	33 ppm	-
	< 0.5 ppm	VC (vinyl chloride) oxidizes	0	76 ppb	0	1,700 ppb	-	41 ppb	0
Methane	> 0.5 ppm	Ultimate reductive daughter product, VC accumulates	3		-		3		-
	< 50 mV	Reductive pathway possible	1	130 mV	-	70 mV	-	62 mV	-
ORP	< -100 mV	Reductive pathway likely	2		-		-		-
	5 < pH < 9	Optimal range for reductive pathway	0	7.51	0	7.09	0	7.51	0
pH	5> pH > 9	Outside optimal range for reductive pathway	-2		-		-		-
TOC	> 20 ppm	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	2	3.5 ppm	-	2.3 ppm	-	0.6 ppm	-
Temperature	> 20˚C	At T > 20˚C biochemical process is accelerated	1	20.02 ˚C	1	19.68 ˚C	-	14.22	-
Alkalinity	>2x background**	Results from interaction between CO_2 and aquifer minerals	1	247 ppm	-	414 ppm	-	562 ppm	-
BTEX	> 0.1 ppm	Carbon and energy source; derives dechlorination	2	0.0 ppb	-	0.8 ppb	-	3.1 ppb	-
Tetrachloroethene	Y/N	Material released	0	50 ppb	0	10,000 ppb	-	520 ppb	
	Y/N	Material released	0	-	-	-	-	-	-
Trichloroethene	Y/N	Daughter product of PCE	2	6.1 ppb	2	2,000	2	< 1.0 ppb	-
	Y/N	Material released	0	-	-	-	-	-	-
Dichloroethene	Y/N	Daughter product of TCE	2	7.4 ppb	2	< 1.0 ppb	-	180 ppb	2
	Y/N	Material released	0	-	-	-	-	-	-
Vinyl Chloride	Y/N	Daughter product of DCE	2	1.1 ppb	2	270 ppb	2	23 ppb	2
1,1,1-Trichloroethane	Y/N	Material released	0	-	-	-	-	-	-
Chloroethane	Y/N	Daughter product of DCA or VC under reducing conditions	2	< 1.0 ppb	-	21 ppb	2	< 1.0 ppb	-
Ethene	> 0.01 ppm	Daughter product of VC/ethene	2	< 7.0 ppb	-	38 ppb	2	< 7.0 ppb	-
Ethane	< 0.1 ppm	Daughter product of VC/ethene	3	< 7.5 ppb	-	62 ppb	2	< 7.5 ppb	-
	Y/N	Material released	0	-	-	-		-	-
Chloroform	Y/N	Daughter product of Carbon Tetrachloride	2	0.4 ppb	2	< 1.0 ppb	-	< 1.0 ppb	-
				Value Total	**11**	Value Total	**15**	Value Total	**4**

** Background derived from Total Alkalinity at MW-17 (282 ppm)
- = Non applicable

1 - EPA Guidance Document "Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater " - Dated Septemeber, 1998

APPENDIX D

Boring Logs

MONITORING WELL / BORING NO. AZSB-1

Site Name: Jacks Dry Cleaners | Date Drilled: October 2nd, 2012

Location: Brewerton NY | Drilling Co.: Aztech Technologies Inc.

Client: NYSDEC | Driller: Ray Hammond / John Stutzke

Phone No.: 518 885 5383 | Logged by: Brian Baulsir

Drilling Method: Direct Push (Dia): 2.25" | Sampling Method: Macro Core (Dia): 2"

Drilled TD: 16.7 feet below grade (Dia): 2.25" | Sampled TD: 16.7 feet below grade (Dia): 2"

Well TD: NA (Dia): NA | Well Type: NA

Screen Interval: NA | Slot Size: NA | Diameter: NA

Cased Interval: NA | Type: NA | Diameter: NA

Sand Pack Interval: NA | Type: NA | Wellhead Prot: NA

Bentonite Seal Interval: NA | Type: NA | Grouted Interval: NA

Aztech Technologies, Inc.

EXPERTISE YOU CAN COUNT ON

5 McCrea Hill Road
Ballston Spa
New York 12020

Phone: 518-885-5383
Fax: 518-885-5385
www.aztechtech.com

KEY:

TD: Total Depth (ft.)

▼ Observed Water Table

LOCATION:

REFER TO FIGURE 3 (APPENDIX A)

Depth (Feet)	Monitoring Well Construction	Sample Recovery:	PID (ppm):	Description / Soil Classification
0				
2		88%	1.6	Brown fine SILT, with some fine Sand, trace organic matter, moist — 1.0'
4			13.1	Light brown fine SILT, with some fine Sand, trace clay and organic matter, moist — 4.5'
6	▼ Wet at 6.5' below grade	86%	24.3	Light brown fine SILT, with some Clay, trace organic matter, moist — 6.5'
8			14.3	Brown fine SILT and CLAY, with some Gravel, wet
10	No Monitoring Well Installed			11.0'
12		73%	33.4	Weathered Rock, dry — 11.5'
14			23.1	Brown fine SILT and CLAY, with some Gravel, wet — 13.5'
16		20%	22.4	Gray medium to coarse SAND, with some gravel, wet — 15.0'
18				Gray medium to coarse SAND, SILT, GRAVEL and CLAY, with some weathered Rock — 16.7'
20				Bedrock Refusal at 16.7 feet below grade
22				
24				
26				
28				

MONITORING WELL / BORING NO. AZSB-2

Site Name: Jacks Dry Cleaners | Date Drilled: October 2nd, 2012

Location: Brewerton NY | Drilling Co.: Aztech Technologies Inc.

Client: NYSDEC | Driller: Ray Hammond / John Stutzke

Phone No.: 518 885 5383 | Logged by: Brian Baulsir

Drilling Method: Direct Push (Dia): 2.25" | Sampling Method: Macro Core (Dia): 2"

Drilled TD: 18.7 feet below grade (Dia): 2.25" | Sampled TD: 18.7 feet below grade (Dia): 2"

Well TD: NA (Dia): NA | Well Type: NA

Screen Interval: NA | Slot Size: NA | Diameter: NA

Cased Interval: NA | Type: NA | Diameter: NA

Sand Pack Interval: NA | Type: NA | Wellhead Prot: NA

Bentonite Seal Interval: NA | Type: NA | Grouted Interval: NA

Aztech Technologies, Inc.

EXPERTISE YOU CAN COUNT ON

5 McCrea Hill Road
Ballston Spa
New York 12020

Phone: 518-885-5383
Fax: 518-885-5385
www.aztechtech.com

KEY:

TD: Total Depth (ft.)

▼ Observed Water Table

LOCATION:

REFER TO FIGURE 3 (APPENDIX A)

Depth (Feet)	Monitoring Well Construction	Sample Recovery:	PID (ppm):	Description / Soil Classification
0				
2	No Monitoring Well Installed	70%	0.6	Light brown fine Sand and SILT, with some Gravel, moist — 1.5'
				Asphalt — 2.0'
				Light brown fine Sand and SILT, with some Gravel, moist — 3.5'
4			1.4	Gray fine SAND and SILT, with some brick, ash and glass, moist
6		100%	1.2	— 6.0'
	▼ Wet at 8' below grade			Brown SILT, trace clay, moist — 8.0'
8			0.8	Brown CLAY, With some Silt, Wet @ 8'
10				
12		80%	18.4	— 12.5'
				Brown fine to coarse SAND, trace silt, Wet — 13.5'
14			11.2	Dark brown fine to coarse SAND and GRAVEL, with some Silt and Clay, Wet
16		58%	27.3	
18			28.8	— 17.5'
				Gray fine to coarse SAND and GRAVEL, with some Silt and Clay, Wet — 18.7'
20				Bedrock Refusal at 18.7 feet below grade
22				
24				
26				
28				

2340 Stock Creek Blvd.
Rockford, TN 37853-3044
Phone: 865.573.8188
Fax: 865.573.8133
Web: www.microbe.com

SITE LOGIC Report

Comprehensive Report

Contact: Brian Baulsir
Address: Aztech Technologies – Balliston Spa
5 McCrea Hill Road
Balliston Spa, NY, 12020

Phone: (518) 855.5383

Email: bbaulsir@aztechtech.com

MI Identifier: 080JK

Report Date: December 13, 2012

Project: Jack's Dry Cleaners; NYSDEL Site# (734112)

Comments:

Executive Summary

Bio-Trap® samplers were deployed in select monitoring wells at the Jack's Dry Cleaners property on October 22, 2012. Following a 35 day deployment period, all Bio-Traps were recovered for CENSUS® quantification of *Dehalococcoides*, *Dehalobacter*, and *Desulfuromonas* spp. to assess the potential for reductive dechlorination of tetrachloroethene (PCE) and trichloroethene (TCE). Analytical results including volatile organic compounds (VOCs), dissolved gases, and geochemical parameters for the September 2012 groundwater sampling event were provided. Summaries of the chemical, geochemical, and microbiological data are provided in Tables 1 and 2.

Overburden Wells (MW-5, MW-9, MW-7, MW-12, and MW-17)

- *Dehalococcoides* spp. were detected in only two of the overburden wells (MW-5 and MW-7) and only at concentrations near the quantification limit indicating that complete reductive dechlorination of PCE and TCE to ethene is unlikely under existing site conditions.
- Likewise, *Dehalobacter* spp. (MW-9 and MW-12) and *Desulfuromonas* spp. (MW-5) were also detected but at low concentrations suggesting the potential for partial reductive dechlorination of PCE and TCE to cis-DCE is limited under existing subsurface conditions.
- The CENSUS® results indicating only low populations of known halorespiring bacteria are consistent with the current groundwater monitoring results for geochemical conditions.
    - Although low, nitrate was detected in groundwater samples from three of the overburden monitoring wells.
    - The presence of nitrate along with limited production of manganese and dissolved iron suggest at most mildly reducing conditions not generally conducive to reductive dechlorination.
    - TOC concentrations are low suggesting that growth of halorespiring bacteria, consumption of competing electron acceptors, and generation of anaerobic conditions is hindered by low electron donor availability.
- While the subsurface conditions are not conducive to growth of halorespiring populations currently, the detection of cis-DCE at significant concentrations suggests that reductive dechlorination has occurred at least to some degree at the site previously.
- Although data is not available to examine historical subsurface conditions, the septic system that was present until 2009 likely provided additional organic materials that could have served as electron donors generating reducing conditions in the source zone and initially supporting reductive dechlorination.

Bedrock Wells (MW-13, MW-14BR, MW-15BR, and MW-17BR)

- Halorespiring bacteria including *Dehalococcoides*, *Dehalobacter*, and *Desulfuromonas* spp. were not detected in Bio-Traps deployed in the bedrock wells indicating that reductive dechlorination is unlikely under current conditions.
- Overall, geochemical parameters are similar to those of the overburden wells and indicate at most mildly reducing conditions.
- As with the overburden wells, cis-DCE and some vinyl chloride production particularly at MW-13 suggest that reductive dechlorination has occurred at the site previously.
- With the overburden and shallow bedrock groundwater as part of the same aquifer, the organic materials in the former septic system may have also stimulated partial reductive dechlorination in the shallow bedrock historically.
- Currently however, growth of halorespiring populations may be hindered by the presence of competing electron acceptors and low electron donor availability.

2340 Stock Creek Blvd.
Rockford, TN 37853-3044
Phone: 865.573.8188
Fax: 865.573.8133
www.microbe.com

Overall Considerations

- Taken as a whole, the available chemical, geochemical, and microbiological data suggest that reductive dechlorination is unlikely under monitored natural attenuation (MNA) conditions.
- The addition of electron donor could generate anaerobic conditions, promote growth of halorespiring bacteria, and stimulate reductive dechlorination.
- However, the low concentrations of halorespiring bacteria particularly in the bedrock wells suggest that bioaugmentation in addition to electron donor addition may need to be considered.
- A Bio-Trap® *In Situ* Microcosm study could be performed to compare biostimulation through electron donor addition and bioaugmentation as remediation options at the site.

2340 Stock Creek Blvd.
Rockford, TN 37853-3044
Phone: 865.573.8188
Fax: 865.573.8133
www.microbe.com

Results

Table 1.

Sample Information Overburden Wells	MW-5	MW-9	MW-7	MW-12	MW-17
Microbial Populations (cells/mL)					
Dehalococcoides spp.	**4.07E+01**	<2.50E+01	**7.25E+01**	<2.50E+01	<2.50E+01
tceA Reductase	<2.50E+01	<2.50E+01	<2.50E+01	<2.50E+01	<2.50E+01
bvcA Reductase	<2.50E+01	<2.50E+01	<2.50E+01	<2.50E+01	<2.50E+01
vcrA Reductase	<2.50E+01	<2.50E+01	<2.50E+01	<2.50E+01	<2.50E+01
Dehalobacter spp.	<1.50E+02	**5.20E+00 (J)**	<1.50E+02	**1.02E+00 (J)**	<1.50E+02
Desulfuromonas spp.	**1.04E+02**	<5.00E+01	<5.00E+01	<5.00E+01	<5.00E+01
Methanogens	**1.26E+05**	**1.24E+06**	**1.56E+06**	**1.09E+06**	**2.97E+06**
Contaminant of Concern (µg/L)					
PCE	**12**	**1,200**	ND	**1,400**	**1,200**
TCE	**3.2**	**320**	**200**	**220**	**320**
1,1-DCE	ND	**0.57 (J)**	ND	ND	**0.57 (J)**
cis-1,2 DCE	**2.3**	**290**	**280**	**400**	**290**
trans-1,2 DCE	ND	**6.6**	**6.7**	ND	**6.6**
Vinyl Chloride	ND	**18**	**14**	**29**	**18**
1,1,1-Trichloroethane	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	**28**	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND
Chloroethane	ND	**1.8**	**1.2**	ND	**1.8**
Dissolved Gases (µg/L)					
Ethene	ND	ND	ND	ND	ND
Ethane	ND	ND	ND	ND	ND
Methane	**220**	**150**	**120**	**56**	**150**
Anions (mg/L) and Geochemistry					
Nitrate as N	**0.037 (J)**	ND	**0.4**	**0.02 (J)**	ND
Manganese	**0.34**	**0.57**	**3.1**	**0.077**	**0.57**
Iron	**0.7**	**0.61**	**0.64**	**1.0**	**0.61**
Sulfate	ND	**54.5**	**71.3**	**41.4**	**54.5**
Methane (ug/L)	ND	**150**	**120**	**56**	**150**
TOC (mg/L)	**3.0**	**2.3**	**2.4**	**1.0**	**2.3**

J - Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
ND - Not detected at the reporting limit.

Table 2.

2340 Stock Creek Blvd.
Rockford, TN 37853-3044
Phone: 865.573.8188
Fax: 865.573.8133
www.microbe.com

Sample Information Bedrock Wells	MW-13	MW-14BR	MW-15BR	MW-17BR
Microbial Populations (cells/mL)				
Dehalococcoides spp.	<2.50E+01	<2.50E+01	<2.50E+01	<2.50E+01
tceA Reductase	<2.50E+01	<2.50E+01	<2.50E+01	<2.50E+01
bvcA Reductase	<2.50E+01	<2.50E+01	<2.50E+01	<2.50E+01
vcrA Reductase	<2.50E+01	<2.50E+01	<2.50E+01	<2.50E+01
Dehalobacter spp.	<1.50E+02	<1.50E+02	<1.50E+02	<1.50E+02
Desulfuromonas spp.	<5.00E+01	<5.00E+01	<5.00E+01	<5.00E+01
Methanogens	**8.30E+05**	**7.47E+05**	**5.67E+05**	**1.44E+06**
Contaminant of Concern (µg/L)				
PCE	**10,000**	**190**	**78**	**15**
TCE	**2,000**	**63**	**9.3**	**1.4**
1,1-DCE	**8.0**	ND	ND	ND
cis-1,2 DCE	**3,000**	**100**	**6.5**	ND
trans-1,2 DCE	**51**	**1.7**	ND	ND
Vinyl Chloride	**270**	**16**	ND	ND
1,1,1-Trichloroethane	**1.7**	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
Chloroethane	**21**	ND	ND	ND
Dissolved Gases (µg/L)				
Ethene	**38**	ND	ND	ND
Ethane	**62**	ND	ND	ND
Methane	**1,700**	**120**	ND	ND
Anions (mg/L) and Geochemistry				
Nitrate as N	**0.33**	**0.051**	**0.26**	**0.15**
Manganese	**0.34**	**0.055**	**0.39**	**0.056**
Iron	ND	**1.2**	**0.59**	**0.046 (J)**
Sulfate	**51**	**49**	**75.2**	**51**
Methane (ug/L)	**1,700**	**120**	ND	ND
TOC (mg/L)	**2.3**	**1.2**	**0.99 (J)**	ND

J - Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
ND - Not detected at the reporting limit.

2340 Stock Creek Blvd.
Rockford, TN 37853-3044
Phone: 865.573.8188
Fax: 865.573.8133
www.microbe.com

Interpretation

The following discussion describes interpretation of results in general terms and is meant to serve as a guide.

Contaminant of Concern (COC) Concentrations: Under anaerobic conditions, some bacteria, most notable *Dehalococcoides* species, can use chlorinated ethenes as electron acceptors in a process called reductive dechlorination. The net result is the sequential dechlorination of PCE and TCE through daughter products DCE and vinyl chloride to ethene. In general, the production of reduced daughter products particularly ethene (See Dissolved Gases) suggests active reductive dechlorination.

Microbial Populations: CENSUS® analysis allows site managers to quantify targeted members of the microbial community deemed critical for site remediation. Total Eubacteria provides an index of the total bacterial biomass and is generally greater than 10^6 cells/bead in the absence of factors inhibiting microbial growth. While a number of bacterial cultures capable of utilizing PCE and TCE as growth supporting electron acceptors have been isolated[1-5], *Dehalococcoides* spp. may be the most important because they are the only bacterial group that has been isolated to date that is capable of complete reductive dechlorination of PCE to ethene[6]. In fact, the presence of *Dehalococcoides* spp. has been associated with the full dechlorination to ethene at sites across North America and Europe[7]. Thus, CENSUS® quantification of *Dehalococcoides* can be used to evaluate the likelihood of complete reductive dechlorination of PCE and TCE. The accumulation of the daughter products *cis*-DCE and vinyl chloride termed "DCE stall" is relatively common at PCE/TCE sites especially under MNA conditions. Accumulation of vinyl chloride, generally considered more carcinogenic than the parent compounds, is particularly problematic. CENSUS® quantification of vinyl chloride reductase genes (*bvc*A and *vcr*A) was developed to more definitively confirm the potential for biodegradation of vinyl chloride. Again, comparison of vinyl chloride reductase copies can be used to assess the efficacy of enhanced bioremediation approaches (biostimulation and bioaugmentation) to enhance populations of organisms specifically capable of reductive dechlorination of vinyl chloride.

Dissolved Gases: While ethene can volatilize, can be further metabolized, or be further reduced to ethane in some environments, greater concentrations of ethene generally indicate complete reductive dechlorination of PCE and TCE. In addition to quantifying the end products of reductive dechlorination, analysis of dissolved gases includes determination of dissolved methane. Combined with results of geochemical analysis, elevated methane concentrations are indicative of highly reducing conditions conducive to reductive dechlorination. However, methanogens also compete with dechlorinating bacteria including *Dehalococcoides* for available hydrogen.

Glossary

CENSUS: CENSUS is based on a technique called quantitative polymerase chain reaction (qPCR) whereby many copies of a specific gene are generated. As each gene copy is made, a fluorescent marker is released, measured, and used to quantify the number of target genes present in a sample.

2340 Stock Creek Blvd.
Rockford, TN 37853-3044
Phone: 865.573.8188
Fax: 865.573.8133
www.microbe.com

References

1. Gerritse, J., V. Renard, T. M. Pedro Gomes, P. A. Lawson, M. D. Collins, and J. C. Gottschal. 1996. "*Desulfitobacterium* sp. Strain PCE1, an anaerobic bacterium that can grow by reductive dechlorination of tetrachloroethene or ortho-chlorinated phenols." Archives of Microbiology 165(2): 132-140.

2. Gerritse, J., O. Drzyzga, G. Kloetstra, M. Keijmel, L. P. Wiersum, R. Hutson, M. D. Collins, and J. C. Gottschal. 1999. "Influence of different electron donors and acceptors on dehalorespiration of tetrachloroethene by *Desulfitobacterium frappieri* TCE1." Applied and Environmental Microbiology 65(12): 5212-5221.

3. Holliger, C., G. Schraa, A.J.M. Stams, and A.J.B. Zehnder. 1993. "A highly purified enrichment culture couples the reductive dechlorination of tetrachloroethene to growth." Applied and Environmental Microbiology 59 (9): 2991-2997.

4. Krumholz, L. R., R. Sharp, and S. S. Fishbain. 1996. "A freshwater anaerobe coupling acetate oxidation to tetrachloroethylene dehalogenation." Applied and Environmental Microbiology 62(11): 4108-4113.

5. Löffler, F.E., R.A. Sanford, and J.M. Tiedje. 1996. "Initial characterization of a reductive dehalogenase from *Desulfitobacterium chlororespirans* Co23." Applied and Environmental Microbiology 62(10): 3809–3813.

6. Maymó-Gatell, X., T. Anguish, and S.H. Zinder. 1999. "Reductive dechlorination of chlorinated ethenes and 1,2-dichloroethane by *Dehalococcoides ethenogenes* 195." Applied and Environmental Microbiology 65(7): 3108–3113.

7. Hendrickson, E.R., J. Payne, R.M. Young, M.G. Starr, M.P. Perry, S. Fahnestock, D.E. Ellis, and R.C. Eversole. 2002. "Molecular analysis of *Dehalococcoides* 16S ribosomal DNA from chloroethene-contaminated sites throughout North America and Europe." Applied and Environmental Microbiology 68(2): 485-495.

8. Maymo-Gatell, X. 1997. "*Dehalococcoides ethenogenes* Strain 195, A novel eubacterium that reductively dechlorinates tetrachloroethene (PCE) to ethene." Report No. AL/EQ-TR-1997-0029.

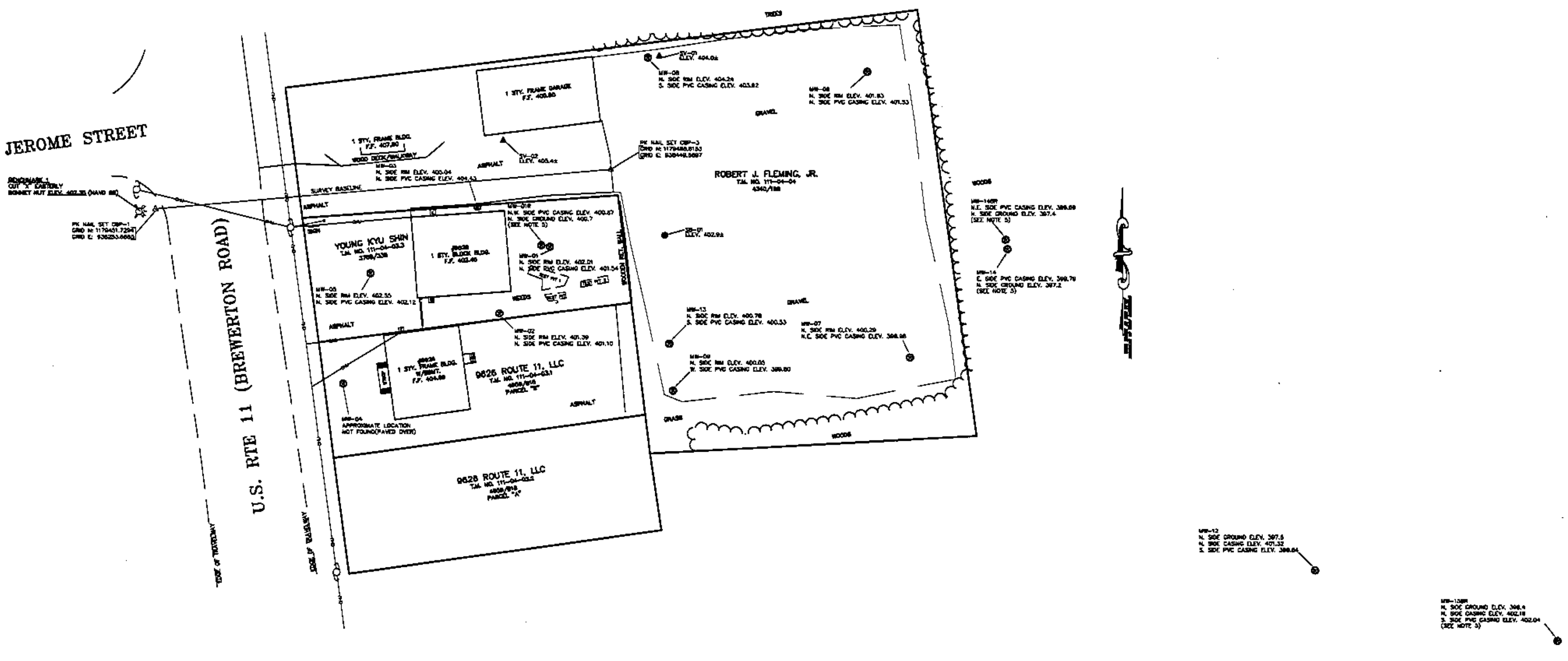
9. Gerritse et al. 1999. "Influence of different electron donors and acceptors on dehalorespiration of tetrachloroethene by *Desulfitobacterium frappieri* TCE1." Applied and Environmental Microbiology 65(12): 5212-5221.

10. Suyama et al. 2001. "Isolation and characterization of *Desulfitobacterium* sp. strain Y51 capable of efficient dehalogenation of tetrachlorethene and polychloroethanes." Bioscience Biotechnology and Biochemistry 65(7): 1474-1481.

2340 Stock Creek Blvd.
Rockford, TN 37853-3044
Phone: 865.573.8188
Fax: 865.573.8133
www.microbe.com

Appendix E

Soil Boring and Monitoring Well Construction Logs



NOTES:

1) STATE PLANE COORDINATES ARE NAD83(2007) NEW YORK STATE PLANE, CENTRAL ZONE, U.S. FOOT. ELEVATION DATUM IS NAVD 88.

2) REFER TO PRUDENT ENGINEERING LLP MAPS OF SURVEYS DATED MARCH 7, 2008 AND SEPTEMBER 14, 2009 FOR ADDITIONAL INFORMATION.

3) THE PURPOSE OF THIS PLAN IS TO SHOW INFORMATION ON MW's 01R, 10BR, 14, 14BR, 15 & 15BR LOCATED MARCH 2, 2010. BENCHMARK 1 WAS USED FOR ELEVATION CONTROL. ALL OTHER DATA IS FOR REFERENCE ONLY. SEE NOTE 2.

4) PVC CASINGS AT MONITOR WELLS 01R, 10BR, 14, 14BR, 15 & 15BR WERE MARKED WITH PAINT MARKS BY PRUDENT ENGINEERING LLP.

5) THE RIM AT MW 01R WAS NOT INSTALLED. THE METAL CASINGS AT MW's 10BR, 14 & 14BR WERE LOOSE AND HAD NOT BEEN CONCRETED. THE METAL CASINGS AT MW's 15 & 15BR WERE FIRM BUT HAD NOT BEEN CONCRETED.

6) PROPERTY LINES ARE APPROXIMATE AND ARE SHOWN FOR REFERENCE ONLY.

LEGEND

3708/338 DEED BOOK / PAGE
FIRE HYDRANT
GAS METER
ELECTRIC METER
UTILITY POLE

GRAPHIC SCALE

(IN FEET)
1 inch = 20 ft.

MAP OF SURVEY
TOPOGRAPHIC SURVEY
PART OF M.L. 10
TOWN OF CICERO
ONONDAGA COUNTY NEW YORK

PROJECT No.	SHEET No.	DATE	SCALE
109.001	1 OF 1	MARCH 2, 2010	1" = 20'

REVISIONS

PRUDENT ENGINEERING LLP

EA Engineering, P.C.

EA Science and Technology

LOG OF SOIL BORING

Coordinates:
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Description:

Job. No.	Client:	Location:
14368.15	New York State Department of Environmental Conservation	Jack's Drycleaners
Drilling Method:	4 1/4" hollow stem augers	Soil Boring Number: MW-06
Sampling Method:	2" Macro Core by 4-ft length	Sheet 1 of 1

					Drilling	
Water Lev.					Start	Finish
Time					2/25/08 935	2/25/2008 1130

Surface Conditions: GRAVEL
Weather: Sunny
Temperature: 30-F

Blow Counts (140-lb)	Feet Drvn/Ft. Recvrd	Well Diagram	PID (ppb) HNu	Depth in Feet	USCS Log	
	2.5/4		0	0		0-2.5 Brown SILTY SAND with trace Limestone/Mudstone rock fragments. Tight, semi-cohesive. Moist
			0	1		
			0	2		
				3		
	3/4		0	4		4-4.5 Brown SILTY SAND with trace Limestone/Mudstone rock fragments. Perched Water
						4.5-5 Peat with wood. Top of native soil
			0	5		5-7 Brown and dark grey mottled SILTY CLAY. Tight, Cohesive. Moist
			0	6		
				7		
	4/4		0	8		8-10 Brown and dark grey mottled SILTY CLAY. Tight, Cohesive. Moist
			0	9		
			0	10		10-12 Brown and dark grey mottled SILTY CLAY with trace SAND. Tight, Cohesive. Moist
			0	11		
	3.5/4		0	12		12-15 Brown and dark grey mottled SILTY CLAY with trace SAND. Tight, Cohesive. Moist
			0	13		
			0	14		
			0	15		15-16 TILL. Light brown SANDY SILT with rock fragements (Shale, Limestone). Till material is saturated.
	2/4		0	16		16-18 TILL. Light grey SANDY SILT with Shale rock fragements. Wet, tight, non-cohesive.
			0	17		
				18		*well heaved while well. Bottom of well is 19.5, not 20-ft below ground surface
				19		
	1/1		0	20		20-21 TILL. Light grey SANDY SILT with Shale rock fragements. Wet, tight, non-cohesive. Refusal at 21-ft. SHALE bedrock

Logged by: Joe Von Uderitz Date: 25 February 2008

Drilling Contractor: Nothnagle Drilling, Inc. Driller: Steve Loranty

WELL SPECIFICATIONS:

Diam. of casing:	2'	Screen Interval:	9.5-19.5 0.01"	Sand pack:	7.5-21' #00N	Grout:	NA
BOH:	21'	Riser Interval:	0-9.5'	Bentonite:	0-7.5'	Cover:	Flushmount

SOIL SAMPLE COLLECTED YES / **NO**

Samples Collected for

Sample Depth:_____feet Sample Time:_____ Sample Date:_____

EA Engineering, P.C.

EA Science and Technology

LOG OF SOIL BORING

Coordinates:
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Description:

Job. No.	Client:	Location:
14368.15	New York State Department of Environmental Conservation	Jack's Drycleaners
Drilling Method:	4 1/4" hollow stem augers	Soil Boring Number: MW-07
Sampling Method:	2" Macro Core by 4-ft length	Sheet 1 of 1

					Drilling	
Water Lev.					Start	Finish
Time					2/25/08 1245	2/25/2008 1330

Surface Conditions: GRAVEL
Weather: Sunny
Temperature: 30-F

Blow Counts (140-lb)	Feet Drvn/Ft. Recvrd	Well Diagram	PID (ppb) HNu	Depth in Feet	USCS Log	
	3/4			0		0-1.5 Brown SILTY SAND with trace Limestone/Mudstone rock fragments. Tight, semi-cohesive. Moist
				1		
				2		1.5-3 Grey brown SANDY with trace SILT. Loose, non-cohesive. Moist
				3		3-3.1 Peat
	4/4			4		4-5 FILL. Light brown SANDY SILT with Shale rock fragments
				5		5-5.75 Peat. Top of Native soil
						5.75-6.5 Brown SANDY SILT. Tight, non-cohesive. Moist
				6		6.5-8 Light grey brown mottled SILTY CLAY with trace SAND. Tight, cohesive. Damp.
				7		
	4/4			8		8-9 Green brown SILTY CLAY. Tight, cohesive. Moist.
				9		9-12 Light grey, light brown mottled SILTY CLAY. Tight, Cohesive. Moist
				10		
				11		
	4/4			12		12-13 Green brown TILL
				13		13-15 Light brown SILTY CLAY. Tight, Cohesve. Wet at 13.5-ft
				14		
				15		15-16 Light grey SILTY CLAY. Tight, Cohesive. Wet
	3/3			16		16-17 Light grey SILTY CLAY. Tight, Cohesive. Wet
				17		17-19 Shale Rock Fragments with medium to fine SAND. Wet
				18		
				19		19-20.5 Shale Rock Fragments with medium to fine SAND. Wet
				20		20.5 Refusal. Weathered SHALE bedrock.

Logged by: Joe Von Uderitz Date: 25 February 2008

Drilling Contractor: Nothnagle Drilling, Inc. Driller: Steve Loranty

WELL SPECIFICATIONS:

Diam. of casing:	2"	Screen Interval:	9.5-19.5 0.01"	Sand pack:	7.5-20.5' #00N	Grout:	NA
BOH:	20.5'	Riser Interval:	0-9.5'	Bentonite:	0-7.5'	Cover:	Flushmount

SOIL SAMPLE COLLECTED YES / **NO**

Samples Collected for

Sample Depth:_____feet Sample Time:_____ Sample Date:_____

EA Engineering, P.C.

EA Science and Technology

LOG OF SOIL BORING

Coordinates:
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Description:

Job. No.	Client:		Location:
14368.15	New York State Department of Environmental Conservation		Jack's Drycleaners
Drilling Method:	4 1/4" hollow stem augers		Soil Boring Number: MW-08
Sampling Method:	2" Macro Core by 4-ft length		Sheet 1 of 1
			Drilling
Water Lev.			Start: 2/25/08 1330 / Finish: 2/25/2008 1540
Time			

Surface Conditions: GRAVEL
Weather: Sunny
Temperature: 30-F

Blow Counts (140-lb)	Feet Drvn/Ft. Recvrd	Well Diagram	PID (ppb) HNu	Depth in Feet	USCS Log	
	1.5-4		0	0		0-1.5 Limestone gravel and brown SAND. FILL
			0	1		
				2		
				3		
	2/4		0	4		4-4.5 Limestone gravel and brown SAND. FILL
						4.5-5 Black fine SANDY SILT. Tight, Cohesive (some PEAT)
			0	5		5-6 Brown SANDY SILT with Shale rock fragments. Tight, non-cohesive. Wet at 7-ft
				6		
				7		
	4/4		0	8		8-10 Brown SANDY SILT with Shale rock fragments. Tight, non-cohesive. Moist
			0	9		
			0	10		10-12 Light brown fine SANDY SILT. Tight, Semi-Cohesive. Wet at 11-ft
			0	11		
	2/2		0	12		12-14 TILL. Brown SANDY SILT and SHALE rock fragements. Wet
			0	13		
			0	14		14-15 TILL. Brown SANDY SILT and SHALE rock fragements. Wet
				15		Refusal at 15-ft Shale Bedrock.
				16		
				17		
				18		
				19		
				20		

Logged by: Joe Von Uderitz Date: 25 February 2008

Drilling Contractor: Nothnagle Drilling, Inc. Driller: Steve Loranty

WELL SPECIFICATIONS:

Diam. of casing:	2"	Screen Interval:	5-15' 0.01"	Sand pack:	3-15' #00N	Grout:	NA
BOH:	15'	Riser Interval:	0-5'	Bentonite:	0-3'	Cover:	Flushmount

SOIL SAMPLE COLLECTED YES / **NO**

Samples Collected for

Sample Depth:_____feet Sample Time:_____ Sample Date:_____

EA Engineering, P.C.

EA Science and Technology

LOG OF SOIL BORING

Coordinates:
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Description:

Job. No.	Client:	Location:
14368.15	New York State Department of Environmental Conservation	Jack's Drycleaners
Drilling Method:	4 1/4" hollow stem augers	Soil Boring Number: MW-09
Sampling Method:	2" Macro Core by 4-ft length	Sheet 1 of 1

					Drilling	
Water Lev.					Start	Finish
Time					2/26/08 700	2/26/2008 1000

Surface Conditions: GRAVEL
Weather: Snowy
Temperature: 25-F

Blow Counts (140-lb)	Feet Drvn/Ft. Recvrd	Well Diagram	PID (ppb) HNu	Depth in Feet	USCS Log	
	2/4		0	0		0-0.5 FILL. Gravel and SAND
						0.5-1.5 Light brown fine SAND with trace SILT. Tight, non-cohesive. Moist to wet
			0	1		
						1.5-2 PEAT
			0	2		
				3		
	4/4		0	4		4-4.5 Light brown fine SAND with trace SILT. Tight, non-cohesive. Moist to wet.
						4.5-8 Light brown grey Mottled SILTY CLAY. Tight, cohesive. Moist
			0	5		
			0	6		
			0	7		
	4/4		0	8		8-10.5 Light brown grey Mottled SILTY CLAY. Tight, cohesive. Moist
			0	9		
			0	10		
						10.5-11.5 Light brown grey Mottled SILTY CLAY with some fine SAND. Tight, Cohesive. Moist
			0	11		
						11.5-12 TILL. Brown SANDY SILT with SHALE rock fragments. Wet at 11.5-ft
	4/4		0	12		12-16 TILL. Brown SANDY SILT with SHALE rock fragments. Wet
			0	13		
			0	14		
			0	15		
	2.5.2.5		0	16		16-18 TILL. Brown SANDY SILT with SHALE rock fragments. Wet
			0	17		
			0	18		18-18.5 TILL. Grey SANDY SILT with SHALE rock fragements. Wet
				19		Refusal at 18.5-ft. SHALE Bedrock.
				20		

Logged by: Joe Von Uderitz Date: 26 February 2008

Drilling Contractor: Nothnagle Drilling, Inc. Driller: Steve Loranty

WELL SPECIFICATIONS:

Diam. of casing:	2"	Screen Interval:	8-18' 0.01"	Sand pack:	6-18.5' #00N	Grout:	NA
BOH:	18.5'	Riser Interval:	0-8'	Bentonite:	0-6'	Cover:	Flushmount

SOIL SAMPLE COLLECTED YES / **NO**

Samples Collected for

Sample Depth:_____feet Sample Time:_____ Sample Date:_____

EA Engineering, P.C.

EA Science and Technology

LOG OF SOIL BORING

Coordinates:
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Description:

Job. No.	Client:		Location:
14368.15		New York State Department of Environmental Conservation	Jack's Drycleaners
Drilling Method:		Geoprobe Hammer	Soil Boring Number: SB-01
Sampling Method:		2" Macro Core by 4-ft length	Sheet 1 of 1

Water Lev.					Drilling	
Time					Start	Finish
					2/26/08 700	2/26/2008 1000

Blow Counts (140-lb)	Feet Drvn/Ft. Recvrd	Well Diagram	PID (ppb) HNu	Depth in Feet	USCS Log	
			0	0		0-1 Gravel
			0	1		1-2 Brown medium SAND. Loose, non-cohesive. Dry
	3/4		0	2		2-3 FILL. Brown SAND and Gravel
				3		
			0	4		4-4.5 FILL. Brown SAND and Gravel
						4.5-5.25 PEAT
			0	5		
	2/4		0	6		5.25-6 Light brown SILTY CLAY. Tight, Cohesive. Moist
			0	7		
			0	8		8-9 TILL. Brown SANDY SILT with Shale Rock fragements. Trace CLAY. Moist
			0	9		9-12 TILL. Brown/green SANDY SILT with Shale rock fragments.
	4/4		0	10		
			0	11		
			0	12		12-16 TILL. Brown/green SANDY SILT with Shale rock fragments. Wet 12-15
			0	13		
	4/4		0	14		
			0	15		
			2	16		16-17.3 Blue grey TILL. SHALE rock fragments
			0	17		Refusal at 17.3-ft
	1.3/1.3		2	18		
				19		
				20		

Surface Conditions: GRAVEL
Weather: Snowy
Temperature: 25-F

Logged by: Joe Von Uderitz Date: 26 February 2008

Drilling Contractor: Nothnagle Drilling, Inc. Driller: Steve Loranty

WELL SPECIFICATIONS:

Diam. of casing: _____ Screen Interval: _____ Sand pack: _____ Grout: _____
BOH: _____ Riser Interval: _____ Bentonite: _____ Cover: _____

SOIL SAMPLE COLLECTED **YES** / NO
Samples Collected for

Sample Depth: 6 feet Sample Time: 1045 Sample Date: 2-26-08
Sample Depth: 17 feet Sample Time: 1100 Sample Date: 2-26-08

* Duplicate Sample collected from 17-ft interval.

EA Engineering, P.C.

EA Science and Technology

LOG OF SOIL BORING

Coordinates:
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Description:

Job. No.	Client:	Location:
14368.15	New York State Department of Environmental Conservation	Jack's Drycleaners
Drilling Method:	Geoprobe Hammer	Soil Boring Number: SV-01
Sampling Method:	2" Macro Core by 4-ft length	Sheet 1 of 1

					Drilling	
Water Lev.					Start	Finish
Time					2/26/08 1130	2/26/2008 1140

Surface Conditions: GRAVEL
Weather: Sunny
Temperature: 30-F

Blow Counts (140-lb)	Feet Drvn/Ft. Recvrd	Well Diagram	PID (ppb) HNu	Depth in Feet	USCS Log	
	4/4		0	0		0-0.5 Asphalt and Subbase
			0	1		0.5-4.5 Limestone gravel and brown SAND. FILL
				2		
				3		
	0.5/0.5		0	4		
			0	5		
				6		
				7		
				8		
				9		
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

Logged by: Joe Von Uderitz Date: 25 February 2008

Drilling Contractor: Nothnagle Drilling, Inc. Driller: Steve Loranty

WELL SPECIFICATIONS:

Diam. of casing:	1 /4"	Screen Interval:	4-4.5'	Sand pack:	3-4.5' #00N	Grout:	NA
BOH:	4.5'	Riser Interval:	0-4'	Bentonite:	0-3'	Cover:	NA

SOIL SAMPLE COLLECTED YES / **NO**

Samples Collected for

Sample Depth:_____feet Sample Time:_____ Sample Date:_____

EA Engineering, P.C.

EA Science and Technology

LOG OF SOIL BORING

Coordinates:
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Description:

Job. No.	Client:		Location:
14368.15		New York State Department of Environmental Conservation	Jack's Drycleaners
Drilling Method:		Geoprobe Hammer	Soil Boring Number: SV-02
Sampling Method:		2" Macro Core by 4-ft length	Sheet 1 of 1

Water Lev.					Drilling Start	Drilling Finish
Time					2/26/08 1145	2/26/2008 1155

Blow Counts (140-lb)	Feet Drvn/Ft. Recvrd	Well Diagram	PID (ppb) HNu	Depth in Feet		USCS Log	
					Surface Conditions:	GRAVEL	
					Weather:	Sunny	
					Temperature:	30-F	
			0	0	0-4.5	Limestone gravel and brown SAND. FILL	
	4/4		0	1			
				2			
				3			
	0.5/0.5		0	4			
			0	5			
				6			
				7			
				8			
				9			
				10			
				11			
				12			
				13			
				14			
				15			
				16			
				17			
				18			
				19			
				20			

Logged by: Joe Von Uderitz Date: 25 February 2008

Drilling Contractor: Nothnagle Drilling, Inc. Driller: Steve Loranty

WELL SPECIFICATIONS:

Diam. of casing:	1 /4"	Screen Interval:	4-4.5'	Sand pack:	3-4.5' #00N	Grout:	NA
BOH:	4.5'	Riser Interval:	0-4'	Bentonite:	0-3'	Cover:	NA

SOIL SAMPLE COLLECTED YES / **NO**

Samples Collected for

Sample Depth:_____feet Sample Time:_____ Sample Date:_____

EA Engineering, P.C.

EA Science and Technology

LOG OF SOIL BORING

Coordinates:
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Description:

Job. No.	Client:	Location:
14368.15	New York State Department of Environmental Conservation	Jack's Drycleaners
Drilling Method:	4 1/4" hollow stem augers	Soil Boring Number: MW-01R
Sampling Method:	NA	Sheet 1 of 1

Water Lev.					Drilling Start	Drilling Finish
Time					1/25/2010 900	1/25/2010 1215

Surface Conditions: Grass
Weather: Rain
Temperature: 55F

Blow Counts (140-lb)	Feet Drvn/Ft. Recvrd	Well Diagram	PID (ppb) HNu	Depth in Feet	USCS Log
				0	
				1	
				2	
				3	
				4	
				5	
				6	
				7	
				8	
				9	
				10	
				11	
				12	
				13	
				14	
				15	
				16	
				17	
				18	
				19	
				20	

0-19ft Straight Hollow Stem Auger to 19ft (bedrock refusal). Well is replacement of MW-01 which was removed during IRM activities (excavation) of former septic area.

Logged by: David Crandall Date: 1-25-10

Drilling Contractor: Paragon Environmental Driller: Stephen

WELL SPECIFICATIONS:

Diam. of casing:	2'	Screen Interval:	9-19' (0.01")	Sand pack:	7-19' (#0)	Grout:	NA
BOH:	19'	Riser Interval:	Surface - 9'	Bentonite:	Surface - 7'	Cover:	Flush Mount

SOIL SAMPLE COLLECTED YES / **NO**

EA Engineering, P.C.

EA Science and Technology

LOG OF SOIL BORING

Coordinates:
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Description:

Job. No.	Client:	Location:
14368.15	New York State Department of Environmental Conservation	Jack's Drycleaners
Drilling Method:	4 1/4" hollow stem augers	Soil Boring Number: MW-10
Sampling Method:	2" Split Sppon	Sheet 1 of 1

Water Lev.					Drilling Start	Drilling Finish
Time					8/24/09	8/24/2009

Surface Conditions: Grass
Weather: Cloudy
Temperature: 65F

Blow Counts (140-lb)	Feet Drvn/Ft. Recvrd	Well Diagram	PID (ppb) HNu	Depth in Feet	USCS Log	
				0		0-0.5 Grass and Organics
						0.5-2 Light Brown SILTY SAND. Loose, Non-Cohesive, Wet @2-ft
				1		
				2		
				3		
				4		
1	2/2		0	5	CL	5-7 Light Brown SILTY CLAY, Tight, Cohesive, Wet
1					CL	
1			0	6	CL	
1					CL	
				7		
				8		
				9		
1	1.5/2		0	10	CL	10-11.5 Brown SILTY CLAY with some Light Grey SILTY CLAY (Mottled). Tight, Cohesive, We
1					CL	
1			0	11	CL	
1					CL	
				12		
				13		
				14		
1	2/2		0	15	CL	15-15.5 Purple Grey CLAY. Tight, Cohesive, Wet.
1						15.5-16 Light Grey Weathered Rock (SHALE) some Gravel.
3			0	16		
5						
				17		
				18		
				19		
				20		

Logged by: Joe Von Uderitz Date: 8/24/09

Drilling Contractor: Paragon Environmental Driller: Robert Baldoze

WELL SPECIFICATIONS:

Diam. of casing:	2'	Screen Interval:	5.5-15.5 (0.01")	Sand pack:	3.5-15.5 (#0)	Grout:	NA
BOH:	15.5	Riser Interval:	0-5.5	Bentonite:	0-3.5	Cover:	Stickup

SOIL SAMPLE COLLECTED YES / **NO**

EA Engineering, P.C.

EA Science and Technology

LOG OF SOIL BORING

Coordinates:
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Description:

Job. No.	Client:	Location:
14368.15	New York State Department of Environmental Conservation	Jack's Drycleaners
Drilling Method:	4 1/4" hollow stem augers Roller Bit	Soil Boring Number: MW-10BR
Sampling Method:	NA	Sheet 1 of 1

Water Lev.					Drilling Start	Drilling Finish
Time					1/27/2010 1245	1/27/2010 1600

Surface Conditions: Grass/Brush
Weather: Clear/Overcast/Partly Sunny
Temperature: 30F

Blow Counts (140-lb)	Feet Drvn/Ft. Recvrd	Well Diagram	PID (ppb) HNu	Depth in Feet	USCS Log	
				0		0-20ft Hollow Stem Auger into weathered bedrock. No split spoon sampling completed in overburden soils
				13		13-ft Top of Bedrock
				20		20-30ft Roller bit utilized to drill through fractured bedrock. No signs of significant competent bedrock observed during drilling activities. Due to previous difficulty coring, no cores were collected during drilling (weather shale and clay previously clogged core barrels repeatedly during coring). Drilled to depth of 15ft into rock.
				28		Well set at 28ft - suspected buckling of fractured rock between 28 and 30 ft after removing roller bit

Logged by: David Crandall Date: 1-27-10

Drilling Contractor: Paragon Environmental Driller: Stephen

WELL SPECIFICATIONS:

Diam. of casing:	2'	Screen Interval:	18-28'	Sand pack:	16-28'(#0)	Grout:	NA
BOH:	28'	Riser Interval:	Surface - 18'	Bentonite:	Surface - 16'	Cover:	Stickup

SOIL SAMPLE COLLECTED YES / **NO**

EA Engineering, P.C.

EA Science and Technology

LOG OF SOIL BORING

Coordinates:
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Description:

Job. No.	Client:	Location:
14368.15	New York State Department of Environmental Conservation	Jack's Drycleaners
Drilling Method:	4 1/4" hollow stem augers	Soil Boring Number: MW-11
Sampling Method:	2" Split Spoon	Sheet 1 of 1

Water Lev.					Drilling Start	Drilling Finish
Time					8/24/09	8/24/2009

Blow Counts (140-lb)	Feet Drvn/Ft. Recvrd	Well Diagram	PID (ppb) HNu	Depth in Feet		USCS Log	
				0			Surface Conditions: Grass
							Weather: Cloudy
				1			Temperature: 65F
							0-0.5 Grass and Organics
				2			
				3			Wet @3'
				4			
1				5		CL	5-7 Light Brown/Blue Grey Mottled SILTY CLAY. Tight, Cohesive, Wet.
1	2/2		0			CL	
1				6		CL	
2			0			CL	
				7			
				8			
				9			
1				10		CL	10-12 Light Grey/Brown SILTY CLAY. Tight, Cohesive, Wet.
1	2/2		0			CL	
1				11		CL	
1			0			CL	
				12			
				13			
				14			
				15			
				16			
1				17		CL	17-18 Light Grey Fat CLAY. Tight, Cohesive, Wet.
1	2/2		0			SM	18-18.5 Light Grey/Red SANDY SILT.
3				18			18.5-19 Weathered SHALE.
4			0				
				19			
				20			

Logged by: Joe Von Uderitz Date: 8/24/09

Drilling Contractor: Paragon Environmental Driller: Robert Baldoze

WELL SPECIFICATIONS:

Diam. of casing:	2'	Screen Interval:	7.5-17.5 (0.01")	Sand pack:	5.5-18 (#0)	Grout:	NA
BOH:	18.0	Riser Interval:	0-7.5;	Bentonite:	0-5.5'	Cover:	Stickup

SOIL SAMPLE COLLECTED YES / **NO**

EA Engineering, P.C.

EA Science and Technology

LOG OF SOIL BORING

Coordinates:
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Description:

Job. No.	Client:	Location:
14368.15	New York State Department of Environmental Conservation	Jack's Drycleaners
Drilling Method:	4 1/4" hollow stem augers	Soil Boring Number: ~~MW-10~~ MW-12
Sampling Method:	2" Split Sppon	Sheet 1 of 1

Water Lev.					Drilling Start	Drilling Finish
Time					8/24/09	8/24/2009

Surface Conditions: Grass
Weather: Cloudy
Temperature: 65F

Blow Counts (140-lb)	Feet Drvn/Ft. Recvrd	Well Diagram	PID (ppb) HNu	Depth in Feet	USCS Log	
				0		0-0.5 Grass and Organics
				1		
				2		
				3		
				4		
1				5	CL	5-6 Light Brown SILTY CLAY. Tight, Cohesive, Wet with some Gravel
3	1/2		0		CL	
3				6		
3			0			
				7		
				8		
				9		
4				10	CL	10-11 Light brown Gray Tile (Shale and SILTY CLAY). Tight, Cohesive, Wet.
7	1/2		0		CL	
11				11	CL	
11			0		CL	
				12		
				13		
				14		
				15		15 Top of Rock (Auger Refusal)
				16		
				17		
				18		
				19		
				20		

Logged by: Joe Von Uderitz Date: 8/24/09

Drilling Contractor: Paragon Environmental Driller: Robert Baldoze

WELL SPECIFICATIONS:

Diam. of casing:	2'	Screen Interval:	4-14 (0.01")	Sand pack:	2-4 (#0)	Grout:	NA
BOH:	15.0	Riser Interval:	0-4'	Bentonite:	0-2'	Cover:	Stickup

SOIL SAMPLE COLLECTED YES / **NO**

EA Engineering, P.C.

EA Science and Technology

LOG OF SOIL BORING

Coordinates:
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Description:

Job. No.	Client:	Location:
14368.15	New York State Department of Environmental Conservation	Jack's Drycleaners
Drilling Method:	4 1/4" hollow stem augers	Soil Boring Number: MW-13
Sampling Method:	2" Split Sppon	Sheet 1 of 1

Water Lev.					Drilling Start	Drilling Finish
Time					8/24/09	8/24/2009

Surface Conditions: Grass
Weather: Cloudy
Temperature: 65F

Blow Counts (140-lb)	Feet Drvn/Ft. Recvrd	Well Diagram	PID (ppb) HNu	Depth in Feet	USCS Log	
	2/4		0	0		0-0.5 FILL. Gravel and SAND
						0.5-1.5 Light brown fine SAND with trace SILT. Tight, non-cohesive. Moist to wet
			0	1		
						1.5-2 PEAT
			0	2		
				3		
	4/4		0	4		4-4.5 Light brown fine SAND with trace SILT. Tight, non-cohesive. Moist to wet.
						4.5-8 Light brown grey Mottled SILTY CLAY. Tight, cohesive. Moist
			0	5		
			0	6		
			0	7		
	4/4		0	8		8-10.5 Light brown grey Mottled SILTY CLAY. Tight, cohesive. Moist
			0	9		
			0	10		
						10.5-11.5 Light brown grey Mottled SILTY CLAY with some fine SAND. Tight, Cohesive.
			0	11		Moist
						11.5-12 TILL. Brown SANDY SILT with SHALE rock fragments. Wet at 11.5-ft
	4/4		0	12		12-16 TILL. Brown SANDY SILT with SHALE rock fragments. Wet
			0	13		
			0	14		
			0	15		
			0	16		16-17 TILL. Brown SANDY SILT with SHALE rock fragments. Wet
			0	17		17.5-18 Grayish Red Dolomite
						18-18.5 Grey Shale
			0	18		18.5-19 Weathered Grey Shale
						RQD = 0% Very Poor
			0	19		19.5-24.5 Light Grey Shale
						Broken Shale 23-24'
			0	20		RQD = 8" / 60" (13%) Very Poor
			0	21		
			0	22		
			0	23		
			0	24		
						24.5-26.5 Gray Shale
			0	25		
			0	26		
						26.5-27 Light Gray CLAY
			0	27		27-29.5 Light Grey SHALE. 28-29.5 More broken (1" thick pieces)
						RQD = 12" / 60 (Poor)
			0	28		
				29		

Logged by: Joe Von Uderitz Date: 8/24/09

Drilling Contractor: Paragon Environmental Driller: Robert Baldoze

WELL SPECIFICATIONS:

Diam. of casing:	2'	Screen Interval:	19-29 (0.01")	Sand pack:	18.5-29 (#0)	Grout:	NA
BOH:	29.5	Riser Interval:	0-19'	Bentonite:	0-18.5	Cover:	Stickup

SOIL SAMPLE COLLECTED YES / **NO**

EA Engineering, P.C.

EA Science and Technology

LOG OF SOIL BORING

Coordinates:
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Description:

Job. No.	Client:	Location:
14368.15	New York State Department of Environmental Conservation	Jack's Drycleaners
Drilling Method:	4 1/4" hollow stem augers	Soil Boring Number: MW-14
Sampling Method:	2" Split Spoon	Sheet 1 of 1

Water Lev.					Drilling Start	Drilling Finish
Time					1/25/2010 1330	1/26/2010 1030

Surface Conditions: Grass
Weather: Cloudy
Temperature: 65F / 35 f

Blow Counts (140-lb)	Feet Drvn/Ft. Recvrd	Well Diagram	PID (ppb) HNu	Depth in Feet	USCS Log	
				0		0-2ft Top soil/Organics
				1		
				2		
				3		
				4		
1	2/2		0	5	CL-ML	5-6ft Brown silty clay (very dense, some placticity, cohesive, wet)
3					CL-ML	
3			0	6	CL-ML	
6					CL-ML	
				7		
				8		
				9		
2	2/1.5		0	10	CL-ML	10-12ft Brown silty clay (very dense, some placticity, cohesive, wet)
3					CL-ML	
3			0	11	CL-ML	
6					CL-ML	
				12		
				13		
				14		
2	2/1		0	15	CL-ML	15-17ft Brown silty clay (very dense, some placticity, cohesive, wet)
2					CL-ML	
1			0	16	CL-ML	
2					CL-ML	
				17		
				18		
				19		
8	2/1		0	20	CL-ML	20-21.5ft Brown silty clay (very dense, some placticity, cohesive, wet)
6					CL-ML	
12			0	21	CL-ML	
15						21.5-22ft Brown-gray silty slay with weathered shale fragments (wet stiff)
				22		
				23		
				24		
17	1/1		0	25		25-26ft Brown-gray silty slay with weathered shale fragments (wet stiff)
28						
				26		26ft Refusal - Competent Bedrock
				27		
				28		
				29		

Logged by: David Crandall Date: 1-26-10

Drilling Contractor: Paragon Environmental Driller: Stephen

WELL SPECIFICATIONS:

Diam. of casing:	2'	Screen Interval:	13-23' (0.01")	Sand pack:	11-23' (#0)	Grout:	NA
BOH:	23'	Riser Interval:	Surface - 13'	Bentonite:	9-11'	Cover:	Stickup

SOIL SAMPLE COLLECTED YES / **NO**

EA Engineering, P.C.

EA Science and Technology

LOG OF SOIL BORING

Coordinates:
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Description:

Job. No.	Client:	Location:
14368.15	New York State Department of Environmental Conservation	Jack's Drycleaners
Drilling Method:	4 1/4" hollow stem augers	Soil Boring Number: MW-14BR
Sampling Method:	NQ Cores	Sheet 1 of 2

Water Lev.					Drilling Start	Drilling Finish
Time					1/26/2010 1100	1/27/2010 1600

Surface Conditions: Grass
Weather: Cloudy
Temperature: 30F

Blow Counts (140-lb)	Feet Drvn/Ft. Recvrd	Well Diagram	PID (ppb) HNu	Depth in Feet	USCS Log	
				0		0-23ft Hollow Stem Auger into weathered bedrock. No split spoon sampling completed in overburden soils
				1		
				2		
				3		
				4		
				5		
				6		
				7		
				8		
				9		
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

Logged by: Joe Von Uderitz Date: 1-27-10

Drilling Contractor: Paragon Environmental Driller: Stephen

WELL SPECIFICATIONS:

Diam. of casing:	2'	Screen Interval:	28-38' (0.01")	Sand pack:	26-38' (#0)	Grout:	NA
BOH:	38'	Riser Interval:	Surface - 28'	Bentonite:	0-26'	Cover:	Stickup

SOIL SAMPLE COLLECTED YES / **NO**

EA Engineering, P.C.

EA Science and Technology

LOG OF SOIL BORING

Coordinates:
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Description:

Job. No.	Client:	Location:
14368.15	New York State Department of Environmental Conservation	Jack's Drycleaners
Drilling Method:	4 1/4" hollow stem augers	Soil Boring Number: MW-14BR
Sampling Method:	NQ Cores	Sheet 2 of 2

Water Lev.					Drilling Start	Drilling Finish
Time					1/26/2010 1100	1/27/2010 1600

Blow Counts (140-lb)	Feet Drvn/Ft. Recvrd	Well Diagram	PID (ppb) HNu	Depth in Feet	USCS Log	Surface Conditions: Grass Weather: Cloudy Temperature: 30F
				21		
				22		
				23		23-30ft Top of Bedrock. NQ Coring
						23.8ft Barrel Clog - Weathered shale and gray clay materials 0% RQD
				24		
						24.5/24.9ft Barrel Clogs - Weathered shale and gray clay materials 0% RQD
				25		25.1ft Barrel Clog Weathered shale and gray clay materials 0% RQD
						25.9ft Barrel Clog Weathered shale and gray clay materials 0% RQD
				26		26ft Set up roller bit and drilled to 29ft - believed to be into competent rock.
				27		
				28		
				29		29ft Shale
						29.5-30ft Weathered shale and gray clay materials 0% RQD
				30		30-38ft Roller bit to 38ft. No competent rock encountered during drilling activities
				31		
				32		
				33		
				34		
				35		
				36		
				37		
				38		
				39		
				40		
				41		

Logged by: Joe Von Uderitz Date: 1-27-10

Drilling Contractor: Paragon Environmental Driller: Stephen

WELL SPECIFICATIONS:

Diam. of casing:	2'	Screen Interval:	28-38' (0.01")	Sand pack:	26-38' (#0)	Grout:	NA
BOH:	38'	Riser Interval:	Surface - 28'	Bentonite:	0-26'	Cover:	Stickup

SOIL SAMPLE COLLECTED YES / **NO**

EA Engineering, P.C.

EA Science and Technology

LOG OF SOIL BORING

Coordinates:
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Description:

Job. No.	Client:	Location:
14368.15	New York State Department of Environmental Conservation	Jack's Drycleaners
Drilling Method:	4 1/4" hollow stem augers	Soil Boring Number: MW-15
Sampling Method:	2" Split Spoon	Sheet 1 of 1

Water Lev.					Drilling Start	Drilling Finish
Time					1/27/2010 1630	1/28/2010 1030

Surface Conditions: Grass/Brush
Weather: Clear/Light Snow
Temperature: 30F

Blow Counts (140-lb)	Feet Drvn/Ft. Recvrd	Well Diagram	PID (ppb) HNu	Depth in Feet	USCS Log	
				0		0-2ft Top soil/Organics
				1		
				2		
				3		
				4		
5				5	CL-ML	5-7ft Brown silty clay (very dense, some placticity, cohesive, moist)
6	2/2		0			
8				6		
11			0			
				7		
				8		
				9		
4				10	CL-ML	10-11.5ft Brown silty clay (very dense, some placticity, cohesive, moist to wet at 11ft)
7	2/1.5		0			
7				11		
14			0		CL-ML	11.5-12ft Brown sandy clay (dense, some placticity, cohesive, wet)
				12		
				13		
				14		
8				15	CL-ML	15-15.5ft Brown sandy clay (dense, some placticity, cohesive, wet)
12	2/2		0			15.5-17ft Brown-gray silty slay with weathered shale fragments (wet stiff)
19				16		Fall back into weathered material, well set at 15.5ft.
24			0			
				17		
				18		
				19		
				20		
				21		
				22		
				23		
				24		
				25		
				26		
				27		
				28		
				29		

Logged by: David Crandall Date: 1/28/10

Drilling Contractor: Paragon Environmental Driller: Stephen

WELL SPECIFICATIONS:

Diam. of casing:	2'	Screen Interval:	5.5-15.5' (0.01")	Sand pack:	3.5-15.5' (#0)	Grout:	NA
BOH:	15.5'	Riser Interval:	Surface - 5.5'	Bentonite:	Surface - 3.5'	Cover:	Stickup

SOIL SAMPLE COLLECTED YES / NO

EA Engineering, P.C.

EA Science and Technology

LOG OF SOIL BORING

Coordinates:
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Description:

Job. No.	Client:	Location:
14368.15	New York State Department of Environmental Conservation	Jack's Drycleaners
Drilling Method:	4 1/4" hollow stem augers	Soil Boring Number: MW-15BR
Sampling Method:	NA	Sheet 1 of 1

Water Lev.					Drilling Start	Drilling Finish
Time					1/28/2010 1045	1/28/2010 1600

Surface Conditions: Grass/Brush
Weather: Clear/Light to Heavy Snow
Temperature: 30F

Blow Counts (140-lb)	Feet Drvn/Ft. Recvrd	Well Diagram	PID (ppb) HNu	Depth in Feet	USCS Log	
				0		0-15ft Straight Hollow Stem Auger - no sampling (MW-15 overburden previously screened)
				1		
				2		
				3		
				4		
				5		
				6		6ft Obstruction at 6ft. Moved location to Northeast and restarted with H.S.A
				7		
				8		
				9		
				10		
				11		
				12		
				13		
				14		
				15		15-30ft Roller bit utilized to drill through fractured bedrock. No signs of significant competent bedrock observed during drilling activities. Due to previous difficulty coring, no cores were collected during drilling (weather shale and clay previously clogged core barrels repeatedly during coring). Drilled to depth of 15ft into rock.
				16		
				17		
				18		
				19		
				20		
				21		
				22		
				23		
				24		
				25		
				26		
				27		
				28		
				29		

Logged by: David Crandall Date: 1/28/2010

Drilling Contractor: Paragon Environmental Driller: Stephen

WELL SPECIFICATIONS:

Diam. of casing:	2'	Screen Interval:	20-30' (0.01")	Sand pack:	18-30' (#0)	Grout:	NA
BOH:	30'	Riser Interval:	Surface - 20'	Bentonite:	Surface - 18'	Cover:	Stickup

SOIL SAMPLE COLLECTED YES / NO