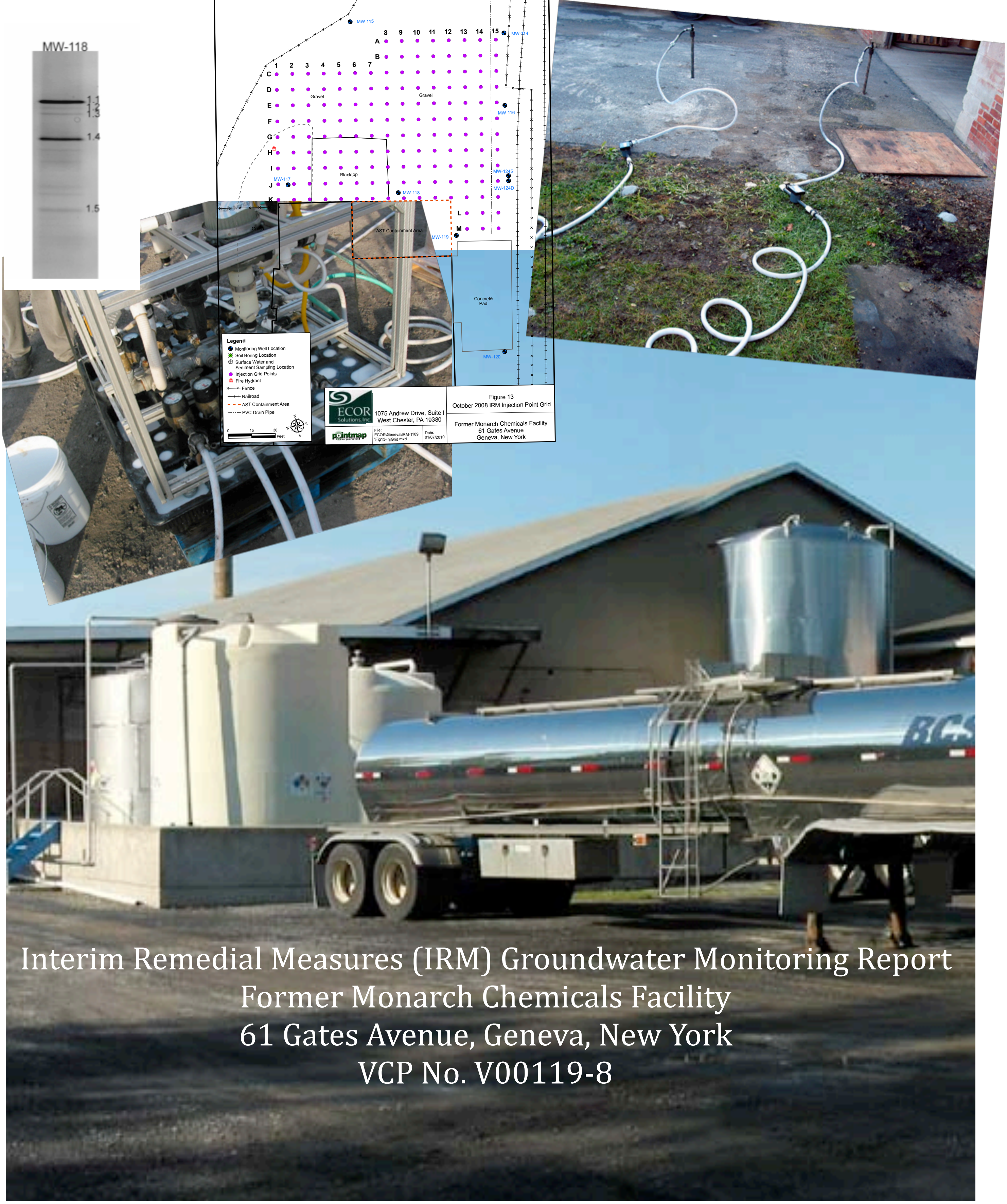

Interim Remedial Measures (IRM) Groundwater Monitoring Report
Former Monarch Chemicals Facility
61 Gates Avenue, Geneva, New York
VCP No. V00119-8

January 15, 2010

ECOR Solutions, Inc.
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1.0 INTRODUCTION

1.1 Purpose

ECOR Solutions, Inc. (ECOR), on behalf of the H.B. Fuller Company (H.B. Fuller) is submitting this *Interim Remedial Measures (IRM) Groundwater Monitoring Report* summarizing the field and monitoring activities completed since the IRM implementation at the Former Monarch Chemicals Facility (Site), located at 61 Gates Avenue in the city of Geneva, Ontario County, New York (Figure 1). The purpose of this report is to provide the New York State Department of Environmental Conservation (NYSDEC) with the corrective action and monitoring data collected in 2008 - 2009, including a summary of the injection program implemented under the NYSDEC approved *Enhanced Reductive Dechlorination In-Situ Bioremediation Interim Remedial Measures Workplan* (ECOR, May 20, 2008) for the Site. This report is prepared pursuant to the Voluntary Cleanup Agreement (VCA) between H.B. Fuller and NYSDEC, VCP No. V00119-8.

1.2 Site Description

The Site is defined as the parcel of real property consisting of approximately 1.7-acres located at 61 Gates Avenue in the City of Geneva, Ontario County, identified as Parcel 90.15-4-68 on the municipal tax maps. The Site is located within the city limits of Geneva, Ontario County, New York (latitude 042° 52' 54" N, longitude 076° 58' 52" W (latitude: 42.881999480, longitude: -76.981248880). The Site is industrially developed with a manufacturing plant occupying approximately 33,700 ft^2, accompanying loading and unloading areas, parking lots, and an above ground storage tank (AST) containment area. The Site exhibits the typical gently rolling glacial topography of the Finger Lakes region, the result of repeated glaciations, most recently during the Wisconsinan glacial period in the late Pleistocene epoch.

Access to the Site is on the south side, via Gates Avenue, which is contiguous along the southern property boundary (Figure 2). The Site is located in an industrial area of Geneva, north of Seneca Lake. Properties bordering the Site include a furniture manufacturer (CCN International) to the north, railroad tracks and easements of the Finger Lakes Railroad, an intermittent stream contained in a drainage ditch, adjacent vacant lots and residences to the east, and vacant manufacturing facilities and residential developments located to the south and west. Located south and southwest of the Site is the Market Basket brownfields property (B-00018-8) at the intersection of Gates Avenue and Lehigh Street.

1.3 Site Regulatory History

The property was developed around 1910 with the construction of part of the existing manufacturing plant, with further additions and improvements completed in the 1930s and 1950s. A boiler and circuit board manufacturer operated on the property until it was purchased in 1979 by Monarch Chemical Company (Monarch), a former operating division of H.B. Fuller. Monarch utilized the Site to manufacture food grade cleaners and sanitizers used in the dairy and related industries. In 1996, H.B. Fuller sold the property and business to HoltraChem Distribution Inc. HoltraChem continued to engage in similar production activities that were employed by Monarch, namely manufacturing related to products used by the dairy industry. In the late 1990s, HoltraChem was acquired by Basic Chemical Solutions (BCS), which now occupies the Site.

Information and aerial maps coupled with a Sanborn map from 1967 indicates the property was at one time occupied by Magnetic Components, Inc.,. Magnetic Components manufactured circuit boards and impregnated capacitors and associated board components in the northern portion of the manufacturing plant.

The current manufacturing plant occupies approximately 33,700 ft^2 of the Site, with corresponding exterior bulk liquid powder loading and unloading areas, parking and truck turnaround areas, and a railroad spur. Currently, BCS stores, mixes, and packages powdered and liquid cleaners and sanitizers on-site. The components of this operation include acids, caustics, sodium hypochlorite and surfactants. Bulk liquids are delivered by tanker truck, connected to piping located outside the east portion of the plant within a concrete secondary containment area. Additional raw materials are delivered via truck in drums and totes and unloaded at a dock along the southeast corner of the manufacturing building. The mixing tanks are connected via piping to the bulk loading area along the northeast portion of the manufacturing plant.

A series of phased environmental investigations began in May 1996, with a *Phase I Assessment* (ESC, May 1996), and continued into March 2006, with the submittal of the *Supplemental Remedial Investigation* (SRI), and the *Baseline Soil Vapor Intrusion Report* (Delta, June 12, 2007). Within these investigations on March 4, 2002, a Voluntary Cleanup Agreement (VCA) between H.B. Fuller and NYSDEC (VCP No. V00119-8), was executed concerning the volatile organic compounds (VOCs) detected in soil, groundwater, and air at the Site. These investigations determined the presence of petroleum hydrocarbons and chlorinated VOCs, including primary chemicals tetrachloroethene (PCE), trichloroethene (TCE), 1,1,1-trichloroethane (111TCA), and the degradation products 1,1-dichloroethene (11DCE), 1,1-dichloroethane (11DCA), cis-1,2-dichloroethene (cDCE), trans-1,2-dichloroethene (tDCE), vinyl chloride (VC), chloroform, and non-chlorinated VOCs including methyl ethyl ketone (MEK), methyl isobutyl ketone (MIBK), benzene, toluene, ethyl benzene, and xylene (BTEX) compounds. VOCs, the primary Site-related compounds of concern, are not used to manufacture food-grade cleaners and sanitizers used in the dairy and related industries. The VOC detected in soil and groundwater are remnant of previous manufacturing practices conducted on-site, and unrelated to H.B. Fuller or Monarch Chemical operations.

These investigations were followed by the *Heating Season Soil Vapor Intrusion Sampling Event* (ERM, May 2008). The 2007 and 2008 soil vapor intrusion (SVI) sampling detected concentrations of TCE and PCE in all indoor air samples, however, these did not exceed the NYSDOH Indoor Air Guidelines of 5 and 100 micrograms per cubic meter (ug/m^3), respectively. Carbon tetrachloride was detected in ambient air, indoor air and sub-slab samples. Similar to the March 2007 Baseline Sampling Event (Delta, June 12, 2007), carbon tetrachloride indoor air concentrations were higher than sub-slab carbon tetrachloride concentrations. Although carbon tetrachloride is not a Site-related compound of concern in soil and groundwater, an evaluation indicates that mitigation is not necessary and source identification/exposure reduction would be protective of human health.

Over the course of the investigation programs a substantial number of soil borings and monitoring wells have been installed and sampled on- and off-site to create a database of subsurface conditions sufficient to delineate source areas, groundwater flowpaths, and impacted media. At the conclusion of the 2006 investigation and sampling programs, H.B. Fuller and NYSDEC staff convened a remedial concept meeting to forecast the corrective action program for the Site. During this February 2, 2007, meeting the issue of further site investigation programs was addressed, and it was generally agreed to be unnecessary given the agreed upon approach for a large scale in-situ enhanced reductive dechlorination (ERD) program to address subsurface VOCs in soil and groundwater as an IRM. It was determined that sufficient data had been collected on the property related to H.B. Fuller activities, and that investigative activities could be considered complete (HB Fuller, personnel communication).

At the conclusion of this February 2007, meeting the decision on the sequence of events to be completed included an on-site SVI study to be conducted in cooperation with the New York State Department of Health (NYSDOH), the evaluation of light non-aqueous phase liquids (LNAPL) and dense non-aqueous phase liquids (DNAPL) around monitoring well MW-118, the installation of a monitoring well between MW-118 and MW-122 (Figure 2), the evaluation of the drainage ditch located east of the Site, and an evaluation of off-site groundwater impacts after access to the property east of the drainage ditch has been attained. In the interim, it was determined that in lieu of additional investigations an effective method to treat source area VOCs would be the implementation of an ERD IRM, and in accordance with this agreement, the following actions have been undertaken:

- H.B. Fuller submitted to NYSDEC and NYSDOH the *Heating Season Soil Vapor Intrusion Sampling Workplan* (ERM, January 4, 2008). The SVI sampling event was conducted January 30 - 31, 2008, with NYSDOH staff. The result of this investigation was submitted to NYSDEC and NYSDOH in the *Heating Season Soil Vapor Intrusion Sampling Event* (ERM, May 21, 2008).
- H.B. Fuller submitted to NYSDEC the *Enhanced Reductive Dechlorination In-Situ Bioremediation, Interim Remedial Measures Workplan, Former Monarch Chemicals Facility, 61 Gates Avenue, Geneva, New York*, (ECOR , December 7, 2007 [revised May 20, 2008]). The injection phase of the IRM was implemented October 9 - 21, 2008.
- H.B. Fuller submitted on June 6, 2008, the *Surface Water Sampling Program*.

- H.B. Fuller installed nested groundwater monitoring wells MW-124s and MW-124d on August 14-15, 2008, located approximately midway between MW-118 and MW-122. Soil and groundwater samples were collected and analyzed from this sampling event.
- H.B. Fuller advanced eight (8) soil borings near monitoring well MW-118 to evaluate subsurface soils for the presence of oil and NAPLs during the IRM injection program. The results and observations from all of the soil sampling were negative for oils and NAPLs, and will be discussed further in this report.
- H.B. Fuller monitored well MW-117 and MW-118 for LNAPL, DNAPL, and oils with observations made from collecting fluid samples in clear bailers. The results and observations from all of the bailer sampling were negative for LNAPL and DNAPL.
- Groundwater sampling events were completed in April, August, and November 2008, and again in April and August 2009.

The data collected from these activities are presented in this report, as noted in the following sections.

1.4 Summary of Monitoring and Reporting – January 1, 2008 – December 31, 2009

Groundwater monitoring, and other tasks completed or reported during 2008 - 2009, as reported herein, including:

- BioTrap™ sampler was installed in well MW-118 to determine various indicator parameters including biomass, genus\species identification, and metabolic acids in groundwater in the VOC source area. The analytical results of this sampling were reported to NYSDEC January 10, 2008, and are included in this report.
- The SVI heating season sampling was conducted at the Site January 30 – 31, 2008. The report summarizing this work was submitted to NYSDEC and NYSDOH in the *Heating Season Soil Vapor Intrusion Sampling Event*, dated May 21, 2008.
- The 2nd-Quarter 2008 Groundwater Sampling Event was conducted April 7 – 9, 2008. These results were summarized and reported to NYSDEC in the May 2008 Project Status Report (PSR).
- The *Surface Water Sampling Program*, was submitted to NYSDEC on June 6, 2008.
- The 3rd-Quarter 2008 Groundwater Sampling Event was conducted August 5 - 6, and August 18, 2008. These results were summarized and reported to NYSDEC in the October 2008 PSR.
- Groundwater monitoring wells MW-124s and MW-124d were installed August 14 - 15, 2008.
- Implementation of the work outlined in the *Enhanced Reductive Dechlorination In-Situ Bioremediation Interim Remedial Measures Workplan* (ECOR, May 20, 2008) between October 9 – 21, 2008. Soil borings BB1 through BB8 were installed to confirm lithology and evaluate LNAPL, DNAPL and oils. A summary of these activities are reported in this document.
- The 4th-Quarter 2008 Groundwater Sampling Event was conducted November 17 – 18, 2008. These results were reported to NYSDEC in the January 2009 PSR.

- Completion and submittal to NYSDEC of the *Off-Site Groundwater\Surface Water Investigation Plan* (ECOR, December 19, 2008).
- The 2nd-Quarter 2009 Groundwater Sampling Event was conducted April 27 – 29, 2009. These results were reported to NYSDEC in the June 2009 PSR.
- The 3rd-Quarter 2009 Groundwater Sampling Event was conducted August 3 – 4, 2009. This included sampling monitoring wells for VOCs and total organic carbon (TOC). These results were reported to NYSDEC in the September 2009 PSR.

1.5 Current Conditions and Site Conceptual Model

The Site is underlain by several unconsolidated units of varying composition and thickness. The subsurface sediments are typical of the gently undulating glacial topography in the Finger Lakes Region of upstate New York. The near surface sediments range between 0 and 4 feet bgs, consisting of a mixed fill (gravel to silt) material which extend across the Site. This fill layer is underlain by native silt and clays ranging in thickness from 0 to 8 feet thick. A sand and sandy loam underlies this unit and ranges from 2 to 10 feet thick. Each of these units is variable in composition, and interbedded laterally with other discontinuous layers, common of a deltaic or fluvio-lacustrine depositional environment. Beneath these granular sediments is a clay and silty clay unit encountered between 9 and 14 feet bgs. This lower confining unit is not continuous, and was not encountered in the upper 16 feet at MW-116 and MW-120, or at off-site locations. The monitoring well MW-124 nest was installed east of MW-118 to investigate and monitor groundwater and soil in this area downgradient of the source area (Figure 2).

Previous investigations identified concentrations of VOCs and petroleum hydrocarbons below the NYSDEC Technical and Administrative Guidance Memorandum (TAGM) #4046 soil cleanup objectives. VOC levels less than TAGM #4046 soil cleanup values were detected in most soil sampling locations (Table 2) in the near surface soils (between 0 and 4 feet bgs). Sampling trends show VOC concentrations generally decreased with depth, with the source area for chlorinated VOCs in soil at and near MW-118, and for BTEX compounds at and near MW-117 (Figure 2). The primary source area for VOCs in the surficial glacial soils is demonstrated in the following sequentially deeper isoconcentration maps starting with Figure 4, TVOC Concentrations in Soil (ug/Kg) - 460' - 456' AMSL Interval, which shows the VOC mass centered at MW-118. The next 5’ deeper interval is shown on Figure 5, TVOC Concentrations in Soil (ug/Kg) - 456' - 451' AMSL Interval indicating a reduction in VOC levels, which decrease further into the deepest interval as shown on Figure 6, TVOC Concentrations in Soil (ug/Kg) - 451' - 446' AMSL Interval. The low level VOCs detected at MW-117 consist largely of BTEX compounds, and have a distinct profile compared to the source area at MW-118.

Groundwater is found in the shallow unconfined sands and sandy clay units below the Site. The depth to groundwater generally follows the surface topography, typical of a shallow unconfined glacial sediments in this region. The area of greatest depth to groundwater is on the eastern portion of the property near the drainage ditch where the hydraulic gradient steepens near the channel. Groundwater flow is somewhat radially outward from the manufacturing plant, with a general easterly to northeasterly flow direction across the Site.

The initial groundwater monitoring wells installed in the mid- to late-1990s were abandoned (Figure 3) due to property considerations, but another set was later installed in 2005 and generally co-located with the earliest set of wells. It is this dataset of soil and groundwater characteristics that confirm the previously identified areas of saturated surficial glacial sediments which are impacted by VOCs. These profiles are consistent with the earliest data collected from the site, and presented graphically on various subsurface profiles noted along Figure 7, Cross Section Location Map A-A', B-B', C-C'. Figure 8 presents a time-independent compilation of the field monitoring results collected during drilling programs with a photoionization detectors (PID). This data confirms the source area identification shown on Figure 4 through Figure 6, namely source areas at MW-118 and MW-117, and groundwater impacts upgradient of the drainage ditch running along the eastern side of the Site. A reconstruction of the VOCs detected in soil from analytical samples is provided on Figure 9, TVOCs Detected in Soil (ug/Kg); Cross Section A-A' - July 2005, which provides consistent source area soil confirmation that H.B. Fuller related impacts are contained west of the drainage ditch, with a minor soil source area east of the drainage ditch at MW-123. The important differences between Figure 8 and Figure 9, namely on the east side of the drainage ditch at MW-123 is the screened interval is deeper, the sand sections are thicker and more uniform, and the lack of a deeper confining layer, which was also confirmed on the west side of the drainage ditch with the installation of the MW-124 nest in August 2009. The important circumstance here is that the contaminant transport and flowpaths west of the ditch are lessened east of the ditch due to the hydraulic barrier, reductive dechlorination, diffusion, natural attenuation, and the fact that the IRM has reduced the VOC levels in the groundwater flow system. The VOCs detected east of the drainage ditch at MW-123 indicate either 1) cross-contamination at the boring during drilling, and/or, 2) an off-site VOC source to the shallow surficial glacial sediments, unrelated to H.B. Fuller operations.

The corresponding evolution of the groundwater monitoring program is demonstrated in Figure 10, Total VOCs Detected in Groundwater - July 1997, which indicates shallow VOC impacts restricted to the area upgradient of the drainage ditch, as confirmed on Figure 11, Total VOCs Detected in Groundwater - February 1998. Essentially all monitoring events indicate the primary chlorinated solvents originate from the area near MW-118, as shown on Figure 12, Trichloroethene Detected in Groundwater - February 1998. This dataset of soil and groundwater profiles provided the basis for the development of the IRM, and shows the areas and depth intervals requiring treatment to be an effective corrective action alternative.

The Site monitoring program confirms the conceptual model which served as an important planning tool to navigate the appropriate regulatory programs. This regulatory process requires careful considerations are made concerning source areas, chemical compounds, and identifying fate and transport scenarios and completed exposure pathways for potential receptors.

A well defined site conceptual model demonstrates:

(1) the chemicals of concern;
(2) the sources areas & impacted media;
(3) the nature and extent of impacted media;
(4) the dominant fate and transport characteristics of the site;
(5) potential exposure pathways; and,
(6) potential receptors.

A review of the data and information regarding the Site indicates several items critical in developing the conceptual model, including:

1. There has been no DNAPL or LNAPL detected at this site. This has been the constant with each and every soil boring, visual observation, field monitoring event, bailer sampling, soil exposure monitoring with Sudan IV, and groundwater observation, conducted by every consultant and investigator on this project. Concentrations in soil and groundwater show evidence of VOCs adsorbed to soil, VOCs in soil vapor, and VOCs dissolved in groundwater. The extent of impacts in soil and groundwater indicate a small area of residual VOCs, primarily centered north of the manufacturing plant in the vicinity of MW-118. The VOC source area in soil is restricted, and shallow, less than 14 feet bgs.

2. The property has been adequately investigated and no further investigative activities are necessary to implement or monitor the approved IRM. This was verbally agreed with NYSDEC in February 2007.

3. VOC impacted groundwater extends downgradient from the source areas, and is largely confined between MW-117 and the adjacent drainage ditch to the east. Impacted groundwater is shallow, less than 15 feet bgs, however, groundwater impacts with VOCs have been detected to roughly 20 feet bgs at MW-124d.

4. Surface water impacts from groundwater seepage is seasonal, and minor.

5. Potential receptors to VOC impacted soil, other than through planned future subsurface construction activities, is extremely remote.

6. Beyond the existing manufacturing plant, there are no known potential receptors to soil vapor concentrations emanating from impacted soil or groundwater on the property. Continued monitoring at BCS suggests this may not appear to present a significant pathway or risk at this site, and that carbon tetrachloride appears to be completely anomalous as it has not been detected in soil or groundwater at the Site.

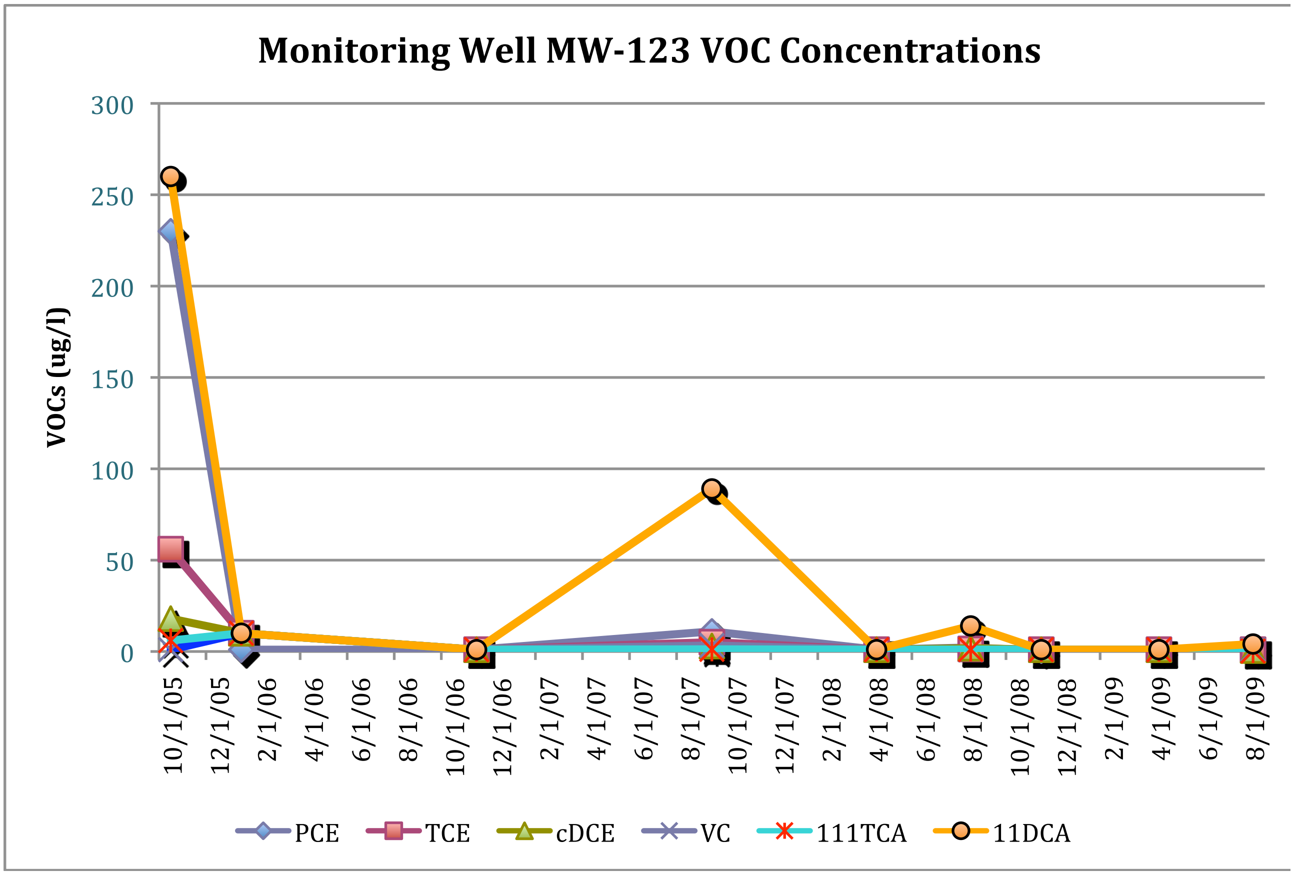
7. The primary exposure pathway is advective groundwater transport, potentially discharging low levels of VOCs to the adjacent drainage ditch. Exposure to VOC impacted groundwater, other than through planned subsurface construction activities, is extremely remote.

8. Natural attenuation is a functioning, albeit slow process, already active on-site.
9. There are no known potential receptors to VOCs in soil, vapor, or groundwater related to Monarch Chemicals operations.

Regulatory Consideration	**Completed**
Identifying chemicals of concern	Yes
Identifying sources areas & impacted media	Yes
Determining the nature and extent of impacted media	Yes
Determining dominant fate and transport characteristics	Yes
Identifying potential exposure pathways	Yes
Identifying potentially receptors	Yes

The current groundwater sampling program consists of a tri-annual sampling events, typically spring, summer and fall sampling. The dataset from the current set of monitoring wells comes from sampling events in October 2005, January and October 2006, September 2007, April, August, and November 2008, and again in April and August 2009. The sampling program utilizes low-flow groundwater sampling techniques, however, due to the rapid changes in potentiometric levels and insufficient saturated intervals in wells to collect groundwater samples with a bladder pump, wells MW-114, MW-116, MW-120, MW-121 and MW-122 are sometimes sampled with either a peristaltic pump or dedicated bailer. This response to droughty conditions has significant implications on contaminant transport and corrective action alternatives, including optimum injection conditions, depth intervals, pressures, and effective methods to implement the IRM and the subsequent monitoring program.

The hydrogeologic conditions suggest that functionally the IRM treats non-potable, geographically limited groundwater in glacial sediments subject to complete evapotranspiration dewatering. The historical groundwater monitoring program site-wide exhibits a decreasing trend of VOCs in groundwater (Appendix M). Off-site groundwater monitoring at MW-123 exhibits continued downward trends for all VOCs, as noted in the chart below.



A summary of the VOC trends in groundwater were provided in the *Enhanced Reductive Dechlorination In-Situ Bioremediation Interim Remedial Measures Workplan* (ECOR, May 20, 2008), and updated information is provided in this report. Based on VOC levels in the saturated subsurface soils and groundwater, there is not a large mass of chlorinated VOCs either in groundwater or sorbed onto the glacial sediments on-site. All site-wide soil sampling and continued groundwater monitoring does not indicate the presence of LNAPL or DNAPL, and based on this model, H.B. Fuller proposed to NYSDEC an IRM to address the existing impacted on-site soil and groundwater. The IRM was implemented in October 2008, and the initial results confirm the model described above.

2.0 IRM INJECTION PROGRAM

2.1 IRM Setup

The IRM injection program began with mobilization to the Site and set-up on October 7-8, with pre-injection water levels measured October 8, 2008. Determining the pre-injection water level conditions were important in determining the injection intervals to fit the hydrogeologic conditions observed in the field. Potentiometric data collected between August 2008, and early-October 2008, indicated that groundwater elevations dropped site-wide by an average of 1.8-feet, as noted in the table below.

Well	Change in water levels 8/15/08 to 10/8/08 (ft)
MW-114	-1.93
MW-115	-1.66
MW-116	-2.88
MW-117	-2.61
MW-118	-2.60
MW-119	-3.66
MW-120	-3.69
MW-121	-0.16
MW-122	-1.94
MW-123	-0.71
MW-124s	-0.69
MW-124d	0.49

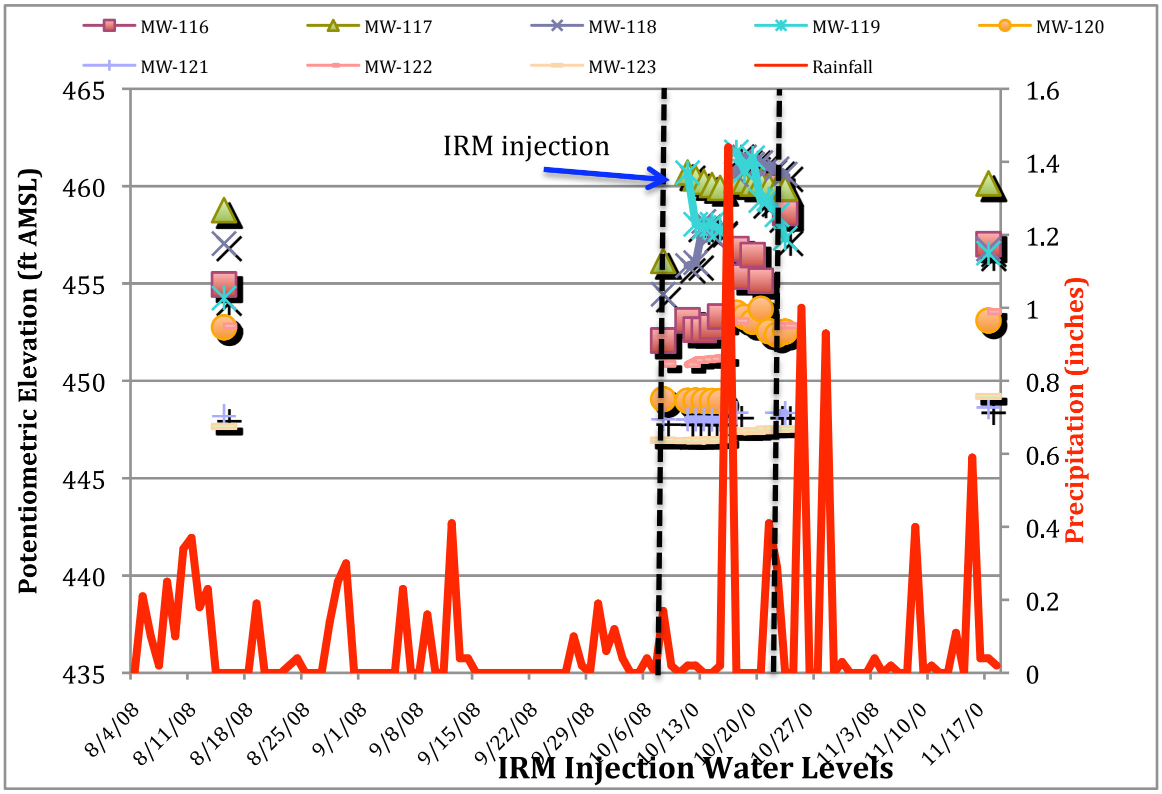
Establishing these conditions was important prior to initiating the IRM injection program as higher water table conditions were desirable to achieve maximum distribution of the ERD amendment, particularly in the shallow unsaturated soils near MW-118. Understanding this, the targeted depth intervals were set across the injection grid established for the IRM, as shown on Figure 13, October 2008 IRM Injection Point Grid. These locations show the grid established for the IRM injection for Newmans Zone (EVO) and Z-Loy zero valent iron (nZVI) amendments. The nomenclature of the injection points for the IRM are rows are identified alphabetically, A thru K (north to south), and columns are identified numerically 1 thru 15 (west to east).

The EVO used in the IRM was Newman Zone®, consisting of a non-anionic solution of stable, sub-micron droplets that are small and uniform in size containing fast- and slow-release electron donors. The EVO contains a proportion of sodium lactate in solution which is used to immediately stimulate microbial growth within hours of injection and rapidly produce anaerobic conditions at the injection site. As the sodium lactate is depleted by microbes, the slow fermentation of the vegetable oil provides a continuous supply of hydrogen and volatile fatty acids (VFAs) in the ERD zone. The hydrogen and VFAs support anaerobic microbial activity for an extended period of time, often years after injection. The soy oil is held in suspension as sub-micron droplets, which remains stable during injection (even under pressure), and does not degrade until the stabilizing additives (primarily surfactants) have been consumed by microbes. The EVO serves as a concentrated source of electron donors, with an electron equivalent dose for the lactate, soybean oil, and food grade additives over 175 electron equivalents per kilogram.

The nZVI injection used in the IRM was Z-Loy™, which is packaged as a concentrated non-aqueous suspension. The Z-Loy™ nZVI contains discrete, sub-micrometer and nano-crystalline particles as multi-particle aggregates of smaller nano-particles. The nZVI is comprised of discrete, irregular sub-micrometer particles with a median particle size of about 200 nm and a typical surface area of 15 m^2/g. The multi-particle material limits aggregation and allows for greater subsurface mobility and subsurface product placement. The multiple sized particles reduce the potential for aggradation and precipitation of the iron in the subsurface.

Factors determining the nZVI reactivity include particle size, manufacturing process, morphology and porosity, the crystalline structure, use of a hydrogenation catalysts (i.e., palladium), and impurities and coating of the particle (DuPont, 2007). Edible oils (e.g., EVO) have been used in conjunction with nZVI to stimulate anaerobic biodegradation of chlorinated solvents in soil and groundwater (ESTCP, 2006). Combining nZVI in a hydrophobic oil protects the compound from other groundwater constituents (inorganics, high pH, etc.) that could consume some of the nZVI reducing capacity, which makes the combination of amendments more effective in contaminant reduction and enable the material to serve as a long-term electron donor in barrier systems. Research indicates that chlorinated solvents may preferentially diffuse through the EVO and react with the nZVI inside the emulsion droplet (Cook, 2009).

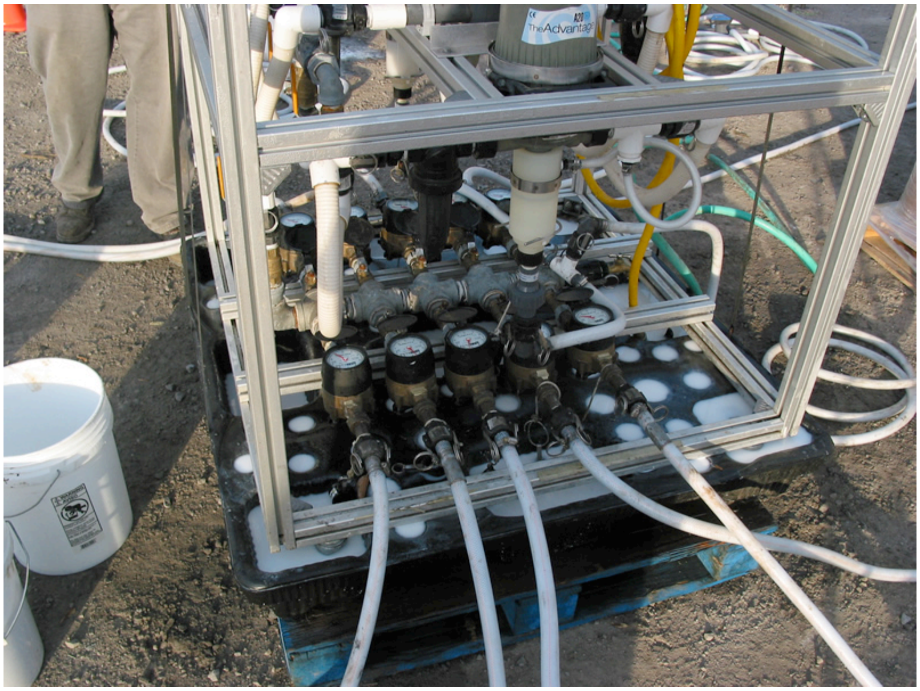
The injection program began October 9, 2008, and continued through October 21, 2008. The injection program began at the outside grid locations injecting Newmans Zone (only), moving inward toward the source area at MW-118. Between October 8 – 30, 2009, more than 4.3-inches of rain fell at the Site, which is above the norm over this timeframe. In conjunction with the injection program, this had considerable effect on raising the water table across the injection grid. Well hydrographs are included in Appendix C of this report, which show the increase during this timeframe, as noted in the chart below.



The amendments arrived on-site prior to October 8, 2008, and were stored along the northern fence line until needed. The make-up water consisted of the municipal supply (city of Geneva) from a fire hydrant located near MW-117, which was metered and recorded daily (see photo below).

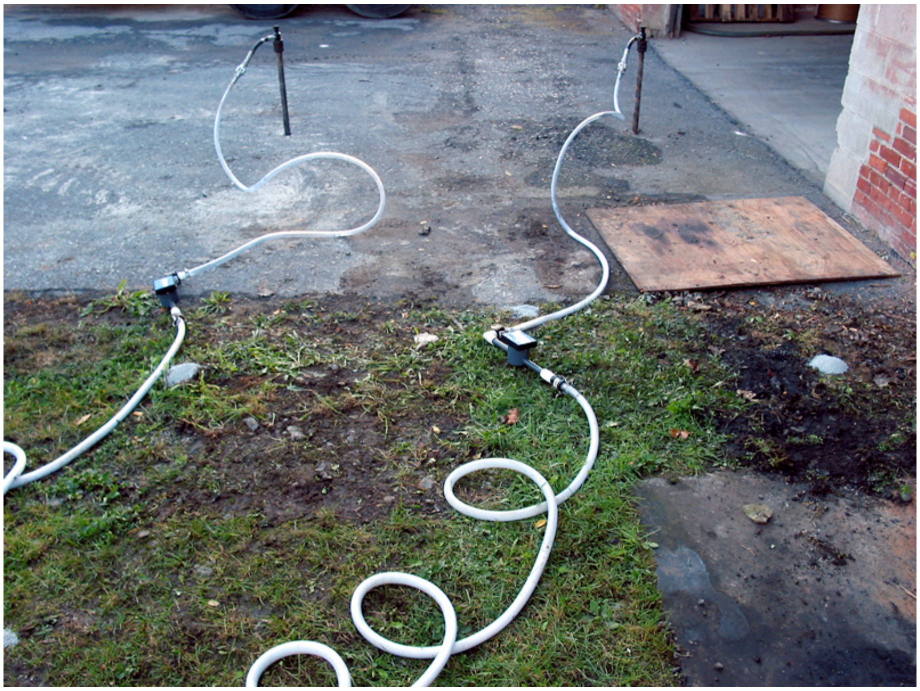
The EVO was shipped to the Site in 2,100 lb totes (approximately 264 gallons) and was moved from the stockpile area along the northern fence line to the injection locations. Approximately 1 tote of EVO was injected per day. The summary of the injection program is provided in Table 6.

The EVO and nZVI were mixed with the municipal potable water supply and distributed to the injection points via a proportional metering system, as shown in the photograph below. This allowed for individual injection point control.

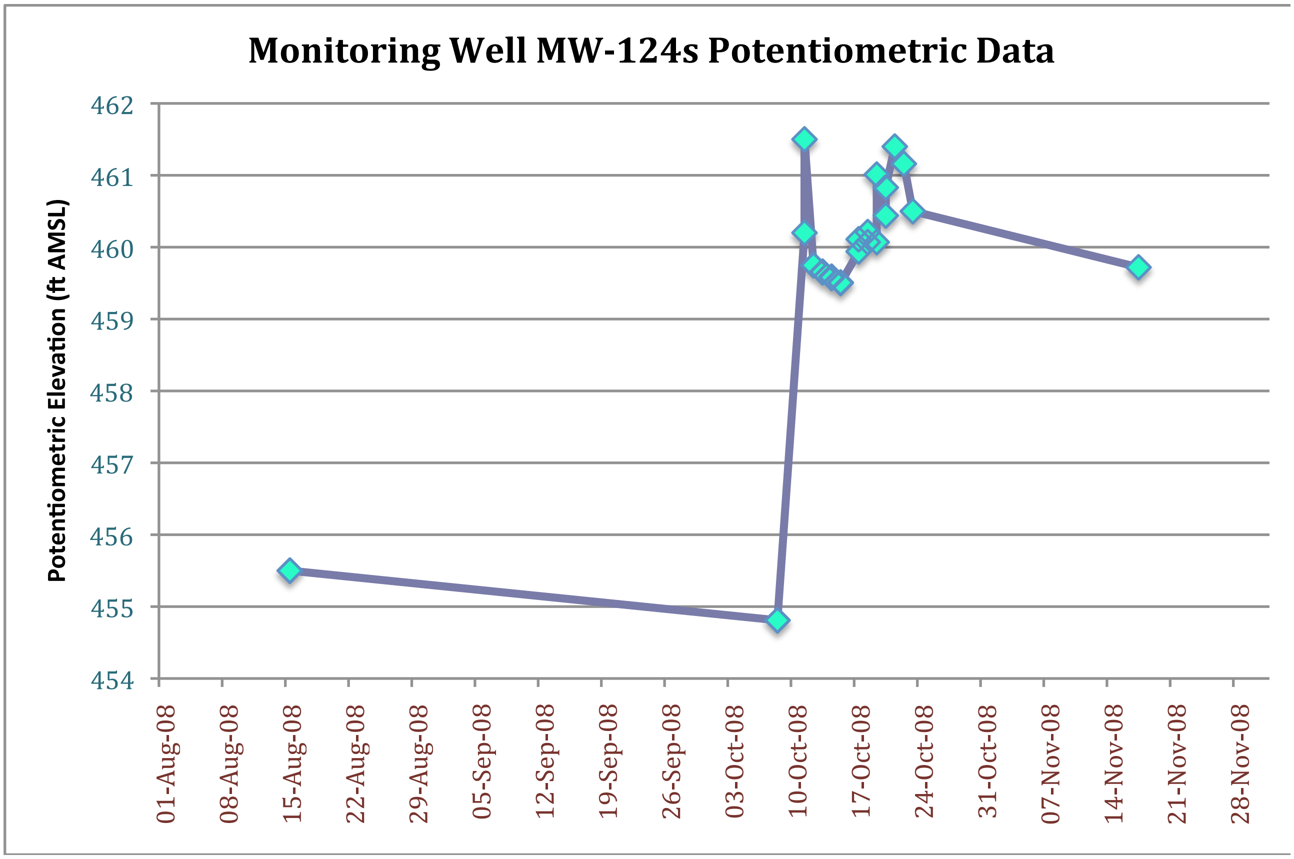


The water and ERD amendments were routed to each injection point and were metered individually at the wellhead. Figure 14 provides the daily injection points in the grid during the IRM. The injection of the nZVI occurred on October 16, 17, and 19, 2008, at and near MW-118 as noted on Figure 15, October 2008 nZVI Injection Point Locations. North and east of the MW-118 source area H.B. Fuller installed a targeted nZVI barrier, downgradient and perpendicular to groundwater flow from the MW-118 source area to act as a treatment zone as groundwater flows to the north and east toward the drainage ditch (injection grid points E-11, F-11, F-12, G-12 thru G-14, H-13, H-14, I-12, I-14, J-12, J-14, and K-14). At this barrier, the targeted injection depths were 11' bgs and 9' bgs into the permeable sediments, as noted on the well logs for the surrounding borings (MW-118, MW-119, BB2, BB-3). The dates of injection of EVO and nZVI are shown on Figure 16, October 2008 IRM ERD Amendment Injection Point Locations. Appendix N contains the daily injection summaries.

Figure 17, October 2008 IRM ERD Injection Point Amendment Volumes (gallons), shows the injection point location and the volume of ERD amendments applied at each location. The number at the top of each injection point is the volume EVO injected (in gallons), and the number at the bottom of the nZVI injection locations is the amount of zero valent iron solution (in gallons), injected at those locations. Injection data was recorded daily (Appendix N). This information is shown graphically on Figure 17, and provided in Table 6.



At each injection point the intended target zone was identified vertically, which often consisted of the more permeable and layered sands which provides the primary groundwater flowpaths. The previous boring logs were used to determine these intervals, in addition to the borings completed during the injection program (BB-1 thru BB-8) as noted in Appendix K.



The initial plan in the IRM Workplan was to inject fluids into the subsurface from the bottom of the boring and inject as the rods were extracted upwards. This injection strategy did not work as intended as after the rods were advanced to the desired depth, minor deviations in the borehole annulus provided ample space for the fluids to be rejected to the surface rather than entering the formation as the injection fluids took the pathway of least resistance. Accordingly, the injection strategy was modified to inject the fluids first into the more permeable section, based on information derived from either earlier boring logs, or borings conducted around the site during the injection program. After the requisite ERD amendments were injected into the more permeable zones at each point, the rods were either advanced or retracted and additional fluids were injected into the formation above or below the initial injection interval. This provided good vertical coverage of the ERD amendments, and potentiometric data shows that laterally the radius of influence (ROI) was greater than the 7.5-foot design ROI. The chart above, and the hydrographs provided in Appendix C demonstrate the significant horizontal and vertical impact the injection program had on the groundwater environment. At most injection locations the horizontal-ROI was noted at least ten (10) feet as evidenced by the arrival of EVO at MW-117 and other wells within a day of injection. At monitoring well 117 this was evidenced by a single depth injection where the water table was raised more than five (5) feet in adjacent wells, and at monitoring well MW-118 water levels were influenced more than six (6) feet above static conditions (Appendix C). At several locations fluids were noted at the ground surface within the 10-point injection grid, in particular during the EVO and nZVI injection adjacent to MW-118. Good vertical distribution in the VOC source area was evident from the potentiometric monitoring at surrounding wells, as significant rainfall did occur during the IRM injection (Appendix C), however, rainfall was not the controlling factor for the rise in potentiometric elevations observed. As noted from the recovery water level monitoring, some wells and locations were slower to respond from the injection fluids, most notably at MW-122 located west of the drainage ditch.

2.1.1 IRM Soil Borings and Sampling

During the IRM injection program H.B. Fuller advanced eight (8) soil borings near monitoring well MW-118 to evaluate subsurface soils for the presence of oil and NAPLs with Sudan IV during the IRM injection program. Figure 18 shows the location of the newly installed monitoring well MW-124 nest, and the IRM Soil Boring Locations advanced in August and October 2008. These borings were completed via geoprobe and soil samples were retrieved though geoprobe rods for visual analysis, monitoring vapors with a PID, lithologic description, and determination of the presence of NAPL or oils in the sediment. The results and observations from all of the soil sampling were negative for oils and NAPLs, as noted in the boring logs in Appendix K.

To further evaluate the possibility of NAPLs on-site, H.B. Fuller monitored well MW-117 and MW-118 for LNAPL and DNAPL with observations made from fluid samples retrieved with clear bailers from these wells before, during, and after the injection program. The results and observations from all of the bailer sampling were negative for LNAPL and DNAPL.

2.2 IRM Assessment

As part of the post-IRM injection several parameters are sampled as part of the ERD process to determine the effectiveness of the IRM, including TOC, dissolved gasses, VOCs, metals, nitrite, sulfide, pH, alkalinity, biological populations, among others. The TOC is monitored in the groundwater environment to determine if anaerobic metabolism of VOCs is possible through the addition of a hydrocarbon substrate. ORP is monitored to confirm the prevailing groundwater environment (aerobic and oxidizing vs. anaerobic and reducing). Later, alkalinity is analyzed as an indicator of the aquifers ability to buffer against variations in pH, and as an additional indicator of enhanced microbial activity. The pH is monitored to keep the groundwater in optimal range for reductive dechlorination as some bacterial populations are sensitive to low pH conditions (e.g., *Dehalococcoides*). The presence of reduced electron acceptors provides another measure of the primary microbial respiration processes controlling the groundwater environment. The presence and relative concentrations of VOC degradation end-products provides confirmation that the ERD process is being driven to completion. Dissolved gasses (methane\ethane\ethene) are monitored as they measure breakdown of the VOCs in a strongly reducing (methanogenic) environment, particularly around the injection wells. Chloride is monitored as a relative indicator that VOCs have been destroyed, leaving innocuous end-products. This performance monitoring is a critical portion of the in-situ ERD program. IRM performance monitoring to date includes field measurement of selected indicator parameters and laboratory analysis of groundwater samples.

A summary of the pre-IRM injection groundwater field and analytical parameters were collected to evaluate the progress of the correction action, as Figure 19, ORP Measurements in Groundwater - August 2008, shows that the area around MW-117 exhibits the most reducing groundwater conditions (most negative), and generally increasing radially outward from that point. This data, coupled with the dissolved oxygen (DO) data indicate less that ideal conditions for anaerobic degradation in the MW-118 area. This is shown on Figure 20, DO in Groundwater - August 2008, indicating excess dissolved oxygen is present in the shallow groundwater.

After injection the ERD field parameters were again measured in November 2008, to compare with the pre-IRM baseline sampling. As shown on Figure 21, ORP Measurements in Groundwater - November 2008, the groundwater environment changed dramatically towards anaerobic conditions west of the drainage ditch. While maintaining reducing conditions, the ORP levels increased across the ERD zone in April 2009, as presented on Figure 22. With the increasing water levels over this time, the trend in ORP levels continued reducing along the eastern margin of the plume at MW-114 and MW-116, an indication that some ERD amendments were held in the unsaturated zone as the increasing water levels flushed the amendments between late-2008 and mid-2009, as noted on Figure 23.

These changes were also noted in regards to DO levels, which decreased rapidly and significantly site-wide following the injection, as shown on Figure 24. The drop in DO, accompanied by further reducing conditions noted by ORP measurements, overlaps well with the increased TOC distribution in and downgradient of the VOC source from MW-117 downgradient to the MW-124 nest, as shown on Figure 25.

To begin the evaluation of the groundwater flowpaths for the ERD amendments, the potentiometric elevations were measured in November 2008, and superimposed on the injection grid, as shown on Figure 26, Post IRM Injection Groundwater Flow Map. This flow pattern is consistent with historical data showing flow from the MW-117 area to the east-northeast and from MW-118 to the east and southeast. This groundwater flow pattern is superimposed with the TCE concentrations detected in November 2008, shown on Figure 27, Post-IRM Injection TCE Concentrations and Groundwater Flow. The pattern of TCE distribution and groundwater flow is consistent, and when evaluated with the TOC concentrations (and corresponding volume of ERD amendments injected), the distribution of TOC from the injection program is sufficient to establish an anaerobic zone in the source areas, as shown on Figure 28, IRM Injection Volumes and TOC Concentrations. To evaluate the ERD zone established, the DO measurements from November 2008, were superimposed onto the total VOC concentrations, which is an important indicator in sustaining the initial ERD zone, as shown on Figure 29, Post-IRM Injection DO and TVOC Concentrations.

The pre-IRM injection TOC concentrations show, as expected, insignificant indigenous carbon to sustain bacterial populations necessary for effective reductive dechlorination, as shown on Figure 30, Total Organic Carbon Concentrations in Groundwater - August 2008, where greater than 10 mg/L TOC concentrations were only detected at MW-117 and MW-118.

Summary Table of TOC Sampling in Groundwater

Total Organic Carbon (mg/L)			
	Pre-Injection	**⇐ Post-Injection ⇒**	
	08/04/08	**11/17/08**	**8/4/09**
MW-114	2.4	3.3	3.3
MW-115	5	3.1	5.3
MW-116	3.6	43	11
MW-117	23.3	1,820	127
MW-118	38.5	1,080	660
MW-119	3.5	330	168
MW-120	5.8	5.9	6.2
MW-121	--	4.2	6.8
MW-122	4.6	3.7	3.1
MW-123	6	3.1	4
MW-124s	--	661	194
MW-124d	--	5,410	844

One month after the initial injection in November 2008, the areal extend of elevated TOC tripled in size, and when overlain with the TVOC concentrations (Figure 31), the correlation shows good overlap, and the distribution of TOC encompasses the known source areas. This TOC concentration and distribution will serve as a good indicator for evaluating the ERD zone in future groundwater sampling events. In profile, the TOC concentration also shows adequate distribution, as noted on Figure 32, Total Organic Carbon Concentrations in IRM Injection Area - Cross Section A-A'. This TOC distribution is what was proposed in the *Enhanced Reductive Dechlorination In-Situ Bioremediation, Interim Remedial Measures Workplan, Former Monarch Chemicals Facility, 61 Gates Avenue, Geneva, New York*, (Figure 34 - ECOR, May 20, 2008). The monitoring of the ERD zone shows the initial TOC levels have decreased in concentration as shown on Figure 33, Total Organic Carbon Concentration in Groundwater - April 2009, and further in the August 2009 data, as shown on Figure 34. As the ERD amendments are consumed the TOC levels will begin to decline, and conversely, maintaining TOC levels will sustain the ERD program as long as VOCs remain available for cometabolic reactions with the indigenous biological communities.

3.0 2008 – 2009 SAMPLING AND MONITORING ACTIVITIES

The intent of this report is to summarize the relevant groundwater monitoring information and presents the data and information in a narrative discussion including groundwater flow maps, diagrammatic illustrations, tabular groundwater summaries, hydrogeologic and potentiometric contour maps/cross sections, chemical parameter trend graphs, contaminant migration pathway delineation, isoconcentration maps and cross-sections, and groundwater flow nets, as appropriate. In 2008, indoor and sub-slab soil vapor and air sampling was conducted, groundwater sampling was conducted three (3) times, the biological sampling results were received and reported, a set of nested groundwater monitoring wells were installed and soil sampling was conducted, the IRM was implemented. In 2009, groundwater sampling was conducted two (2) times, and the results were presented to NYSDEC. The requisite description of these monitoring activities is provided in the following sections.

3.1 Soil Vapor Intrusion Sampling Program

A baseline SVI survey was conducted March 27, 2007, which detected select Site-related VOCs, including carbon tetrachloride. Based on the results of the baseline sampling, a follow-up SVI sampling program was proposed to evaluate the sub-slab and indoor air concentrations under worst-case conditions, a heating season setting. The results of this sampling was reported to NYSDEC and NYSDOH in the *Heating Season Soil Vapor Intrusion Sampling Event* (ERM, May 21, 2008).

The SVI heating season sampling was conducted January 30 – 31, 2008. During the initial inspection the PID readings in the sub-slab sampling ports were as follows:

SS-1: 64.9 ppm;
SS-2: 20.5 ppm;
SS-3: 7.5 ppm; and,
SS-4: 2.3 ppm.

SS-1 (Figure 35) is located farthest from the source area and is also located within the office area/break room (Figure 35). In other words, the highest indoor air impacts were detected farthest from the known subsurface source areas. The primary differences between the Baseline and Heating Season Sampling Events included the following conditions:

- No scrubbers in operation during the Heating Season Sampling Event.
- No tank loading in the plant.
- Only minimal stenciling occurred during the morning prior to the sampling event.
- No helium used.
- 100% certified summa canisters used.

The results of the Heating Season Sampling event appears to be relatively consistent with the Baseline Event, with generally lower detectable concentration of VOCs. The following Site-related compounds were detected during the sampling: PCE, TCE, cDCE, tDCE, 11DCE, 111TCA, 11DCA, chloroform, ethylbenzene, toluene, and xylene.

Concentrations of TCE and PCE detected in all indoor air samples did not exceed the NYSDOH Indoor Air Guidelines of 5 and 100 micrograms per cubic meter ($\mu g/m^3$), respectively. Sub-slab vapor concentrations were generally higher than or equal to the co-located indoor air sampling stations (SS-1 thru SS-4).

Carbon tetrachloride was detected in both indoor air and sub-slab samples, similar to the Baseline Event. Consistent with the Baseline Event the indoor air carbon tetrachloride concentrations were greater (higher concentration) than the sub-floor vapor concentrations. Carbon tetrachloride is not a Site-related VOC, and guidance indicates that mitigation is not necessary and source identification\exposure reduction should be protection of human health. The results of this assessment are contained in the *Heating Season Soil Vapor Intrusion Sampling Event* (ERM, May 21, 2008).

3.2 Monitoring Well MW-118 Biological Profiling

A single BioTrap® was installed in monitoring well MW-118 (Figure 2) to evaluate the groundwater environment for biomass and identify biomarkers. The intent of this profiling was to determine the pre-IRM conditions of the groundwater environment in the source area, and the BioTrap™ was contained in well MW-118 from September 26, 2007 to December 20, 2007 (85-days). The BioTrap samplers contain a unique matrix, called Bio-Sep® beads which have a very large surface area (~600 m_2/g), and are 2-3 mm in diameter. The beads are engineered from a composite of Nomex and powdered activated carbon (PAC), which is surrounded by an ultra filtration-like membrane. The sampler was retrieved and sent to Microbial Insights for analysis of various indicator parameters including biomass, genus\species identification, and metabolic acids. The laboratory analytical report for this sampling is provided in Appendix B of this report.

Phospholipids fatty acids (PLFA) are a main component of the membrane of microbes and provide a means of evaluating the subsurface environment for microbial populations, and changes in that environment over time. PLFA analysis is one of the most reliable and accurate methods available to determine viable microbial biomass. Overall, the abundance of microbes and dechlorinating species in groundwater at MW-118 is considered moderate, which is a positive pre-IRM condition, as outlined below.

Several dechlorinating bacteria were identified in the groundwater at MW-118, as summarized in the table below.

MW-118	Sample Date: 12/20/2007	
Dechlorinating Bacteria	**Units: cells\bead**	
Dehalococcoides spp	2.25E+01	(J)
Desulfuromonas spp.	2.10E+03	
Dehalobacter spp.	4.08E+03	
Desulfitobacterium sp.	4.57E+04	
Functional Genes		
TCE R-Dase	<2.5E+01	
BAV1 VC R-Dase	<2.5E+01	
VC R-Dase	<2.5E+01	
Phylogenetic Group		
Eubacteria	2.85E+06	
Methanogens	9.16E+04	
Sulfate & Iron Reducing Bacteria	<3.75E+01	
Methanotrophs (total)	1.16E+01	(J)
Type I MOB	1.16E+01	(J)
Type II MOB	<5E+01	
Ammonia Oxidizing Bacteria	4.86E+03	
Denitrifying Bacteria (nirK)	7.15E+02	
Dentrifying Bacteria (nirS)	5.82E+04	

NA = Not Analyzed, NS = Not Sampled, J = Estimated gene copies below PQL but above LQL, I = Inhibited, < = Result not detected

The overall quantity of microbes in groundwater is often used as an indicator of the potential for bioremediation to occur, but the species and population of the biomass are also an important determining factor on the success of the ERD program. The following levels are general benchmarks for evaluating biomass levels:

Low	Moderate	High
10^3 to 10^4 cells\bead	$10^5$to 10^6 cells\bead	10^7 to 10^8 cells\bead

Biomass at MW-118	**2.89E+05 cells\bead**
Firmicutes	4.76 %
Proteobacteria	62.06 %
Anaerobic metal reducers	0.64 %
SRB/Actinomycetes	2.71 %
General	28.2 %
Eukaryotes	1.63 %

The general population of biomass at MW-118 is considered moderate. The analytical report for the biological profile is included in Appendix B of this report.

As important as biomass in the ERD process are the biological species present, which are synergistically utilized as a consortium of bacterial populations to effectuate the reductive dechlorination process. As noted in the tables above, important dechlorinating bacteria were identified at MW-118, with a general description below.

Dechlorinating Bacteria	**Contaminant Addressed**	**Environmental Relevance**
Dehalococcoides spp.	PCE, TCE, DCE, VC	Only "known" group of bacteria capable of dechlorinating PCE and/or TCE to ethene. Capabilities vary depending upon the strain.
BAV1 R-Dase	VC	Functional gene found within the DHC strain BAV1 which encodes the reductive dehalogenase that catalyzes the direct dechlorination of VC.
TCE R-Dase	-	Functional gene for strains 195 and FL2, that encodes for the TCE reductive dehalogenase (TCE R-Dase) which catalyzes the dechlorination of TCE to VC.
Dehalobacter spp.	PCA, TCA, PCE, TCE	Capable of dechlorinating PCE and TCE to cist-DCE and converting TCA to chloroethane.
Desulfuromonas spp.	PCE, TCE	Capable of dechlorinating PCE and TCE to cist-DCE using acetate as it's electron donor.
Bacterial Groups	**Contaminant**	**Environmental Relevance**
Total Eubacteria	-	Used as a broad index at the domain level for the amount of total bacterial biomass. This target is used to provide an index of the total amount of bacteria within a given sample by targeting a conserved region found in all bacteria. Results from this target can be used to correlate changes in the ratio of total biomass to a specific group of bacteria (i.e. Dehalococcoides).
SRB/IRB	-	Estimates the abundance of sulfate and iron reducing by targeting bacteria within the deltaproteobacteria group including Geobacter, Pelobacter, Desulfovibrio, Desulfomicrobium, Desulforomusa, and Desulfuromonas.
Methanogens	-	Quantifies the abundance of methanogens which compete with dechlorinating bacteria for available hydrogen (to produce methane).
Methanotrophs	Co-Metabolic oxidation of TCE & DCE	Methanotrophic bacteria possess the methane monooxygenase (MMO) enzyme which can oxidize or metabolize compounds such as TCE and DCE.
sMMO	Co-Metabolic oxidation of TCE & DCE	Functional gene which targets the enzyme soluble methane monooxygenase (sMMO) which is found in methanotrophic bacteria.

There were no metabolic acids detected at MW-118 in the BioTrap, as noted in the table below.

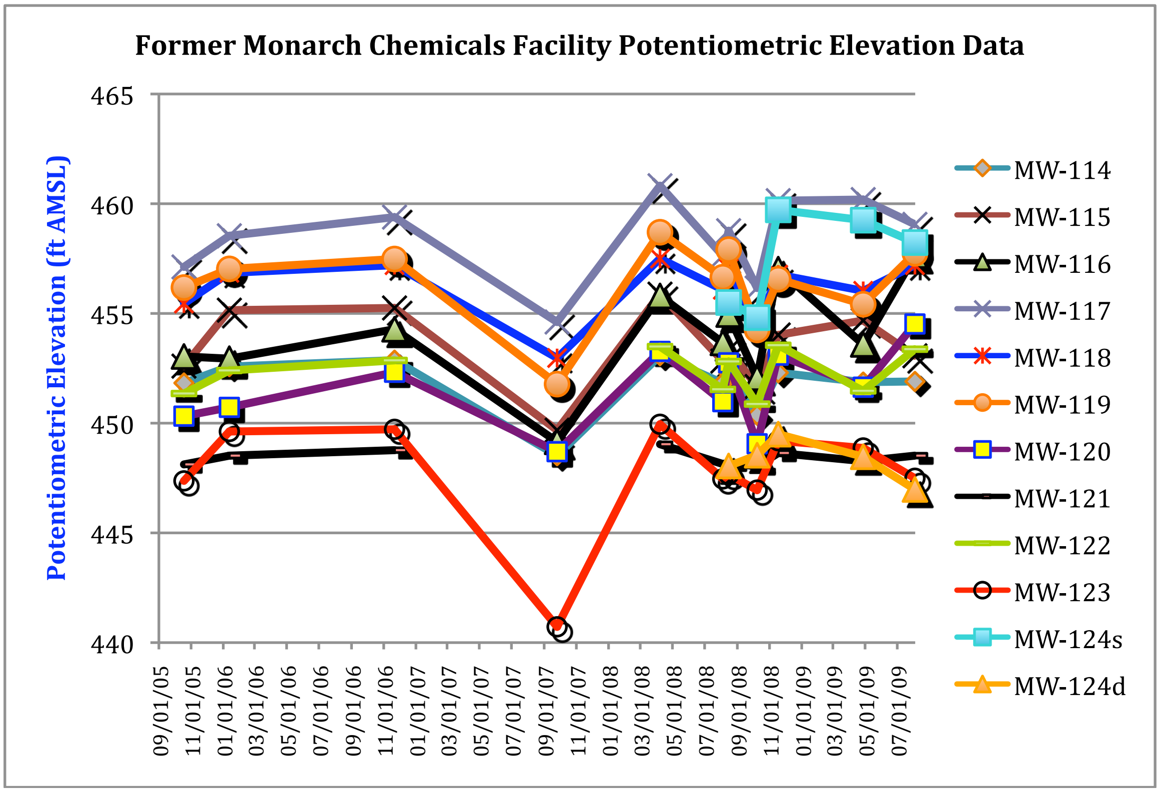
MW-118	**12/20/2007**
Metabolic Acids (mg/L)	
Pyruvic	<4 mg/L
Lactic	<1 mg/L
Formic	<1 mg/L
Acetic	<1 mg/L
Propionic	<1 mg/L
Butyric	<1 mg/L

These results were evaluated in the context of the subsurface injection program proposed in the IRM, which indicated favorable conditions for ERD (ECOR, May 20, 2008). To evaluate biological population trends over time, additional BioTraps could be installed in MW-118 and other wells after the injection to evaluate biological populations and the developing ERD monitoring program.

3.3 Groundwater Monitoring Program

3.3.1 Groundwater Flow Conditions

The depth to groundwater generally follows the surface topography, typical of the shallow unconfined glacial sediments in this region. In general, groundwater levels across the site is seasonally cyclic, with groundwater monitoring well MW-121 and MW-120 exhibiting the smallest (lowest) water level fluctuations, and monitoring wells MW-118, MW-122, MW-123, and MW-124s showing the widest fluctuations. The historical water level data are provided in Appendix A, and summarized in the chart below.



The following figures depict the groundwater flow conditions monitored pre- and post-IRM injection, and start with Figure 36, Potentiometric Elevation Contour Map - April 2008, which depicts the groundwater flow patterns measured in the initial groundwater sampling event for 2008. The groundwater flow during this sampling event (April 7 – 9, 2008) shows the groundwater flow from the MW-117 area to the east-northeast, and from the MW-119 area east-southeast. This radial flow is consistent with historical groundwater flow patterns. Figure 37, Potentiometric Elevation Contour Map - August 2008, provides a similar depiction of groundwater flow as in April 2008, however, the site-wide groundwater levels are lower than in the spring-2008, roughly 1- to 2-feet lower. After this sampling event groundwater monitoring wells MW-124s and MW-124d were installed based on hydrogeologic data and lithologic information from the deep boring at MW-124d. The screened intervals were determined by the historic observed water level data, and the necessity to separate the screened intervals to determine vertical gradients. The well construction completion details are provided on Table 1.

Figure 38, Potentiometric Elevation Contour Map - October 8, 2008, depicts the groundwater flowpaths and potentiometric elevations prior to the IRM injection program, conducted October 9 – 21, 2008. Groundwater levels during the IRM injection program were collected essentially on a daily basis, an example noted in the chart below. The injections nearest MW-118 were conducted October 18, 2008, and as noted in the chart below the water levels in MW-118 started increasing with the initiation of the injection program on October 9.

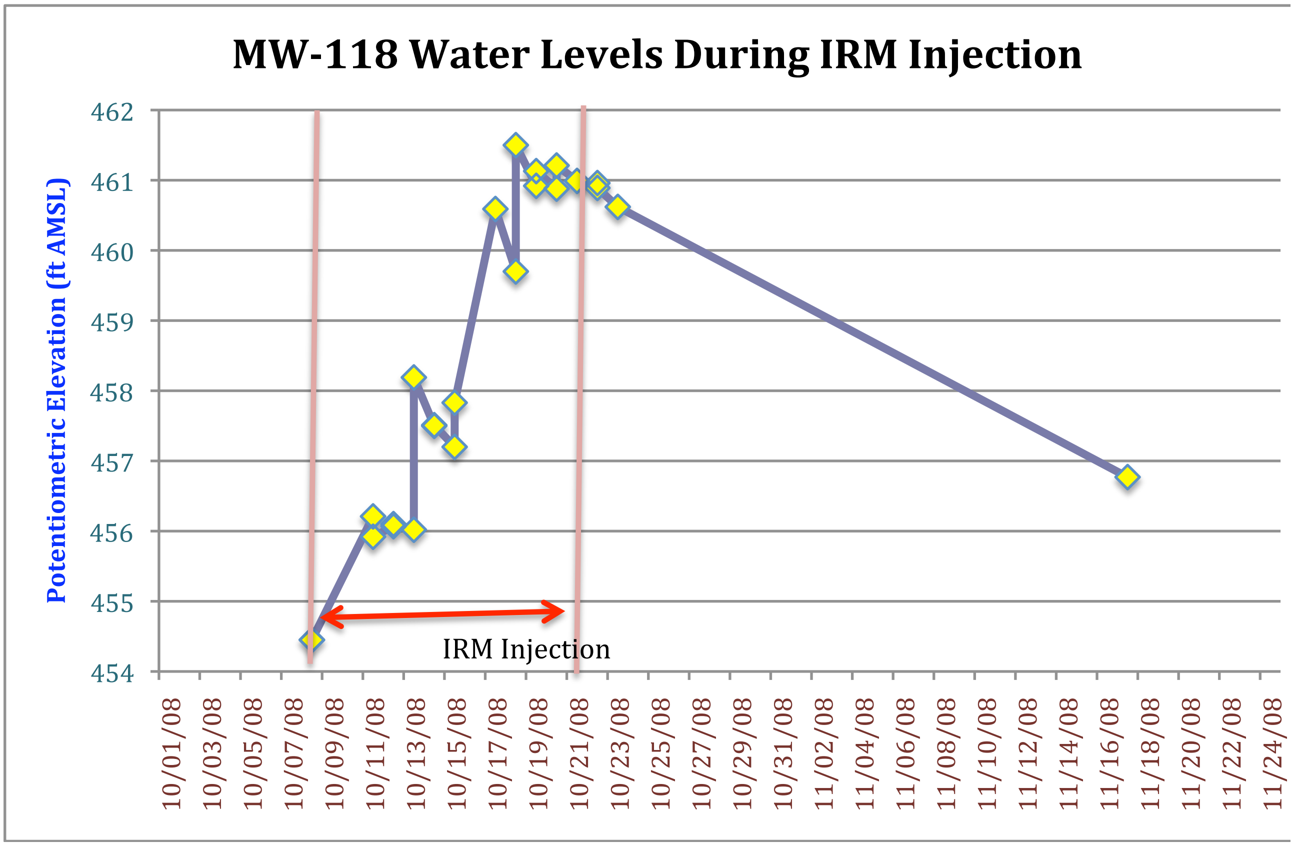


Figure 39, Potentiometric Elevation Contour Map - November 17, 2008, depicts the groundwater flowpaths approximately one-month following the IRM injection program. As noted in the data, several monitoring wells were still adjusting to the injection program, while others rebounded quickly to near static conditions after the injection program ceased. The November 2008, groundwater flow is consistent with historical trends. The historical water level data are provided in Appendix A, and Appendix C contains graphs of potentiometric levels for each well.

Figure 40, Potentiometric Elevation Contour Map - April 2009, depicts a groundwater flowpath similar to that measured in November 2008, with flow from the MW-118 area toward the drainage ditch to the east, however, the hydraulic gradient is less than earlier measurements. The April 2009, groundwater flow is consistent with historical trends. Figure 41, Potentiometric Elevation Contour Map - August 2009, depicts a post-injection groundwater flowpath with a more northerly flow direction compared to the previous monitoring event in April 2009. As noted in the groundwater monitoring event, the potentiometric levels are higher in the recharge area and significantly lower east of the drainage ditch at MW-123. The August 2009, groundwater flow is consistent with historical trends. The change in water levels across the monitoring network between August 2008 and August 2009 can be divided into areas along the drainage ditch and east which show a relative gain of 0’ to $^{+}$2’ raise in potentiometric levels, and the areas westward which have experienced a relative decline of up to $^{-}$2’, and shown on Figure 42.

3.4 Groundwater Quality Monitoring - VOCs

3.4.1 2nd-Quarter 2008 Groundwater Sampling Event (April 7 – 9, 2008)

The first 2008 tri-annual groundwater sampling was conducted April 7 – 9, 2008. As noted in the previous section the groundwater levels across the Site rebounded from the drought conditions observed in the fall-2007, as provided in the hydrographs provided in Appendix C. Potentiometric data indicates site-wide rebound of the groundwater levels as the result of groundwater recharge and a rise in the water table in early-2008. The groundwater sampling event collected water samples from all wells, in general accordance with the low flow sampling program, however, the water column in well MW-121 was below the bladder intake and a peristaltic pump was used to collect the sample. Otherwise the sampling program was conducted routinely and water quality samples were submitted for VOCs under EPA Test Method 8260. Appendix D provides the field sampling logs for the sampling events.

A summary of the VOCs detected in the 2nd-Quarter 2008 Groundwater Sampling Event are noted in the table below.

Summary Table of April-08 VOC Sampling

		PCE	TCE	11DCE	cDCE	tDCE	VC	111TCA	11DCA
SITE	**DATE**	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
DEC-GW-STD		5	5	5	5	5	2	5	5
MW-114	4/8/08	62	18	1.6	4.2	< 1	1	6.9	2.2
MW-115	4/8/08	13	< 1	< 1	< 1	< 1	< 1	1.5	1.2
MW-116	4/8/08	180	22	3.5	19	< 1	2.4	68	4.8
MW-117	4/8/08	2.8	< 1	< 1	< 1	< 1	< 1	< 1	< 1
MW-118	4/9/08	3100	1700	1100	2300	32	630	4900	670
MW-119	4/9/08	24	58	1.4	49	0.84	2	31	33
MW-120	4/8/08	11	17	< 1	32	< 1	3.8	17	19
MW-121	4/8/08	1.2	2.7	< 1	2.7	< 1	< 1	1.5	1.6
MW-122	4/7/08	4.7	68	24	1200	33	650	160	240
MW-123	4/7/08	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1

Concentrations in ug/L
DEC-GW-STD = groundwater cleanup standards

The laboratory analytical report is included in Appendix E, and the data is summarized on Table 3. In general, the April 2008, Groundwater Sampling Event is consistent with historical data, as described below. Figure 43, Tetrachloroethene Concentrations in Groundwater - April 2008, depicts the highest concentrations at and downgradient of MW-118, with a PCE concentration of 3,100 ug/L. Cross-gradient at MW-116 and downgradient at monitoring well MW-122 the concentrations of PCE were 118 ug/L and 4.7 ug/L, respectively.

Figure 44, Trichloroethene Concentrations in Groundwater - April 2008, depicts a similar profile as PCE in groundwater, with the highest concentrations located at MW-118 with a concentration of 1,700 ug/L, cross-gradient at MW-116 PCE was detected at 22 ug/L, and downgradient at MW-122 PCE was detected at a concentration of 68 ug/L. Figure 45, 1,1,1-Trichlorethane Concentrations in Groundwater - April 2008, depicts the highest concentrations in the soil source area at MW-118 with a concentration of 4,900 ug/L, decreasing markedly downgradient at MW-122 with a concentration of 160 ug/L.

Figure 46, cis-1,2-Dichloroethene Concentrations in Groundwater - April 2008, depicts a narrower area of impacted groundwater extending from MW-118 with a concentration of 2,300 ug/L, downgradient to MW-122 at a concentration of 1,200 ug/L, and cross-gradient at MW-116 at a concentration of 19 ug/L, and at MW-119 cDCE was detected at a concentration of 49 ug/L. Figure 47, 1,1-Dichloroethane Concentrations in Groundwater - April 2008, depicts a similar profile as the primary chlorinated solvents at MW-118, which detected 11DCA at a concentration of 670 ug/L, decreasing downgradient at MW-122 at a concentration of 240 ug/L, and a slight shift southward toward MW-119 with a concentration of 33 ug/L, to MW-120 with a concentration of 19 ug/L.

Figure 48, Vinyl Chloride Concentrations in Groundwater - April 2008, depicts a similar profile as the primary chlorinated VOCs. The level of VC and other degradation or daughter products is indicative of biodegradation occurring within the zone of impacted soil and groundwater. Figure 49, Total VOCs in Groundwater - April 2008, shows that the primary area of VOCs in groundwater is consistent with historical data with the primary VOC mass centered at MW-118 with a concentration of 15,004 ug/L, decreasing downgradient at MW-122 with a concentration of 2,385 ug/L and cross-gradient at MW-116 TVOCs were detected at a concentration of 300 ug/L, at MW-119 at a concentration of 205 ug/L, and at MW-114 with a concentration of 96 ug/L. Lower levels of VOCs were detected at the upgradient of the main source area in MW-117 with a concentration of 3 ug/L, at MW-115 with a concentration of 16 ug/L, and southward at MW-120 with a concentration of 102 ug/L, and at MW-121 with a concentration of 10 ug/L. Off-site MW-123 detected less than 1 ug/L TVOCs.

3.4.2 3rd-Quarter 2008 Groundwater Sampling Event (Aug. 5-6, & Aug. 18, 2008)

The second 2008 tri-annual groundwater sampling was conducted August 5-6, and August 18, 2008. It was in August 2008 that the nested groundwater monitoring wells MW-124s and MW-124d were installed and first sampled. Between April and August 2008, the groundwater levels decreased site-wide, as noted in the monitoring well potentiometric graphs included in Appendix C.

The groundwater sampling event collected water samples from all wells, in general accordance with the low flow sampling program, however, the water column and drawdown induced even by the low pumping rate at well MW-114, MW-116, MW-121, and MW-122 were insufficient to use a bladder pump, and a peristaltic pump was used to collect the groundwater samples at each well. Otherwise the sampling program was conducted routinely and water quality samples were submitted for VOCs under EPA Test Method 8260. Appendix D provides the field sampling logs for the sampling events.

The August 2008 sampling event is considered the pre-IRM baseline sampling event. A summary is noted in the table below.

Summary Table of August-08 VOC Sampling

		PCE	TCE	11DCE	cDCE	VC	111TCA	11DCA
SITE	**DATE**	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
DEC-GW-STD		5	5	5	5	2	5	5
MW-114	8/5/08	75	30	3.7	7.3	2.2	13	4
MW-115	8/5/08	30	7.7	8.8	9.4	2.9	22	34
MW-116	8/5/08	530	62	14	40	6.5	260	9.3
MW-117	8/5/08	4.1	< 1	< 1	< 1	< 1	< 1	< 1
MW-118	8/6/08	3200	1500	580	2400	800	3000	500
MW-119	8/6/08	34	110	1.4	93	4.9	52	29
MW-120	8/5/08	4.4	11	0.72	37	4.1	14	23
MW-121	8/5/08	4.7	4.1	< 1	9.3	< 1	4.5	6.2
MW-122	8/5/08	7.2	83	37	1600	1000	180	330
MW-123	8/4/08	2.2	1.4	2.6	1.8	< 1	1.1	14
MW-124s	8/18/08	< 1	0.94	< 1	5.1	13	0.98	130
MW-124d	8/18/08	< 1	49	31	260	81	0.7	460

Concentrations in ug/L
DEC-GW-STD = groundwater cleanup standards

In general, the August 2008, Groundwater Sampling Event is consistent with historical data, as described below. Potentiometric elevations plotted on Figures 37 through 39 depict the groundwater levels and hydrogeologic regime extending from MW-117 upgradient of the soil source areas extending downgradient through MW-118 and MW-122, across the drainage ditch east of the Site and off-site to MW-123. This transect is used to display the area of impacted groundwater in August 2008 in the following series of figures.

Figure 50, Tetrachloroethene Concentrations in Groundwater - August 2008, depicts a similar profile as the PCE concentration detected in April 2008, with a slight increase in PCE from MW-118 at a concentration of 3,200 ug/L, slightly shifting northward and cross-gradient at MW-116 at 530 ug/L, and decreasing at MW-114 to 75 ug/L. Downgradient of MW-118 at newly installed monitoring wells MW-124s (shallow nested well) and at MW-124d (deep well), PCE was not detected at or above the laboratory method detection limit (MDL) of 1 ug/L. This profile is shown in cross section on Figure 51, Tetrachloroethene Concentrations in Groundwater, Cross Section A-A' - August 2008, which clearly identifies the source area of PCE at MW-118.

Figure 52, Trichloroethene Concentrations in Groundwater - August 2008, depicts a smaller zone of groundwater impacted with TCE extending downgradient of MW-118 with a concentration of 1,800 ug/L, to MW-119 at a concentration of 110 ug/L. Downgradient of the source area at MW-124s the TCE was detected at 0.94 ug/L, and at MW-124d TCE was detected at 49 ug/L, and further downgradient at MW-122 with a concentration of 83 ug/L. This profile is shown on Figure 53, Trichloroethene Concentrations in Groundwater, Cross Section A-A' - August 2008, with shows the TCE concentrations extending downgradient from MW-118 toward the adjacent drainage ditch.

Figure 54, 1,1,1-Trichlorethane Concentrations in Groundwater - August 2008, depicts a source area at MW-118 with a concentration of 3,000 ug/L, decreasing downgradient to less than 1 ug/L at MW-124s and MW-124d, to MW-122 with a concentration of 180 ug/L. In profile, the area of impacted 111TCA in groundwater is shown extending from the source area at MW-118 (Figure 55), downgradient to MW-122.

Figure 56, cis-1,2-Dichloroethene Concentrations in Groundwater - August 2008, depicts two areas of moderate cDCE concentrations, one at MW-118 with a concentration of 2,400 ug/L and the other at MW-122 with a concentration of 1,600 ug/L, separated by the MW-124 nest with concentrations of 5.1 ug/L and 260 ug/L at MW-124s and MW-124d, respectively. This area of impacted groundwater is shown on Figure 57, cis-1,2-Dichloroethene Concentrations in Groundwater, Cross Section A-A' - August 2008, which indicates a broad area of cDCE, a breakdown product of the chlorinated VOCs, and an indication of the pre-IRM reductive dechlorination process.

Figure 58, 1,1-Dichloroethane Concentrations in Groundwater - August 2008, depicts a narrow band of impacted groundwater extending from the source area at MW-118 with 500 ug/L 11DCA, decreasing downgradient to 330 ug/L at MW-122. This profile is shown on Figure 59, 11DCE Concentrations in Groundwater, Cross Section A-A' - August 2008.

Figure 60, Vinyl Chloride Concentrations in Groundwater - August 2008, shows the highest area of groundwater impacted with VC detected at MW-122 at a concentration of 1,000 ug/L, which is not unexpected as the result of reductive dechlorination and downgradient migration of VOCs from the source area. In profile, this is shown on Figure 61, Vinyl Chloride Concentrations in Groundwater, Cross Section A-A' - August 2008, where off-site at MW-123 vinyl chloride was not detected at or above the laboratory MDL.

Figure 62, Total VOCs in Groundwater - August 2008, depicts the VOC mass consistent with historical trends, with the highest concentrations detected at MW-118 with TVOCs at 12,024 ug/L (a reduction from April 2008), extending downgradient at MW-122 to 3,293 ug/L. The installation of monitoring well nest MW-124 shows that the contaminant distribution is uneven and dependant on hydrogeologic conditions. Additionally, in conjunction with the August 2008 monitoring and sampling for NAPLs and oil in soil, and gauging the groundwater with bailers, there was no indication that either oils, LNAPL or DNAPL were present at or downgradient of MW-118. In profile, this is evident on Figure 63, Total VOCs in Groundwater, Cross Section A-A' - August 2008, which clearly demonstrates the source area and downgradient migration of VOCs in groundwater.

Groundwater monitoring also included collecting the baseline pre-injection parameters. Monitoring well MW-121 contained only sufficient groundwater for collecting a VOC sample, however, baseline parameters were collected at MW-114, MW-115, MW-116, MW-117, MW-118, MW-119, MW-120, MW-122, and MW-123. These analytes included total and dissolved iron, total and dissolved manganese, biochemical oxygen demand (BOD), chemical oxygen demand (COD), chloride, nitrate-nitrite, sulfate, sulfide, total Kjeldahl nitrogen, TOC, total phosphorous, and dissolved gasses ethane, ethene, methane, and carbon dioxide. The results of this sampling are provided in Table 5. The analytical laboratory report for this sampling event is included in Appendix F.

3.4.2.1 Monitoring Well MW-124 Nest Installation (August 2009)

To properly place the screens for the nested wells (Figure 18), the deep well MW-124s was drilled first. The subsurface conditions encountered were interbedded layers of varying thickness of surficial fill, fine sand, clays, and sandy clays. The screened interval for MW-124d is 16’ – 21’ bgs (441.33’ to 446.33 ft AMSL), largely across a basal fine sand and sandy clay. Monitoring well MW-124s was installed with a water table spanning 10-foot screen, extending from roughly 2.5’ - 12.5’ bgs (449.75’ to 459.75 ft AMSL), screened across clays and fine sands. To evaluate vertical gradients the separation distances in the screens was an important factor, and the 5-foot screen installed in MW-124d was important in this delineation. The boring logs for MW-124s and MW-124d are included in Appendix J, and the completion details for these wells are summarized on Table 1.

As noted on the boring logs included in Appendix J, the maximum detection for VOCs in the subsurface soil was found in the surficial fill, with a detection of 0.3 ppm approximately 2 feet bgs on the PID. Due to the lack of detectable VOCs in soil, only samples from the screened intervals were submitted for laboratory analysis for VOCs. The table below summarizes the positive detections in soil for the samples collected August 14, 2008, at 21’ bgs at MW-124d, and 11’ bgs at MW-124s.

Summary of Soil VOC Detections at MW-124 nest

Analyte	MW-124d 21' bgs	MW-124s 11' bgs	Units
Acetone	32	7 J	ug/Kg
Benzene	2 J	< 5	ug/Kg
1,1-dichloroethane	< 6	2 J	ug/Kg
cDCE	< 6	3 J	ug/Kg
ethylbenzene	22	< 6	ug/Kg
isopropylbenzene	8	< 5	ug/Kg
methylene chloride	8 B	9 B	ug/Kg
methyl-t-butyl ether	18	< 5	ug/Kg
total xylenes	47	< 16	ug/Kg

J = estimated concentration
B = analyte detected in blank

The analytical results suggests no VOC source area in the screened intervals at these wells, and these wells are downgradient of the VOC source area at MW-118. Table 4 provides the summary table of the sampling event, and the analytical laboratory report is included in Appendix L.

3.4.3 4th-Quarter 2008 Groundwater Sampling Event (November 17 – 18, 2008)

The groundwater sampling event collected water samples from all wells, in general accordance with the low flow sampling program, however, the water column in well MW-121 was below the bladder intake and a peristaltic pump was used to collect the sample at this well. Otherwise the sampling program was conducted routinely and water samples were submitted for VOCs under EPA Test Method 8260. Appendix D provides the field sampling logs for the sampling events. A summary of the VOCs detections are noted in the table below.

Summary Table of November-08 VOC Sampling

		PCE	TCE	11DCE	cDCE	VC	111TCA	11DCA
SITE	**DATE**	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
DEC-GW-STD		5	5	5	5	2	5	5
MW-114	11/17/08	71	23	2.8	5.5	1.5	9	3.2
MW-115	11/17/08	30	9.1	16	16	9.2	24	47
MW-116	11/18/08	3.6	1.1	< 1	1.4	< 1	< 1	2.4
MW-117	11/17/08	26	< 1	< 1	< 1	< 1	< 1	< 1
MW-118	11/18/08	8.4	450	10	210	49	24	57
MW-119	11/18/08	6.9	42	2.4	45	24	18	62
MW-120	11/17/08	8.8	19	1.5	49	5.3	24	28
MW-121	11/17/08	8.4	7.7	< 1	12	2.1	4.4	8.1
MW-122	11/17/08	< 20	43	20	1,200	580	81	160
MW-123	11/17/08	0.44	< 1	< 1	< 1	< 1	< 1	< 1
MW-124s	11/18/08	< 4	< 4	< 1	5.2	4.3	< 4	160
MW-124d	11/18/08	< 1	120	34	1,600	770	< 20	510

Concentrations in ug/L
DEC-GW-STD = groundwater cleanup standards

In general, significant decreases in the VOCs detected in groundwater were observed from the November 2008 Groundwater Sampling Event, as described as follows. Figure 64, Tetrachloroethene Concentrations in Groundwater - November 2008, depicts a marked change in the one of the primary chlorinated VOCs from pre-injection monitoring periods. In November 2008, the first post-IRM injection sampling event, the highest PCE concentrations are no longer detected at MW-118, decreasing from 3,200 ug/L in August 2008, to 8.4 ug/L in November 2008. Downgradient of MW-118 PCE was not detected at or above the laboratory MDL at MW-124s, MW-124d or MW-122. The primary areas of PCE detected were upgradient at MW-117 at a concentration of 26 ug/L, and in an arc encompassing MW-115 at a concentration of 30 ug/L, and MW-114 at 71 ug/L. The change in PCE concentrations is shown in profile on Figure 65, Tetrachloroethene Concentrations in Groundwater, Cross Section A-A' - November 2008, which indicates significant reduction on PCE concentrations in groundwater approximately 1-month following the IRM injection.

Figure 66, Trichloroethene Concentrations in Groundwater - November 2008, also depicts a vastly reduced area of TCE impacted groundwater following the IRM injection, with the highest concentrations detected at MW-118 at 450 ug/L (reduction from 1,800 ug/L in August 2008), decreasing downgradient at MW-124d at 120 ug/L and MW-122 at 43 ug/L. This reduction in TCE is shown in profile on Figure 67, Trichloroethene Concentrations in Groundwater, Cross Section A-A' - November 2008.

Figure 68, 1,1,1-Trichlorethane Concentrations in Groundwater - November 2008, also depicts a significant change in the area and concentrations of 111TCA impacted groundwater. The primary area of 111TCA occurs in an arc extending in the north at MW-115 with a concentration of 24 ug/L, southeastward to MW-118 and MW-120 each with a concentration of 24 ug/L, and eastward to MW-122 with a concentration of 81 ug/L. The MW-124 nest, with concentrations less than the laboratory MDL separates these areas as shown on Figure 69, 1,1,1-Trichlorethane Concentrations in Groundwater, Cross Section A-A' - November 2008.

Figure 70, depicts a plume configuration similar to earlier monitoring periods in April 2008 (Figure 46) and August 2008 (Figure 56), where one of the primary areas of cDCE impacts is located at MW-122 (1,200 ug/L) and MW-124d (1,600 ug/L). In the source area at MW-118 biodegradation is accelerating, within one month of the IRM injection. As expected, with a pre-IRM cDCE stall of the degradation process, the configuration of the cDCE plume may take the longest to appreciably change as the primary chlorinated VOCs degrade to and from cDCE to VC, ethene, ethane, CO_2 and water (Figure 71). Highly chlorinated VOCs are reduced relatively easily because their carbon atoms are highly oxidized. During direct reactions, the microorganism causing the reaction gains energy or grows as the VOC is degraded or oxidized. During cometabolic reactions, the VOC degradation or oxidation is caused by an enzyme or co-factor produced during microbial metabolism. VOC degradation or oxidation does not yield any energy or growth benefit for the microorganism mediating the cometabolic reaction (EPA, 2000).

In Situ Biodegradation Mechanisms

	Aerobic Oxidation		Anaerobic Reductive Dechlorination	
	Direct	**Cometabolic**	**Direct**	**Cometabolic**
Chlorinated Ethenes				
PCE	X	X	◇	◇
TCE	X	◇	◇	◇
cDCE	X	◇	◇	◇
tDCE	X	◇	◇	◇
11DCE	X	◇	◇	◇
VC	◇	◇	◇	◇
Chlorinated Ethanes				
111TCA	X	◇	X	◇
12DCA	◇	X	X	◇
11DCA	◇	X	X	◇
Chloroethane	X	X	X	X
Chlorinated Methanes				
carbon tetrachloride	X	X	X	◇
chloroform	X	◇	X	◇
methylene chloride	◇	◇	◇	◇
chloromethane	◇	◇	X	X

Adapted from RTDF 1997; ITRC 1998; EPA 1998

◇ = Typically occurring
X = Not typically occurring

As noted in the table above, the goal of the IRM is to drive the subsurface anaerobically and produce cometabolic reactions to destroy the chlorinated ethenes, chlorinated ethanes, and chlorinated methanes.

Figure 72, 1,1-Dichloroethane Concentrations in Groundwater - November 2008, shows the contraction of the area of groundwater impacted by 11DCA. The primary change in the plume configuration from earlier monitoring events is the reductions noted in the VOC source area at and near MW-118 (57 ug/L in November 2009 v 500 ug/L detected in August 2008), and the areal distribution of 11DCA. The primary zone of 11DCA detection was at MW-122 (160 ug/L), and at MW-124d (510 ug/L), with the concentration decreasing rapidly downgradient to non-detectable concentrations at MW-123, as noted on Figure 73.

Figure 74, VC Concentrations in Groundwater - November 2008, also depicts a narrow zone of VC centered at MW-124d with a concentration of 770 ug/L, and downgradient to MW-122 at 580 ug/L. The reduction in VC in the MW-118 area is significant compared to earlier monitoring events in April and August 2008, as shown on Figure 75, Vinyl Chloride Concentrations in Groundwater, Cross Section A-A' - November 2008.

One of the most notable developments in the November 2008, groundwater sampling event is the change in the area of the highest concentrations, or greatest VOC mass, which historically was detected at MW-118, but has shifted downgradient to MW-124d and MW-122, as depicted on Figure 76, Total VOCs in Groundwater - November 2008. The principle change in the first month post-IRM injection is the reduction of the primary chlorinated VOCs in the source area at MW-118, the slight increase in VOCs upgradient at MW-117, which was not unexpected, and the increase of daughter products downgradient of MW-118. The analytical laboratory report for this sampling event is included in Appendix G.

3.4.4 2nd-Quarter 2009 Groundwater Sampling Event (April 27 – 29, 2009)

The 2nd-Quarter 2009 Groundwater Sampling Event was conducted April 27 – 29, 2009. This represents the 2nd post-injection groundwater sampling event, and all groundwater monitoring wells were sampled in general accordance with the low flow sampling program, however, the groundwater recharge was sufficiently slow even at low-flow pumping rates that the water column was insufficient to sample wells MW-114, MW-116, MW-120, and MW-121 with a bladder pump, and samples from these wells were collected from a low-flow peristaltic pump. Otherwise the sampling program was conducted routinely and water quality samples were submitted for VOCs under EPA Test Method 8260. Appendix D provides the field sampling logs for the sampling events.

The general trend in VOCs in groundwater after the October 2008 injection have been decreasing, particularly in the parent chlorinated VOCs – PCE, TCE, and 111TCA as summarized in the table below.

Summary Table of April-09 VOC Sampling

		PCE	TCE	11DCE	cDCE	tDCE	VC	111TCA	11DCA
SITE	**DATE**	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
DEC-GW-STD		**5**	**5**	**5**	**5**	**5**	**2**	**5**	**5**
MW-114	**4/28/09**	53	16	1.9	4.5	< 1	1.4	7.3	2.3
MW-115	**4/28/09**	22	3.9	2.4	4.4	< 1	0.7	9.6	12
MW-116	**4/28/09**	0.37	< 1	< 1	14	< 1	1.3	< 1	0.78
MW-117	**4/28/09**	4	0.73	< 1	0.41	< 1	< 1	< 1	< 1
MW-118	**4/29/09**	< 10	11	490	7,800	100	310	1,700	1,400
MW-119	**4/28/09**	< 1	0.7	0.51	31	1.5	25	8.7	65
MW-120	**4/28/09**	8.4	17	0.74	42	0.62	4.9	19	21
MW-121	**4/27/09**	0.7	3.1	< 1	5.7	< 1	< 1	2.2	3.7
MW-122	**4/27/09**	< 20	44	16	1,000	22	510	73	140
MW-123	**4/27/09**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
MW-124s	**4/28/09**	< 1	0.83	< 1	4.7	7	3.3	0.7	130
MW-124d	**4/28/09**	4.2	30	27	1,300	15	760	44	720

DEC-GW-STD = NYSDEC groundwater standard, in ug/L
Analytes in bold exceed DEC-GW-STD

In general, the primary chlorinated VOCs continued to decrease in groundwater as detected in the April 2009 Groundwater Sampling Event, as described as follows.

Figure 77, Tetrachloroethene Concentrations in Groundwater - April 2009, depicts a marked reduction in PCE from 1-year earlier (Figure 43), with a reduction at MW-118 from 3,100 ug/L to less than 10 ug/L, and a reduction at MW-119 from 24 ug/L to less than 1 ug/L. This reduction is shown along the primary groundwater flowpath from MW-117 to the drainage ditch in Figure 78, where the PCE concentrations have been effectively reduced by the ERD program. Although the VOC levels remain elevated at MW-118 above the NYSDEC groundwater standard, the TCE concentrations have also decreased dramatically since the injection, as shown on Figure 79, Trichloroethene Concentration in Groundwater - April 2009, and in profile on Figure 80, TCE Detected in Groundwater; April 2009 - Cross Section A-A'.

The 111TCA concentrations in groundwater in April 2009 also depicts a marked reduction in concentration from 1-year earlier with a decline at MW-118 from 4,900 ug/L to 1,700 ug/L, a reduction at MW-119 from 31 ug/L to 8.7 ug/L, and at MW-122 a decrease from 160 ug/L to 73 ug/L (Figure 81). This reduction is shown in profile on Figure 82, 1,1,1-Trichlorethane Concentrations in Groundwater, Cross Section A-A' - April 2009.

The transition of the primary chlorinated VOCs (PCE, TCE, 111TCA) to breakdown products is shown well on Figure 83, cis-1,2-Dichloroethene Concentrations in Groundwater - April 2009, with the increase most dramatic in the source area at MW-118, and downgradient at wells MW-124d and MW-122. In profile this trend is depicted on Figure 84, cis-1,2-Dichloroethene Concentrations in Groundwater, Cross Section A-A' - April 2009. The concentrations of 11DCA exhibit an increase in concentrations from April 2008 to April 2009 at MW-118 (Figure 85) from 670 ug/L to 1,400 ug/L, at MW-119 an increase from 33 ug/L to 65 ug/L, and at MW-122 a decrease from 240 ug/L to 140 ug/L. This change is shown in profile on Figure 86, 1,1-Dichloroethane Concentrations in Groundwater, Cross Section A-A' - April 2009. The pattern of detection for vinyl chloride concentrations in groundwater in April 2009 shows a similar trend (Figure 87), however, the concentrations are lower than the previous year. In profile this trend is depicted on Figure 88, Vinyl Chloride Concentrations in Groundwater, Cross Section A-A' -April 200.

The April 2009 Groundwater Laboratory Report for this sampling event is included as Appendix H to this report.

3.4.5 3rd-Quarter 2009 Groundwater Sampling Event (August 3 – 4, 2009)

The 3rd-Quarter 2009 Groundwater Sampling Event was conducted August 3 – 4, 2009. This represents the 3rd post-injection groundwater sampling event, and all groundwater monitoring wells were sampled. The groundwater sampling event collected water samples from all wells, in general accordance with the low flow sampling program, however, the water column in well MW-121 was below the bladder intake and a peristaltic pump was used to collect the sample. Otherwise the sampling program was conducted routinely and water quality samples were submitted for VOCs under EPA Test Method 8260. Appendix D provides the field sampling logs for the sampling events.

The decreasing trend of VOCs in groundwater is evident, particularly in the parent chlorinated VOCs - PCE, TCE, and 111TCA, while breakdown products have shown an increase, particularly cDCE, 11DCA, 11DCE, and VC, as summarized in the table below.

Summary Table of August-09 Groundwater VOC Sampling

		PCE	TCE	11DCE	cDCE	VC	111TCA	11DCA
SITE	**DATE**	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
DEC-Standard		5	5	5	5	2	5	5
MW-114	8/4/09	23	57	2.6	17	2.4	11	4
MW-115	8/3/09	33	9.5	7.7	13	3.7	22	33
MW-116	8/4/09	< 1	0.53	< 1	1.9	0.75	< 1	3.6
MW-117	8/4/09	2.1	< 1	< 1	6.9	< 1	< 1	< 1
MW-118	8/4/09	< 10	< 10	460	10,000	550	2,300	1,500
MW-119	8/4/09	< 1	1.1	< 1	12	30	3.7	45
MW-120	8/4/09	7.4	16	0.92	40	8.7	19	25
MW-121	8/3/09	13	8.7	0.37	18	7.1	5.4	12
MW-122	8/3/09	< 10	30	9.1	590	360	47	93
MW-123	8/3/09	0.72	< 1	1.2	0.54	< 1	0.27	4.1
MW-124s	8/4/09	< 1	0.51	< 1	1.3	1.4	< 1	4.5
MW-124d	8/4/09	< 5	17	17	720	510	8.4	470

DEC-GW-STD = NYSDEC groundwater standard, in ug/L
Analytes in bold exceed DEC-GW-STD

In general, the primary chlorinated VOCs continued to decrease in groundwater as detected in the August 2009 Groundwater Sampling Event, as described as follows. Compared to the August 2008, sampling results the 3rd Quarter 2009 sampling continues to depict a marked reduction in PCE (Figure 50), with a reduction at MW-118 from 3,200 ug/L to less than 10 ug/L, a reduction at MW-119 from 34 ug/L to less than 1 ug/L, and at MW-116 a reduction from 530 ug/L to less than 1 ug/L (Figure 89). Along the primary groundwater flowpath to the east, PCE was detected at the upgradient location at MW-117 at 2.1 ug/L, with no detection in the drainage ditch at SW-2 at or above the MDL, and a concentration of 0.72 ug/L PCE at MW-123, as shown on Figure 90, Tetrachloroethene Concentrations in Groundwater, Cross Section A-A' - August 2009. The reduction of the another primary chlorinated solvent, TCE, continues the downward trend with a reduction in concentration between August 2008 to August 2009, highlighted at MW-118 from 1,500 ug/L to less than 10 ug/L, at MW-119 from 110 ug/L to less than 1 ug/L, and a reduction at MW-116 from 62 ug/L to less than 1 ug/L (Figure 91). This is shown in profile on Figure 92, TCE Detected in Groundwater; August 2009 - Cross Section A-A'.

The levels of 111TCA detected in groundwater at MW-118 reduced by 5,400 ug/L between September 2007 and August 2009, and continues the post-injection decline, as shown on Figure 93, 111TCA Concentration in Groundwater - August 2009. In profile, the 111TCA concentrations in groundwater are restricted to the MW-118 area with a small impacted zone located west of the drainage ditch at MW-122, as shown on Figure 94, 111TCA Detected in Groundwater; August 2009 - Cross Section A-A'. With continued development of the ERD zone this area will continue to decrease in size and concentration.

Figure 95, cis-1,2-Dichloroethene Concentrations in Groundwater - August 2009, demonstrates that by August 2009, the VOC of highest concentration at MW-118 is cDCE. The decrease in the primary chlorinated VOCs by August 2009 at MW-118 are shown on Figure 96, and it is this compound which is generally the most difficult to eliminate, known as the “cDCE stall”, which will require monitoring and further evaluation to determine the rate of reductive dechlorination. An evaluation of the molar equivalents (Appendix O), at MW-118 demonstrates this issue. The following discussion is a narrative of the molar equivalent charts located in Appendix O.

MW-116 - this chart shows a greater diversity of VOCs prior to the IRM injection, including up to a combined 45 % TCE and PCE. Post injection the predominant VOC is acetone, a common byproduct detected in ERD zones shortly after the injection. Acetone is typically quickly consumed over time, as shown on this chart. Post-injection VOCs (other than acetone) indicate the predominance of cDCE, 11DCA, and VC.

MW-118 - this chart demonstrates the high proportion of PCE and TCE in groundwater (up to 60 %) in the source area prior to the injection program. Conversely, this is also evidence of the relatively moderate reductive dechlorination that occurred prior to the IRM. Shortly after the injection, the PCE and TCE have been eliminated, with a corresponding increase in cDCE, as expected (Appendix O).

MW-119 - this chart, similar to MW-118, indicated pre-injection molar fractions dominated by as much as 45 % combined PCE and TCE. Shortly after the Oct-08 injection program the PCE has been removed, with a minor molar fraction of TCE remaining. Post-injection VOCs are dominated by 11DCA, cDCE and VC.

MW-122 - this well exhibits the greatest persistence of the primary chlorinated solvents PCE and TCE. While the molar equivalents have not changed markedly since the injection, the overall reduction of VOCs by roughly two-thirds of the pre-injection concentrations are encouraging, and this well appears to lag the other downgradient wells in reductive dechlorination. This is supported by the persistence of tDCE, which suggests some abiotic oxidation is occurring.

MW-124s - the suite of VOCs detected at this well is dissimilar to adjacent wells, and suggest a different source, or advanced reductive dechlorination prior to the IRM. The groundwater environment pre-injection is dominated by 11DCA (<70%), which shows a progressive trend in reduction, accompanied by positive molar equivalents of chloroethane, acetone, and methyl ethyl ketone. The persistence of toluene, ethyl benzene and xylenes and this wells geographic proximity to the adjacent railroad is concerning, and will be continue to be monitored.

MW-124d - the evolution of the ERD program at this deeper nested well starts out similar to MW-124s with a dominant 11DCA VOC fraction, but shortly after the injection TCE, PCE and 111TCA are detected. This condition was not unexpected due to co-solvent effects upgradient, and the increasing trend toward daughter products in the August 2009 sampling event is encouraging. Again, similar to MW-122 the overall VOC reduction by almost between November 2008 and August 2009 is a positive trend.

Evidence of further reductive dechlorination is depicted at various wells for the primary solvent breakdown products from TCE and 111TCA, as noted in the isoconcentration graphs in Appendix M, an example provided on Figure 97, 1,1-Dichloroethene Concentration in Groundwater - August 2009, and in profile on Figure 98. The pattern of detection for vinyl chloride concentrations in groundwater in August 2009 shows a similar trend with a reduction at MW-118 from 800 ug/L to less than 550 ug/L, and a reduction at MW-122 from 1,000 ug/L to 360 ug/L (Figure 99). This is shown in profile on Figure 100, Vinyl Chloride Concentrations in Groundwater, Cross Section A-A' - August 2009. The August 2009 Groundwater Laboratory Report for this sampling event is included as Appendix I to this report.

3.4.5.1 3rd-Quarter 2009 Surface Water Sampling (Aug. 3 – 4, 2009)

During the August 2009, groundwater sampling event surface water samples were collected at the historic sampling locations SW-1, SW-2 and SW-3. These results are provided on Figure 101, Surface Water Quality Sampling Results - VOCs, August 2009, which indicates the VOCs were detected coincident with the area of primary groundwater impacts near monitoring well MW-122. To put these sampling results in a historical context, this sampling event shows a VOC decrease in SW-1 and SW-3, and a slight increase in concentration at SW-2, as shown on Figure 102, Historical Surface Water Quality Sampling Results – TVOCs. This data is summarized in the table below.

Summary Table of August-09 Surface Water VOC Sampling

		PCE (µg/L)	**TCE** (µg/L)	**11DCE** (µg/L)	**cDCE** (µg/L)	**VC** (µg/L)	**111TCA** (µg/L)	**11DCA** (µg/L)
NYSDEC Class D Surface Water		**1 (GV)**	**40**	**NS**	**NS**	**NS**	**NS**	**NS**
SW-1	**8/4/09**	< 1	< 1	< 1	< 1	< 1	< 1	< 1
SW-2	**8/4/09**	< 1	J 0.65	J 0.49	8.8	3.0	J 0.86	5.7
SW-3	**8/4/09**	< 1	< 1	< 1	4.2	0.40	J 0.39	3.7

J = Analyte detected at a level less than the Reporting Limit (RL) and greater than or equal to the MDL. Concentrations within this range are estimated.
GV = guidance value. NS = no standard

4.0 IRM PROGRESS SUMMARY

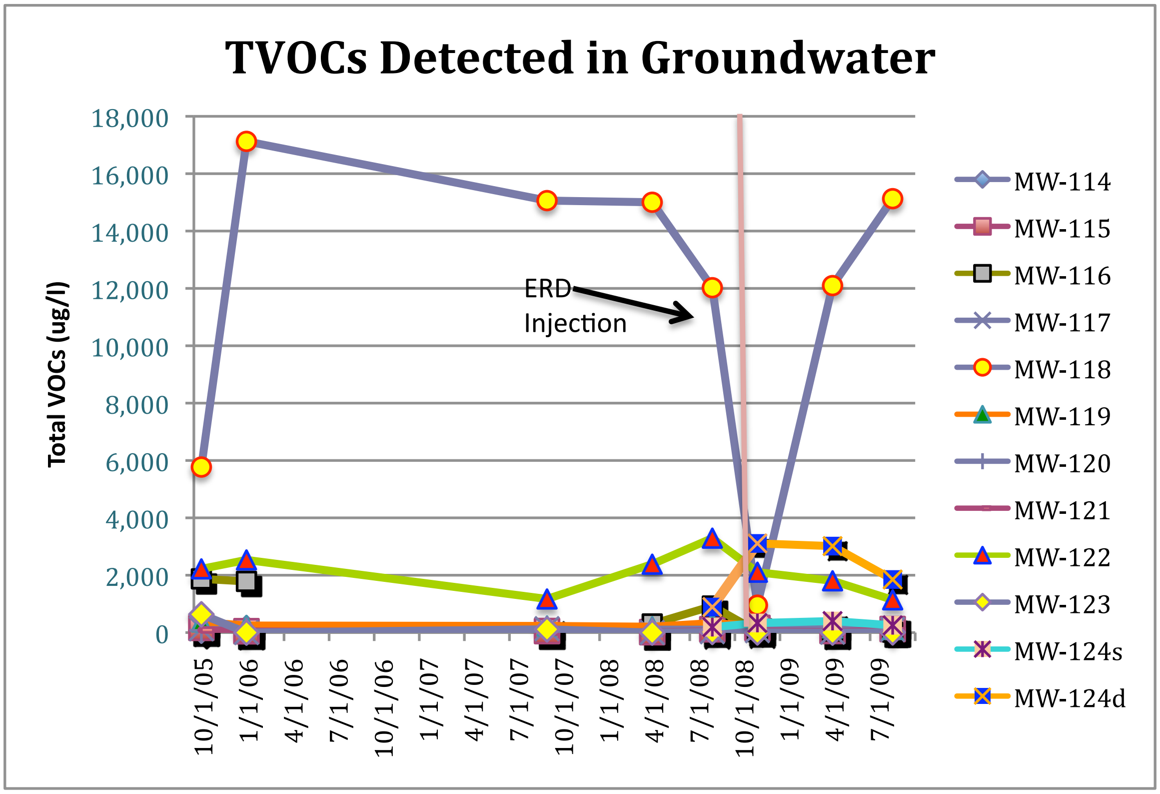
As noted in the previous sections, the IRM groundwater monitoring program demonstrates the continued evolution of the ERD process, and the corresponding decrease in VOC concentrations in groundwater across the site. A total of 2,640 gallons of Newman Zone was injected with 23,361 gallons of water at 106 points at an average concentration of 5.2 % EVO. The EVO portion of the IRM included 26,001 gallons of injectate, or approximately 2,601 gallons per day. A total of 95 gallons of Z-Loy was injected with 1,135 gallons of water at 23 points at an average concentration of 8.3 % nZVI. The nZVI injection portion of the IRM included 1,230 gallons of injectate, or approximately 430 gallons injected per the 3-day program.

The IRM injection program provided for an infusion of TOC into the groundwater flow system, which coupled with the nZVI reduced the subsurface environment anaerobically, provided a food-source for the indigenous biological community, which up through August 2009, remains sufficient to sustain the ERD program. This data is shown graphically on Figure 103, Post-IRM Expansion of TOC Concentrations Exceeding 100 mg/L in Groundwater. The TOC concentrations overlap well with the TVOC impacted groundwater zone, and in fact the areas of highest TOC overlaps well with the area of primary cDCE concentrations in groundwater, as shown on Figure 104, cDCE and TOC Concentrations in Groundwater - August 2009. The primary chlorinated VOC degradation at MW-118 is summarized in the table below.

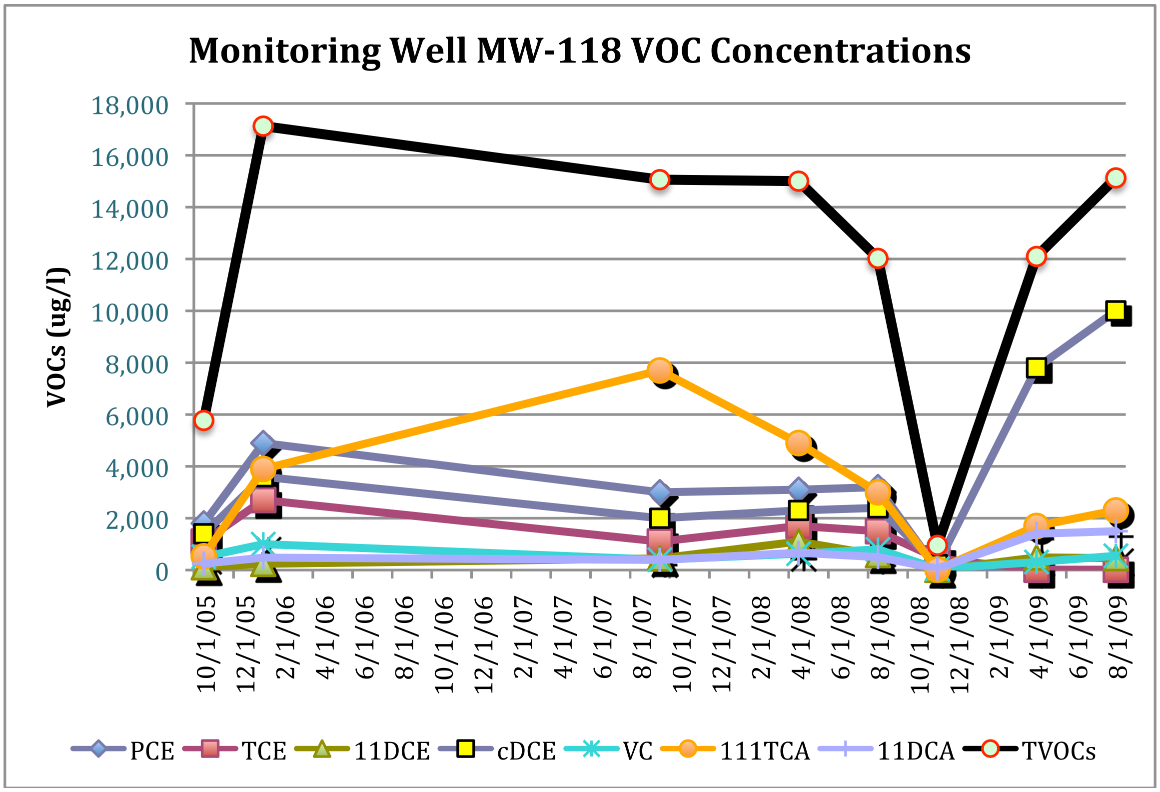
Summary Table of Primary Chlorinated VOCs at MW-118

	Date	PCE (ug/L)	TCE (ug/L)	111TCA (ug/L)	
MW-118	10/18/05	1,800	1,100	530	
MW-118	1/12/06	4,900	2,700	3,900	
MW-118	9/26/07	3,000	1,100	7,700	
MW-118	4/9/08	3,100	1,700	4,900	
MW-118	8/4/08	3,200	1,500	3,000	⇐injection
MW-118	11/18/08	8.4	450	24	
MW-118	4/29/09	< 10	11	1,700	
MW-118	8/4/09	< 10	< 10	2,300	

At other locations VOC concentrations at MW-114 have decreased by more than 16% since the baseline pre-IRM sampling conducted in August 2008, and concentrations at well MW-115 have increased by approximately 5%. VOC concentrations at well MW-116 have decreased by more than 5,000%, while concentrations at well MW-117 have increased by approximately 72%. VOC concentrations at well MW-118 have increased by 20% essentially all daughter products, indicating a flushing and reduction of VOCs adsorbed to soil. The VOC concentrations at well MW-119 have decreased by more than 194%, while the concentrations at well MW-120 have increased by approximately 13%, and concentrations at well MW-121 have increased by approximately 31%. The VOC concentrations at well MW-122 have decreased by more than 188%, and the concentrations at well MW-123 have decreased by more than 238%. In newly installed MW-124s the concentrations have increased by approximately 25%, and concentrations at well MW-124d have increased by approximately 52%. The chart below demonstrates the total VOC trends site-wide.



Concentrations of PCE and TCE in the primary source area at MW-118 continue to decline, as



expected, and is noted in these charts above, with the principle chlorinated VOCs in groundwater at MW-118 being cDCE. An example of this reduction in the primary chlorinated compounds in the source area at MW-118 is highlighted in the chart below, which shows the change in primary VOCs from 111TCA, PCE and TCE pre-injection to cDCE post-IRM injection. This is an indication that ERD was proceeding prior to the injection program. This data directly supports monitoring and sampling history which has not detected any NAPL mass dissolving and liberating VOCs into the groundwater environment as the primary chlorinated VOCs – PCE, TCE, 1111TCA are gone. The degradation of VOCs in groundwater is the direct result of the IRM ERD process in both the unsaturated and saturated zone. Specifically, the trend of VOCs in groundwater is progressing as expected.

This post-injection sampling program demonstrates the reduction of the primary chlorinated VOCs, principally PCE (Figure 105), between August 2008 to August 2009, as well as reductions in TCE (Figure 106), and 111TCA (Figure 107). During this time, a 1,000 ug/L increase has been seen at MW-118 in 11DCA (Figure 108), a 7,600 ug/L increase in cDCE between August 2008 to August 2009 is exhibited at MW-118 (Figure 109), and downgradient at MW-124d an increase in more than 400 ug/L of VC (Figure 110), has been detected. Continued monitoring will further establish these trends, and determine if further injections are necessary to maintain the ERD zone.

The data provided above are representative of questions NYSDEC posed to H.B Fuller in mid-2009. Table 7 provides a Checklist for NYSDEC Technical Considerations from the July 10, 2009, e-mail.

5.0 RECOMMENDATIONS

Consistent with the schedule presented in Section 4.6 of the approved IRM Workplan, as well as based on the positive results of the IRM groundwater monitoring program, H.B. Fuller recommends continued water quality sampling for the remainder of 2010. To maintain the consistency with the previous groundwater sampling events, H.B. Fuller recommends sampling in the 2nd Quarter 2010 (April-May), the 3rd Quarter 2010 (June-July), and the 4th Quarter (Oct-Nov) 2010. This proposed sampling would consist of the following:

2nd Quarter 2010

All groundwater monitoring wells sampled for VOCs (EPA 8260), TOC (9060), and field parameters - temperature (°C), ORP (mV), pH (SU), DO, and specific conductance. Additionally, a BioTrap™ will be installed in MW-118 and left to incubate for 60+ days. Upon retrieval the sample will be run for the same parameters as the December 2007 sample (PFLA, Census, Quantitative PCR, DGGE, metabolic acids).

3rd Quarter 2010

All groundwater monitoring wells and surface water locations (SW-1, SW-2, and SW-3) will be sampled for VOCs (EPA 8260). Monitoring wells will also be sampled for TOC (9060), and field parameters - temperature (°C), ORP (mV), pH (SU), DO, and specific conductance. Additionally, IRM performance monitoring samples will be collected for total and dissolved iron and manganese (EPA 6010), Biochemical Oxygen Demand (405.1), Chemical Oxygen Demand (410.4), Chloride (9056), Nitrate-Nitrite (300), Sulfate and Sulfide (9056), Total Kjeldahl Nitrogen (300), Total Phosphorous (365.2), Ethane, Ethene, Methane (AM18 or AM20GAX) and Carbon Dioxide (RSK114).

4th Quarter 2010

All groundwater monitoring wells sampled for VOCs (EPA 8260), TOC (9060), and for field parameters temperature (°C), ORP (mV), pH (SU), DO, and specific conductance.

At the culmination of the 2010 groundwater sampling program a *IRM Performance Monitoring Report* will be prepared and submitted to NYSDEC summarizing the groundwater monitoring data collected to-date. As common in many in-situ bioremediation programs, based on performance monitoring, adjustments may be necessary and a re-application of the amendment is sometimes required. The Contingency Plan for this IRM would be re-application of the amendments, to be implemented based on the results of the performance monitoring program.

6.0 REFERENCES

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Table 1
Groundwater Monitoring Well Construction Details
Former Monarch Chemicals Facility
61 Gates Avenue, Geneva, New York
VCP No. V00119-8

	Top of Casing Elevation (ft AMSL)	Depth of Borehole (ft below TOC)	Well Diameter (in)	Casing Material	Screen Material	Screen Slot Size (in)	Screen Length (ft)	Total Well Depth (ft below TOC)	Measured Well Depth (ft below TOC)	Occlusion Depth	Height of TOC (ft. above surface)	Bottom Sump Depth (ft)	Depth to Top of Screen (ft below TOC)	Top of Screen Elevation (ft AMSL)	Depth to Bottom of Screen (ft below TOC)	Bottom of Screen Elevation (ft AMSL)	Date Installed
MW-114	462.03	16	2	PVC	unk	0.01	10	14.0	13.51	0.49	0	0	4.0	458.03	14.0	448.52	7/15/05
MW-115	462.25	16	2	PVC	unk	0.01	10	14.0	13.11	0.89	0	0	4.0	458.25	14.0	449.14	7/13/05
MW-116	462.44	16	2	PVC	unk	0.01	10	13.9	13.48	0.42	0	0	3.9	458.54	13.9	448.96	7/13/05
MW-117	463.44	16	2	PVC	unk	0.01	10	13.7	13.50	0.20	unk	0	3.7	459.74	13.7	449.94	7/13/05
MW-118	462.40	16	2	PVC	unk	0.01	10	14.0	13.28	0.72	0	0	4.0	458.40	14.0	449.12	7/13/05
MW-119	462.68	16	2	PVC	unk	0.01	10	14.0	13.56	0.44	0	0	4.0	458.68	14.0	449.12	7/12/05
MW-120	462.12	16	2	PVC	unk	0.01	10	14.0	13.55	0.45	0	0	4.0	458.12	14.0	448.57	7/12/05
MW-121	461.77	16	2	PVC	unk	0.01	10	14.0	13.97	0.03	0	0	4.0	457.77	14.0	447.80	7/14/05
MW-122	461.65	16	2	PVC	unk	0.01	10	14.0	13.55	0.45	0	0	4.0	457.65	14.0	448.10	7/14/05
MW-123	456.42	16	2	PVC	unk	0.01	10	16.5	15.70	0.80	0.5	0	6.5	449.92	16.5	440.72	7/15/05
MW-124d	462.33	24	2	PVC	stainless	0.01	5	21.0	21.00	0.00	0	0	16.0	446.33	21.0	441.33	8/15/08
MW-124s	462.25	14	2	PVC	stainless	0.01	10	12.5	12.50	0.00	0	0	2.5	459.75	12.5	449.75	8/15/08

Table 2
Historical Soil Analytical Data - VOCs
Former Monarch Chemicals Facility
61 Gates Ave., Geneva, NY
VCP No. V00119-8

Location Analyte Depth (ft bgs)	Units	TAGM 4046 Soil Cleanup Objective (ug/Kg)	MW-114 2 - 4	MW-114 8 - 12	MW-115 1 - 4	MW-115 8 - 12	MW-116 2 - 4	MW-116 8 - 14	MW-117 6 - 10	MW-117 12 - 16	MW-118 2 - 4	MW-118 6 - 11
Vinyl chloride	ug/Kg	**200**	ND	ND	ND	ND	**3 J**	ND	ND	ND	ND	ND
Chloroethane	ug/Kg	**1,900**	ND	ND	ND	ND	**2 J**	ND	ND	ND	ND	ND
Methylene chloride	ug/Kg	**100**	**7 J**	**7 J**	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	ug/Kg	**200**	ND	ND	ND	**3 J**	**70**	**5 J**	**15**	**7 J**	**4 J**	**8 J**
Carbon disulfide	ug/Kg	**2,700**	ND	ND	ND	ND	**4 J**	ND	ND	ND	ND	ND
1,1-Dichloroethene	ug/Kg	**400**	ND	ND	ND	ND	ND	ND	ND	**100**	ND	ND
1,1-Dichloroethane	ug/Kg	**200**	ND	ND	ND	ND	ND	ND	ND	**93**	**4 J**	ND
Chloroform	ug/Kg	**300**	ND	ND	ND	ND	ND	ND	ND	ND	**1 J**	ND
2-Butanone	ug/Kg	**300**	ND	ND	ND	ND	**12**	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ug/Kg	**800**	**6 J**	ND	ND	ND	**7 J**	**1 J**	ND	ND	**44**	ND
Trichloroethene	ug/Kg	**700**	**160**	**5 J**	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	ug/Kg	**60**	ND	ND	ND	ND	**16**	ND	ND	**1 J**	ND	ND
Tetrachloroethene	ug/Kg	**1,400**	**51**	**8 J**	ND	**1 J**	**8 J**	**66**	**1 J**	ND	**75**	**8 J**
Toluene	ug/Kg	**1,500**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	ug/Kg	**5,500**	ND	ND	ND	ND	**9 J**	ND	**170**	ND	ND	ND
Styrene	ug/Kg	**NS**	ND	ND	ND	ND	**3 J**	ND	ND	ND	ND	ND
Xylene (total)	ug/Kg	**1,200**	ND	ND	ND	ND	**22**	ND	**200**	ND	ND	ND
cis-1,2-Dichloroethene	ug/Kg	**250**	ND	ND	ND	ND	**53**	**2 J**	ND	**8 J**	**4 J**	**8 J**
trans-1,2-Dichloroethene	ug/Kg	**300**	**2 J**	ND	ND	ND	**4 J**	ND	ND	ND	ND	ND
Dichlorodifluoromethane	ug/Kg	**NS**	ND	ND	ND	ND	**4 J**	ND	**2 J**	ND	**2 J**	ND
Cyclohexane	ug/Kg	**NS**	ND	ND	ND	ND	ND	ND	**23**	ND	ND	ND
Methylcyclohexane	ug/Kg	**NS**	ND	ND	ND	ND	ND	ND	**120**	ND	ND	ND
Isopropylbenzene	ug/Kg	**2,300**	ND	ND	ND	ND	**2 J**	ND	**200**	**2 J**	ND	ND

Notes:
ND = compound not detected
at or above MDL
NS = no standard

J = estimated value
B = analyte detected in blank

Table 2
Historical Soil Analytical Data - VOCs
Former Monarch Chemicals Facility
61 Gates Ave., Geneva, NY
VCP No. V00119-8

Location Analyte Depth (ft bgs)	Units	TAGM 4046 Soil Cleanup Objective (ug/Kg)	MW-119 2 - 4	MW-119 8 - 12	MW-120 2 - 4	MW-120 8 - 12	MW-121 2 - 4	MW-121 8 - 12	MW-122 2 - 4	MW-122 8 - 12	MW-123 8 - 12	MW-123 12 - 16
Vinyl chloride	ug/Kg	**200**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	ug/Kg	**1,900**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	ug/Kg	**100**	ND	ND	ND	ND	ND	**8 J**	**11 J**	**12**	**6 J**	**5 J**
Acetone	ug/Kg	**200**	**5 J**	**6 J**	**50**	**7 J**	ND	ND	ND	**4 J**	ND	ND
Carbon disulfide	ug/Kg	**2,700**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	ug/Kg	**400**	ND	ND	ND	ND	ND	ND	ND	ND	**35**	**21**
1,1-Dichloroethane	ug/Kg	**200**	**5 J**	ND	**4 J**	ND	ND	**2 J**	ND	ND	**160**	**140**
Chloroform	ug/Kg	**300**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	ug/Kg	**300**	ND	ND	**14**	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ug/Kg	**800**	**18**	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	ug/Kg	**700**	**180**	ND	ND	ND	ND	**3 J**	ND	ND	**5 J**	ND
Benzene	ug/Kg	**60**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	ug/Kg	**1,400**	**18**	**5 J**	ND	**1 J**	ND	ND	ND	ND	**17**	**3 J**
Toluene	ug/Kg	**1,500**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	ug/Kg	**5,500**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Styrene	ug/Kg	**NS**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylene (total)	ug/Kg	**1,200**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	ug/Kg	**250**	**26**	**2 J**	ND	**1 J**	ND	**3 J**	ND	**2 J**	**4 J**	**1 J**
trans-1,2-Dichloroethene	ug/Kg	**300**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	ug/Kg	**NS**	**2 J**	ND	ND	ND	**2 J**	ND	ND	ND	ND	ND
Cyclohexane	ug/Kg	**NS**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylcyclohexane	ug/Kg	**NS**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene	ug/Kg	**2,300**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:
ND = compound not detected
at or above MDL
NS = no standard

J = estimated value
B = analyte detected in blank

Table 2
Historical Soil Analytical Data - VOCs
Former Monarch Chemicals Facility
61 Gates Ave., Geneva, NY
VCP No. V00119-8

Location Analyte	Units	TAGM 4046 Soil Cleanup Objective	MW-124s	MW-124d	SB-12	SB-12	SBC-16	SB-16	SB-11	SB-11
Depth (ft bgs)		(ug/Kg)	10 -12	20 - 21	4 - 8	8 - 12	2 - 4	8 - 12	2 - 4	8 - 12
Vinyl chloride	ug/Kg	**200**	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	ug/Kg	**1,900**	ND	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	ug/Kg	**100**	**9 B**	**8 B**	**6 J**	**8 J**	ND	**8 J**	**8 J**	**6 J**
Acetone	ug/Kg	**200**	**7**	**32**	ND	ND	ND	ND	ND	ND
Carbon disulfide	ug/Kg	**2,700**	ND	ND	**2 J**	ND	ND	ND	ND	ND
1,1-Dichloroethene	ug/Kg	**400**	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	ug/Kg	**200**	**2 J**	ND	ND	ND	ND	ND	ND	ND
Chloroform	ug/Kg	**300**	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	ug/Kg	**300**	ND	**18**	ND	**6 J**	**11 J**	ND	ND	ND
1,1,1-Trichloroethane	ug/Kg	**800**	ND	ND	ND	ND	ND	**2 J**	ND	ND
Trichloroethene	ug/Kg	**700**	ND	ND	ND	ND	ND	**2 J**	**45**	**5 J**
Benzene	ug/Kg	**60**	ND	**2 J**	ND	ND	ND	ND	ND	ND
Tetrachloroethene	ug/Kg	**1,400**	ND	ND	ND	ND	ND	**4 J**	**2 J**	ND
Toluene	ug/Kg	**1,500**	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	ug/Kg	**5,500**	ND	**22**	ND	ND	ND	ND	ND	ND
Styrene	ug/Kg	**NS**	ND	ND	ND	ND	ND	ND	ND	ND
Xylene (total)	ug/Kg	**1,200**	ND	**47**	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	ug/Kg	**250**	**3**	ND	ND	ND	ND	**2 J**	ND	ND
trans-1,2-Dichloroethene	ug/Kg	**300**	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	ug/Kg	**NS**	ND	ND	**3 J**	ND	ND	ND	**2 J**	ND
Cyclohexane	ug/Kg	**NS**	ND	ND	ND	ND	ND	ND	ND	ND
Methylcyclohexane	ug/Kg	**NS**	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene	ug/Kg	**2,300**	ND	**8**	ND	ND	ND	ND	ND	ND

Notes:

ND = compound not detected
at or above MDL
NS = no standard

J = estimated value
B = analyte detected in blank

Table 3
Historical Groundwater Quality Data - VOCs
Former Monarch Chemicals
61 Gates Avenue, Geneva, NY
VCP No. V00119-8

		Tetrachloroethene	Trichloroethene	1,1-Dichloroethene	cis-1,2-Dichloroethene	trans 1,2-Dichloroethene	Vinyl chloride	1,1,1-Trichloroethane	1,1,2-Trichloroethane	1,1-Dichloroethane	Chloroform	Chloromethane	Chlorobenzene	Methyl Ethyl Ketone	Methyl Isobutyl Ketone	Methylene Chloride	Benzene	Toluene	Ethylbenzene	Xylene (total)
SITE	**DATE**	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
	DEC-GW-STD	**5**	**5**	**5**	**5**	**5**	**2**	**5**	**NS**	**5**	**7**	**5**	**5**	**50**	**50**	**5**	**0.7**	**5**	**5**	**5**
MW-114	**10/18/05**	37	24	2	4	< 10	< 10	7	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
MW-114	**1/12/06**	98	33	3	6	< 10	2	14	< 10	3	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
MW-114	**4/8/08**	62	18	1.6	4.2	< 1	1	6.9	< 1	2.2	< 1	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-114	**8/5/08**	75	30	3.7	7.3	< 1	2.2	13	< 1	4	< 1	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-114	**11/17/08**	71	23	2.8	5.5	< 1	1.5	9	< 1	3.2	< 1	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-114	**4/28/09**	53	16	1.9	4.5	< 1	1.4	7.3	< 1	2.3	0.8	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-114	**8/4/09**	23	57	2.6	17	< 1	2.4	11	< 1	4	1.3	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-115	**10/18/05**	34	11	9	15	< 10	8	38	< 10	50	1	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
MW-115	**1/12/06**	42	< 10	< 10	< 10	< 10	< 10	4	< 10	1	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
MW-115	**9/26/07**	23	2.8	3	3.4	< 1	< 1	9	< 1	11	0.2	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 2
MW-115	**4/8/08**	13	< 1	< 1	< 1	< 1	< 1	1.5	< 1	1.2	< 1	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-115	**8/5/08**	30	7.7	8.8	9.4	< 1	2.9	22	< 1	34	0.5	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-115	**11/17/08**	30	9.1	16	16	< 1	9.2	24	< 1	47	0.8	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-115	**4/28/09**	22	3.9	2.4	4.4	< 1	0.7	9.6	< 1	12	< 1	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-115	**8/4/09**	33	9.5	7.7	13	< 1	3.7	22	0.3	33	0.5	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-116	**10/18/05**	1100	130	38	140	2	11	440	< 10	11	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
MW-116	**1/12/06**	1100	110	14	110	< 50	< 50	440	< 50	10	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50
MW-116	**4/8/08**	180	22	3.5	19	< 1	2.4	68	< 1	4.8	< 1	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-116	**8/5/08**	530	62	14	40	0.49	6.5	260	< 1	9.3	< 1	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-116	**11/17/08**	3.6	1.1	< 1	1.4	< 1	< 1	< 1	< 1	2.4	< 2	< 2	< 2	3.3	< 5	< 2	< 2	< 2	< 2	< 3
MW-116	**4/28/09**	0.37	< 1	< 1	14	< 1	1.3	< 1	< 1	0.78	< 2	0.88	< 2	5.1	< 5	< 2	< 2	< 2	< 2	< 3
MW-116	**8/4/09**	< 1	0.53	< 1	1.9	0.43	0.8	< 1	< 1	3.6	< 2	< 1	< 2	< 5	< 5	< 2	3.2	< 2	0.56	< 3
MW-117	**10/18/05**	1	< 10	< 10	3	< 10	< 10	1	< 10	< 10	< 10	< 10	< 10	2	< 10	< 10	< 10	< 10	69	58
MW-117	**1/12/06**	3	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
MW-117	**9/26/07**	< 4	< 4	< 4	4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 20	< 20	< 4	< 4	< 4	71	33
MW-117	**4/8/08**	2.8	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-117	**8/5/08**	4.1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 5	< 5	< 1	< 1	< 1	14	< 3
MW-117	**11/17/08**	26	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 5	< 5	< 1	< 1	< 1	17	< 3
MW-117	**4/28/09**	4	0.73	< 1	0.41	< 1	< 1	< 1	< 1	< 1	< 1	0.51	< 1	3.4	< 5	< 1	0.48	< 1	1.7	< 3
MW-117	**8/4/09**	2.1	< 1	< 1	6.9	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	10	< 5	< 1	0.45	< 1	1.2	1
MW-118	**10/18/05**	1800	1100	110	1400	14	510	530	< 10	250	10	< 10	< 10	< 10	48	< 10	< 10	< 10	< 10	< 10
MW-118	**1/12/06**	4900	2700	240	3600	< 250	##	3900	< 250	480	< 250	< 250	< 250	< 250	< 250	56	< 250	< 250	< 250	< 250
MW-118	**9/26/07**	3000	1100	450	2000	< 330	400	7700	< 330	390	< 330	< 330	< 330	< 1700	< 1700	< 330	< 330	< 330	< 330	< 670
MW-118	**4/8/08**	3100	1700	1100	2300	32	630	4900	16	670	12	< 1	< 1	< 5	< 5	3.9	0.75	0.93	< 1	3.3
MW-118	**8/5/08**	3200	1500	580	2400	26	800	3000	8.9	500	7.5	< 1	< 1	< 5	< 5	< 1	0.85	0.76	< 1	2.3
MW-118	**11/17/08**	8.4	450	10	210	< 8	49	24	< 8	57	4.2	< 8	< 8	42	< 8	< 8	< 8	< 8	< 8	< 8
MW-118	**4/28/09**	< 10	11	490	7800	100	310	1700	6.7	1400	3.9	< 8	< 8	38	< 8	4.8	< 8	< 8	< 8	< 8
MW-118	**8/4/09**	< 10	< 10	460	10000	130	550	2300	6.5	1500	< 10	< 8	< 8	49	< 8	< 10	< 8	< 8	< 8	< 1
MW-119	**10/18/05**	34	110	2	91	2	8	73	1	44	4	< 10	< 10	< 10	< 10	< 10	1	< 10	< 10	< 10
MW-119	**1/12/06**	21	64	1	56	1	4	44	< 10	42	2	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
MW-119	**9/26/07**	8.1	64	1.6	45	1.2	1.3	45	< 2.5	60	1.9	< 2.5	< 2.5	< 12	< 12	< 2.5	< 2.5	< 2.5	< 2.5	< 5
MW-119	**4/8/08**	24	58	1.4	49	0.84	2	31	0.6	33	2.2	< 1	< 1	< 5	< 5	< 1	0.78	< 1	< 1	< 3
MW-119	**8/5/08**	34	110	1.4	93	1.1	4.9	52	0.89	29	3.3	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3

Table 3
Historical Groundwater Quality Data - VOCs
Former Monarch Chemicals
61 Gates Avenue, Geneva, NY
VCP No. V00119-8

		Tetrachloroethene	Trichloroethene	1,1-Dichloroethene	cis-1,2-Dichloroethene	trans 1,2-Dichloroethene	Vinyl chloride	1,1,1-Trichloroethane	1,1,2-Trichloroethane	1,1-Dichloroethane	Chloroform	Chloromethane	Chlorobenzene	Methyl Ethyl Ketone	Methyl Isobutyl Ketone	Methylene Chloride	Benzene	Toluene	Ethylbenzene	Xylene (total)
SITE	**DATE**	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
MW-119	**11/17/08**	6.9	42	2.4	45	1.5	24	18	< 1	62	2	< 1	< 1	19	< 5	1	1.1	< 1	< 1	< 3
MW-119	**4/28/09**	< 1	0.7	0.51	31	1.5	25	8.7	< 1	65	0.5	0.87	< 1	< 5	< 5	< 1	1.3	< 1	< 1	< 3
MW-119	**8/4/09**	< 1	1.1	< 1	12	1.6	30	3.7	< 1	45	< 1	0.87	< 1	2.9	< 5	< 1	0.93	< 1	< 1	< 3
MW-120	**10/18/05**	6	11	< 10	26	< 10	4	11	< 10	20	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
MW-120	**1/12/06**	4	12	1	36	< 10	9	19	< 10	25	1	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
MW-120	**4/8/08**	11	17	< 1	32	< 1	3.8	17	< 1	19	2	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-120	**8/5/08**	4.4	11	0.72	37	0.47	4.1	14	< 1	23	1.3	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-120	**11/17/08**	8.8	19	1.5	49	0.47	5.3	24	< 1	28	1.4	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-120	**4/28/09**	8.4	17	0.74	42	0.62	4.9	19	< 1	21	0.9	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-120	**8/4/09**	7.4	16	0.92	40	0.64	8.7	19	< 1	25	0.5	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-121	**10/18/05**	7	11	6	24	< 10	3	4	< 10	15	< 10	< 10	< 10	< 10	18	< 10	< 10	< 10	< 10	< 10
MW-121	**1/12/06**	3	6	2	11	< 10	2	3	< 10	9	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
MW-121	**9/26/07**	1.5	3.7	< 1	5.1	< 1	< 1	1.8	< 1	2.2	< 1	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-121	**4/8/08**	1.2	2.7	< 1	2.7	< 1	< 1	1.5	< 1	1.6	< 1	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-121	**8/5/08**	4.7	4.1	< 1	9.3	< 1	< 1	4.5	< 1	6.2	< 1	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-121	**11/17/08**	8.4	7.7	< 1	12	< 1	2.1	4.4	< 1	8.1	< 1	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-121	**4/28/09**	0.7	3.1	< 1	5.7	< 1	< 1	2.2	< 1	3.7	< 1	< 1	< 1	2.5	< 5	< 1	< 1	< 1	< 1	< 3
MW-121	**8/4/09**	13	8.7	0.37	18	< 1	7.1	5.4	< 1	12	0.5	< 1	< 1	2.3	< 5	< 1	< 1	< 1	< 1	< 3
MW-122	**10/18/05**	10	100	31	1400	36	310	170	2	160	< 10	< 10	< 10	< 10	< 10	< 10	2	< 10	< 10	< 10
MW-122	**1/12/06**	11	79	26	1600	27	450	160	< 10	180	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
MW-122	**9/26/07**	2.8	29	11	760	13	210	55	< 10	91	< 10	< 10	< 10	< 50	< 50	< 10	< 10	< 10	< 10	< 30
MW-122	**4/8/08**	4.7	68	24	1200	33	650	160	1.2	240	< 1	< 1	< 1	< 5	< 5	< 1	1.6	1.1	< 1	0.93
MW-122	**8/5/08**	7.2	83	37	1600	45	##	180	1.8	330	< 1	< 1	< 1	< 5	< 5	< 1	2.1	< 1	< 1	< 3
MW-122	**11/17/08**	< 20	43	20	1200	21	580	81	< 20	160	< 1	< 1	< 1	< 5	< 5	< 1	< 20	< 1	< 1	< 3
MW-122	**4/28/09**	< 20	44	16	1000	22	510	73	< 20	140	< 20	< 20	< 20	< 100	< 20	< 20	< 20	< 20	< 20	< 40
MW-122	**8/4/09**	< 10	30	9.1	590	13	360	47	< 20	93	< 20	< 20	< 20	< 100	< 20	< 20	< 20	< 20	< 20	< 40
MW-123	**10/18/05**	230	56	64	18	< 10	1	6	< 10	260	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
MW-123	**1/12/06**	1	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
MW-123	**11/21/06**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-123	**9/26/07**	11	5.1	6.7	3	< 3.3	< 3.3	1.2	< 3.3	89	< 3.3	< 3.3	< 3.3	< 17	< 17	< 3.3	< 3.3	< 3.3	< 3.3	< 3.3
MW-123	**4/8/08**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-123	**8/5/08**	2.2	1.4	2.6	1.8	< 1	< 1	1.1	< 1	14	< 1	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-123	**11/17/08**	0.44	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 3
MW-123	**4/28/09**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 2
MW-123	**8/4/09**	0.72	< 1	1.2	0.54	< 1	< 1	0.27	< 1	4.1	< 1	< 1	< 1	< 5	< 5	< 1	< 1	< 1	< 1	< 2
MW-124s	**8/18/08**	< 1	0.94	< 1	5.1	9.2	13	0.98	< 1	130	< 1	< 1	< 1	1.5	< 5	< 1	< 1	1.8	6.8	8.3
MW-124s	**11/18/08**	< 4	< 4	< 1	5.2	6.7	4.3	< 4	< 1	160	< 1	2.8	< 1	34	< 5	< 1	< 1	11	36	37
MW-124s	**4/28/09**	< 1	0.83	< 1	4.7	7	3.3	0.7	< 1	130	< 1	< 1	< 1	33	< 5	< 1	0.24	15	37	45
MW-124s	**8/4/09**	< 1	0.51	< 1	1.3	7.2	1.4	< 1	< 1	4.5	< 1	< 1	< 1	10	< 5	< 1	< 1	17	34	35
MW-124d	**8/18/08**	< 1	49	31	260	2.4	81	0.7	< 1	460	1.1	< 1	< 1	< 5	< 5	< 1	< 1	< 1	0.54	< 3
MW-124d	**11/18/08**	< 1	120	34	1600	20	770	< 20	< 20	510	< 20	< 1	< 1	54	< 5	< 1	< 1	< 1	< 20	< 3
MW-124d	**4/28/09**	4.2	30	27	1300	15	760	44	< 5	720	< 5	2.2	< 1	72	< 5	4.3	< 1	3.2	< 5	4.2
MW-124d	**8/4/09**	< 5	17	17	720	12	510	8.4	< 5	470	< 5	< 5	< 1	76	< 5	4.3	< 1	< 5	1.1	< 10

Table 4
MW-124 Nest Soil Sampling Summary - VOCs
Former Monarch Chemicals Facility
61 Gates Avenue, Geneva, New York
VCP No. V00119-8

Sample Date 8/14/2008 Analyte	Location & Depth (ft bgs) MW-124d 21'	Flags	Location & Depth (ft bgs) MW-124s 11'	Flags	Units	Method
1,1,1-Trichloroethane	6	U	5	U	UG/KG	8260/5035
1,1,2,2-Tetrachloroethane	6	U	5	U	UG/KG	8260/5035
1,1,2-Trichloro-1,2,2-trifluoroethane	6	U	5	U	UG/KG	8260/5035
1,1,2-Trichloroethane	6	U	5	U	UG/KG	8260/5035
1,1-Dichloroethane	6	U	**2**	J	UG/KG	8260/5035
1,1-Dichloroethene	6	U	5	U	UG/KG	8260/5035
1,2,4-Trichlorobenzene	6	U	5	U	UG/KG	8260/5035
1,2-Dibromo-3-chloropropane	6	U	5	U	UG/KG	8260/5035
1,2-Dibromoethane	6	U	5	U	UG/KG	8260/5035
1,2-Dichlorobenzene	6	U	5	U	UG/KG	8260/5035
1,2-Dichloroethane	6	U	5	U	UG/KG	8260/5035
1,2-Dichloropropane	6	U	5	U	UG/KG	8260/5035
1,3-Dichlorobenzene	6	U	5	U	UG/KG	8260/5035
1,4-Dichlorobenzene	6	U	5	U	UG/KG	8260/5035
2-Butanone	30	U	27	U	UG/KG	8260/5035
2-Hexanone	30	U	27	U	UG/KG	8260/5035
4-Methyl-2-pentanone	30	U	27	U	UG/KG	8260/5035
Acetone	**32**		**7**	J	UG/KG	8260/5035
Benzene	**2**	J	5	U	UG/KG	8260/5035
Bromodichloromethane	6	U	5	U	UG/KG	8260/5035
Bromoform	6	U	5	U	UG/KG	8260/5035
Bromomethane	12	U	11	U	UG/KG	8260/5035
Carbon Disulfide	6	U	5	U	UG/KG	8260/5035
Carbon Tetrachloride	6	U	5	U	UG/KG	8260/5035
Chlorobenzene	6	U	5	U	UG/KG	8260/5035
Chloroethane	12	U	11	U	UG/KG	8260/5035
Chloroform	6	U	5	U	UG/KG	8260/5035
Chloromethane	12	U	11	U	UG/KG	8260/5035
cis-1,2-Dichloroethene	6	U	**3**	J	UG/KG	8260/5035
cis-1,3-Dichloropropene	6	U	5	U	UG/KG	8260/5035
Cyclohexane	6	U	5	U	UG/KG	8260/5035
Dibromochloromethane	6	U	5	U	UG/KG	8260/5035
Dichlorodifluoromethane	6	U	5	U	UG/KG	8260/5035
Ethylbenzene	**22**		5	U	UG/KG	8260/5035
Isopropylbenzene	**8**		5	U	UG/KG	8260/5035
Methyl acetate	6	U	5	U	UG/KG	8260/5035
Methylcyclohexane	6	U	5	U	UG/KG	8260/5035
Methylene chloride	**8**	B	**9**	B	UG/KG	8260/5035
Methyl-t-Butyl Ether (MTBE)	**18**		5	U	UG/KG	8260/5035
Styrene	6	U	5	U	UG/KG	8260/5035
Tetrachloroethene	6	U	5	U	UG/KG	8260/5035
Toluene	6	U	5	U	UG/KG	8260/5035
Total Xylenes	**47**		16	U	UG/KG	8260/5035
trans-1,2-Dichloroethene	6	U	5	U	UG/KG	8260/5035
trans-1,3-Dichloropropene	6	U	5	U	UG/KG	8260/5035
Trichloroethene	6	U	5	U	UG/KG	8260/5035
Trichlorofluoromethane	6	U	5	U	UG/KG	8260/5035
Vinyl chloride	12	U	11	U	UG/KG	8260/5035

Table 5
August 2008, Pre-IRM Baseline Groundwater Sampling Summary
Former Monarch Chemicals Facility
61 Gates Avenue, Geneva, New York
VCP No. V00119-8

Geochemical Parameter	Test Method (or equivalent)	units	MW-114	MW-115	MW-116	MW-117	MW-118	MW-119	MW-120	MW-121	MW-122	MW-123
			8/6/08	8/6/08	8/6/08	8/6/08	8/7/08	8/7/08	8/6/08	8/6/08	8/6/08	8/5/08
Iron, Total	6010	mg/L	2.1	0.43	0.096	9	2.3	0.34	<0.05	ns	<0.05	18.6
Iron, Dissolved	6010	mg/L	2.1	<0.05	<0.05	8.6	1.1	<0.05	<0.05	ns	<0.05	1
Manganese, Total	6010	mg/L	0.42	0.18	0.74	2	3.6	0.1	3.3	ns	0.15	0.86
Manganese, Dissolved	6010	mg/L	0.41	0.14	0.69	2	3.6	0.12	3.2	ns	0.11	0.26
Biochemical Oxygen Demand	5210B	mg/L	<2	<1.7	<3.4	12.6	4.1	<2	<2	ns	<2	<2
Chemical Oxygen Demand	410.4	mg/L	<10	14.2	<10	93.3	129	11	18.1	ns	<10	<10
Chloride	9056	mg/L	128	396	99.3	2.1	298	84.6	171	ns	91.9	27.1
Nitrate-Nitrite	353.2	mg/L	<0.05	0.8	0.27	<0.05	<0.05	0.64	<0.05	ns	<0.05	<0.05
Sulfate	D 516-90	mg/L	128	188	129	67.3	150	138	119	ns	78.8	82
Sulfide	4500-S	mg/L	<1	<1	<1	<1	<1	<1	<1	ns	<1	<1
Total Kjeldahl Nitrogen	351.2	mg/L	0.024	0.44	0.5	2	4.8	0.46	0.43	ns	0.28	0.24
Total Organic Carbon	9060	mg/L	2.4	5	3.6	23.3	38.5	3.5	5.8	ns	4.6	6
Total Phosphorous	4500	mg/L	0.063	0.028	0.01	0.3	0.091	0.89	0.22	ns	<0.01	0.83
Ethane	RSK175	ug/l	<1.5	<1.5	<75	<75	<15	<1.5	<1.5	<1.5	<75	<1.5
Ethene	RSK175	ug/l	<1.5	<1.5	<75	<75	<15	<1.5	<1.5	<1.5	<75	<1.5
Methane	RSK175	ug/l	<1	1.3	170	280	84	16	10	ns	200	2.4
Carbon Dioxide	RSK175	ug/l	13,000	39,000	17,000	39,000	41,000	9,200	14,000	ns	21,000	34,000

Table 6
IRM Injection Summary
Former Monarch Chemicals Facility
61 Gates Avenue, Geneva, New York
VCP No. V00119-8

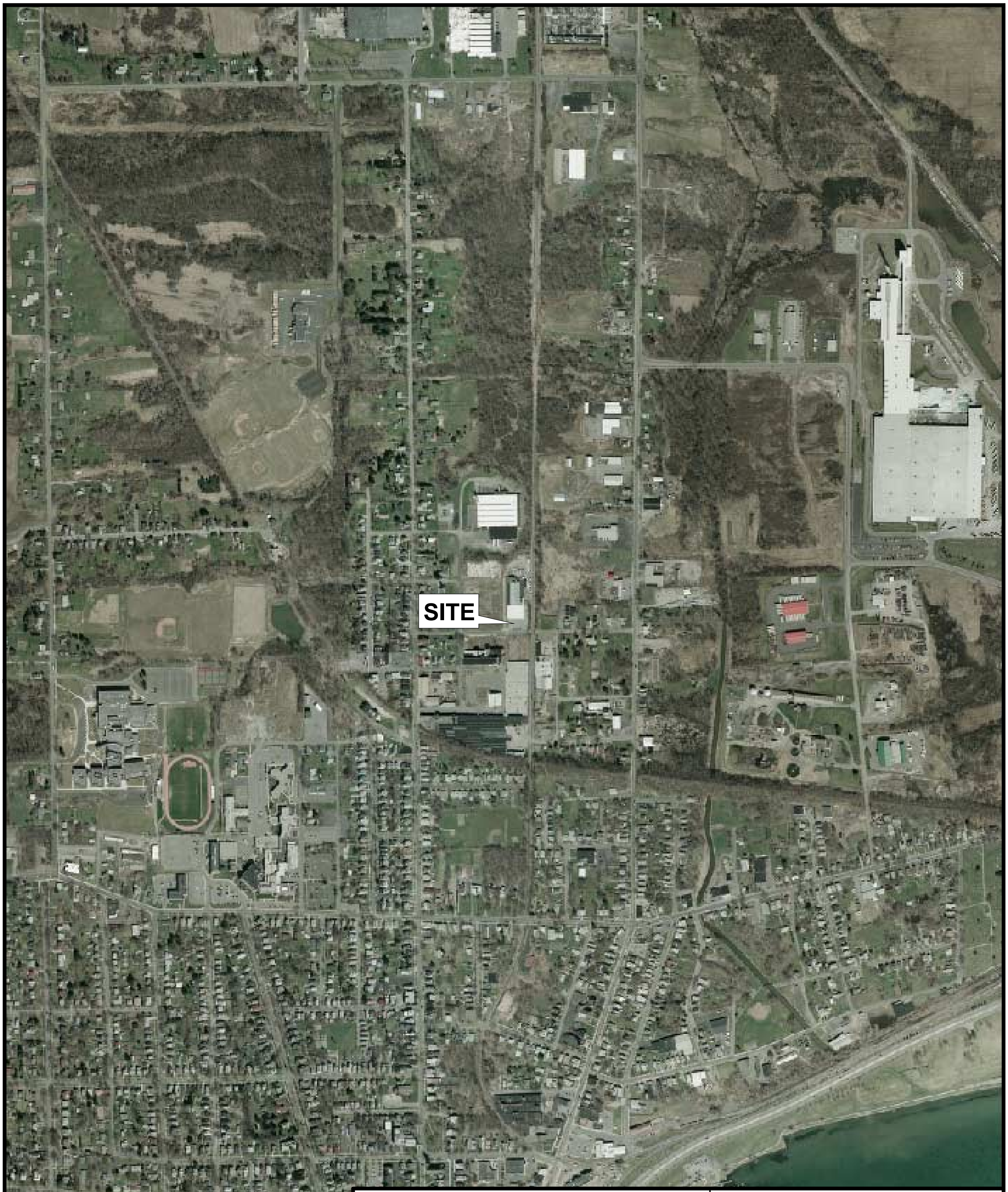
ERD Injection	Injection Day	Water Dosimeter Flow Total (gallons)	Water Hydrant Flow Total (gallons)	Newmans Zone (gallons)	EVO Solution	ZVI (gallons)	Water in ZVI Injectate (gallons)	ZVI Solution	Daily Gallons injected	EVO Locations	ZVI Locations
10-Oct-08	**1**	2533.7	2337.5	264	5.2%	0	0.0	0.0%	2601.5	G1, H1, I1, J1, K1, G3, H3, I3, J3, K3, K2, K3	
11-Oct-08	**2**	2464.6	2244.7	264	5.4%	0	0.0	0.0%	2508.7	G2, H2, I2, J2, K2, G4, H4, I4, J4, K4	
12-Oct-08	**3**	2566.8	2325.5	264	5.2%	0	0.0	0.0%	2589.5	I13, J13, K13, L13, M13, I15, J15, K15, L15, M15	
14-Oct-08	**4**	2502.7	2297.1	264	5.3%	0	0.0	0.0%	2561.1	F5, G5, H5, I5, F7, G7, H7, I7, J7, K7	
15-Oct-08	**5**	2519.7	2293.4	264	5.3%	0	0.0	0.0%	2557.4	B11, B12, B13, B14, B15, D11, D12, D13, D14, D15	
16-Oct-08	**6**	2783.8	2565.6	264	4.7%	0	0.0	0.0%	2829.6	B8, C8, D8, E8, F8, B10, C10, D10, E10, F10	
17-Oct-08	**7**	0.0	0.0	0	0.0%	30	360.0	8.3%	390.0		I9, I10, J8, J12, K8, K10
18-Oct-08	**8**	0.0	0.0	0	0.0%	20	240.0	8.3%	260.0		I12, J9, J10, K9, K10, J11, K11
19-Oct-08	**9**	2616.3	2363.7	264	5.1%	0	0.0	0.0%	2627.7	I9, I10, I11, I12, J12, K8, K10, K12, K8, K9, J8, J9	
20-Oct-08	**10**	2473.7	2209.7	264	5.5%	45	535.0	8.4%	3053.7	E11, F11, F12, G12, G13, H13, H14, I14, J14, K14	E11, F11, F12, G12, G13, H13, H14, I14, J14, K14
21-Oct-08	**11**	2591.5	2407.0	264	5.0%	0	0.0	0.0%	2671.0	G9, G10, G11, H8, H9, H10, H11, H12, I8, I11	
22-Oct-08	**12**	2593.0	2316.6	264	5.2%	0	0.0	0.0%	2580.6	D13, D14, D15, E13, E14, E15, F14, F15, G15, J14, J15	
Injection Totals		**25,645.8**	**23,361**	**2,640**	**5.2%**	**95.0**	**1,135.0**	**8.36%**	**27,230.8**		

Table 7
Checklist for NYSDEC Technical Considerations from July 10, 2009 e-mail
Former Monarch Chemicals Facility
61 Gates Avenue, Geneva, New York
VCP No. V00119-8

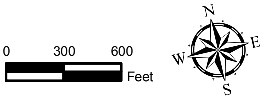
NYSDEC Outstanding Issues from July 10, 2009 e-mail	Information Summary	Location in Report for cited information
Communication Issues	…NYSDEC project manager has not been copied on the e-mailed monthly status reports….	PSRs are mailed (USPS) to all individuals on the distribution list, with an electronic copy sent via e-mail to Mr. Putzig (NYSDEC) and Ms. Colberg (H.B. Fuller)
Characterization of Off-Site Groundwater	....an appropriate work plan for offsite groundwater characterization has not been provided. In 2006-2007, a phase II supplemental RI work plan was nearly finalized which included offsite wells but the consultant (Delta) was replaced by ECOR and the focus changed to solely IRM implementation....	Section 1.5 - Site Conceptual Model. The NYSDEC approved IRM is the result of the February 2, 2007 meeting between NYSDEC and H.B. Fuller. Further off-site investigative work is not necessary to determine on-site soil or groundwater impacts.
	….the State has no overall objection to this proposed ditch study, it would ultimately prove very little, it is clearly not an essential precursor to further groundwater characterization, and it certainly could not be relied upon to indicate that the ditch is a "potential groundwater barrier" ….	Section 5.0 Recommendations. H.B. Fuller recommends to continue groundwater and surface water in 2010, consistent with the recommendations in the NYSDEC approved IRM Workplan.
	….Experience with vapor intrusion at VOC sites statewide indicates a high potential for exposure given VOC plumes beneath structures. It is imperative that we fully define this plume in a timely and forthright manner (i.e., this construction season; too many years have been lost). Once the plume is defined, its stability can be assessed and a final remedy selected. Please provide a work plan to fully characterize offsite groundwater within 30 days.….	Section 3.1. Figure 35, Figures 4 - 12, Figures 43 - 49. The constituents of concern have been identified in vapor, soil, and groundwater. The extent of on-site impacts for each media have been delineated. The constiuents of concern are unrelated to H.B. Fuller operations.
Comments on the June PSR – IRM monitoring	….Initial post-IRM results are encouraging but of course, rebound is a common problem as the aquifer re-equilibrates from dilution effects of the injections, VOC diffusion/contributions from finer-grained units, and as the microbial breakdown of dissolved phase VOCs increases the rate of dissolution from residual DNAPL. Large increases were noted in cis-1,2-DCE at MW-118 which indicates dehalogenation from PCE/TCE. While a positive development, stall and accumulation of DCE is very common at similar sites. According to the ITRC Technical/Regulatory Guidance document: "In Situ Bioremediation of Chlorinated Ethene: DNAPL Source Zones", June 2008 (sent previously), a specific genus of bacteria, Dehalococcoides, is necessary to complete the dehalogenation process (an excerpt follows below)….	Section 3.2, Appendix B, Appendix O, Figures 102 - 110. H.B. Fuller conducted pre-IRM evaluation of the biological community, which detected delaococoides and other dechlorinating bacteria in MW-118. As specific degraders in the biomass are important, it is actually the synergistic interaction of a consortium of bacterial populations which effectuate the reductive dechlorination process. H.B. Fuller will monitor the potential for cDCE stall and propose solutions if this condition occurs.

Table 7
Checklist for NYSDEC Technical Considerations from July 10, 2009 e-mail
Former Monarch Chemicals Facility
61 Gates Avenue, Geneva, New York
VCP No. V00119-8

NYSDEC Outstanding Issues from July 10, 2009 e-mail	Information Summary	Location in Report for cited information
Comments on the June PSR – IRM monitoring	….Please provide a response to these comments and a work plan to fully characterize offsite groundwater within 30 days.….	Section 5, Table 3, Figure 77 - 100, Appendix O. The *Interim Remedial Measures Groundwater Monitoring Report* provides sufficient data to evaluate the on-site soil, SVI, and groundwater impacts, and the progress of the NYSDEC approved IRM.
HB Fuller Geneva SRI Workplan Comments & prior correspondence	several older e-mails and documents concerning correspondence between Delta and NYSDEC, and H.B. Fuller (&/or ECOR) and NYSDEC.	Section 1.5, Section 2. The site conceptual model provides ample evidence for determining the nature and extent of on-site impacts to all media, and the dataset confirms this model. Several of the recommendations in these e-mail correspondence have been implemented - e.g., investigation methods, soil vapor sampling, groundwater sampling and purging techniques, have been addressed by H.B. Fuller since 2006.



Basemap Source: USGS Digital Orthoimagery of Ontario County, New York, April 2005.



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File:
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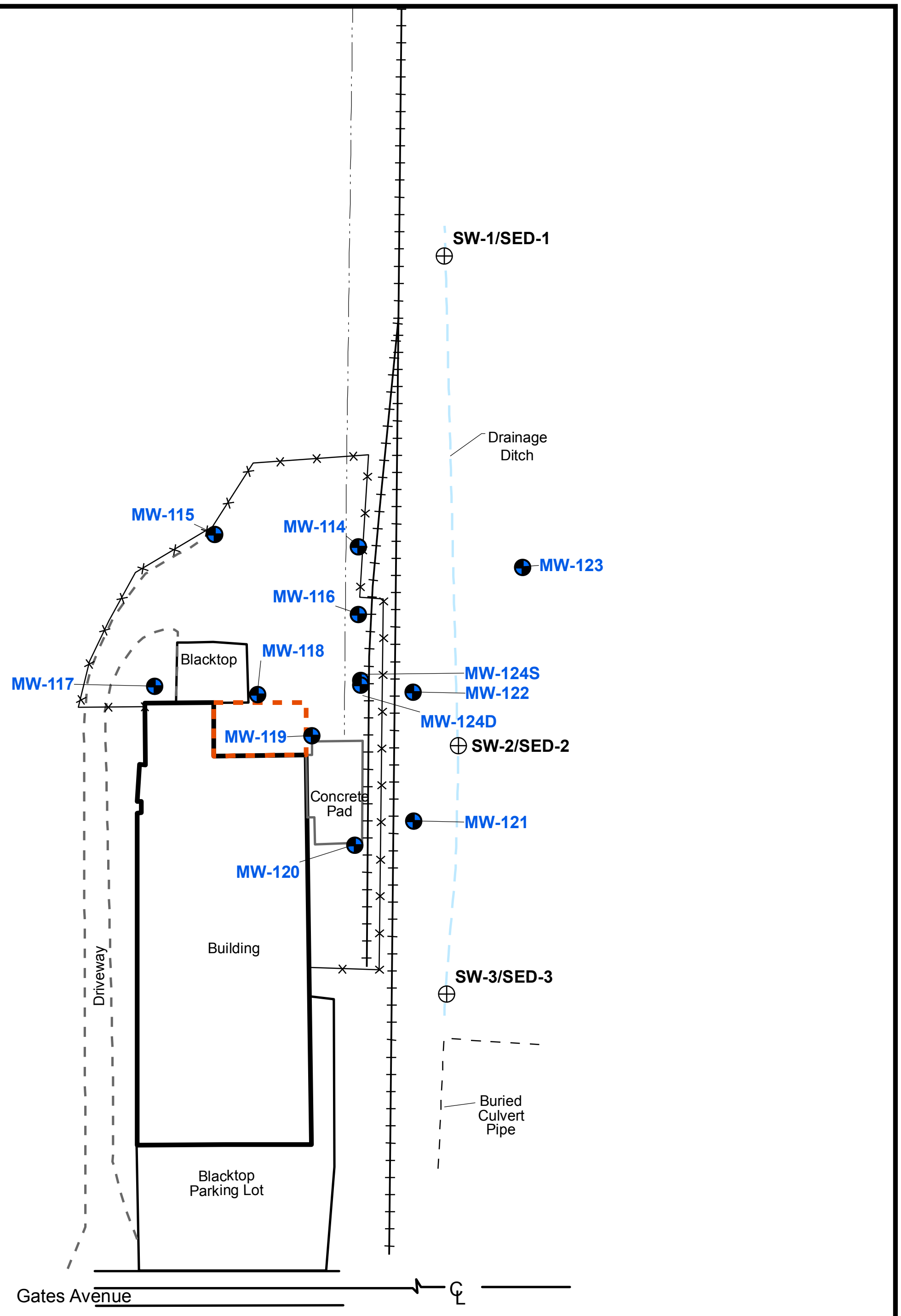
IRM-1109\Fig1-Site.mxd

Date:
11/23/2009

Figure 1
Site Location Map

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



Legend

● Monitoring Well Location
⊕ Surface Water and Sediment Sampling Location
×—× Fence
+++ Railroad
- - - AST Containment Area
—·— PVC Drain Pipe

0 60 120 Feet

N E S W

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File:
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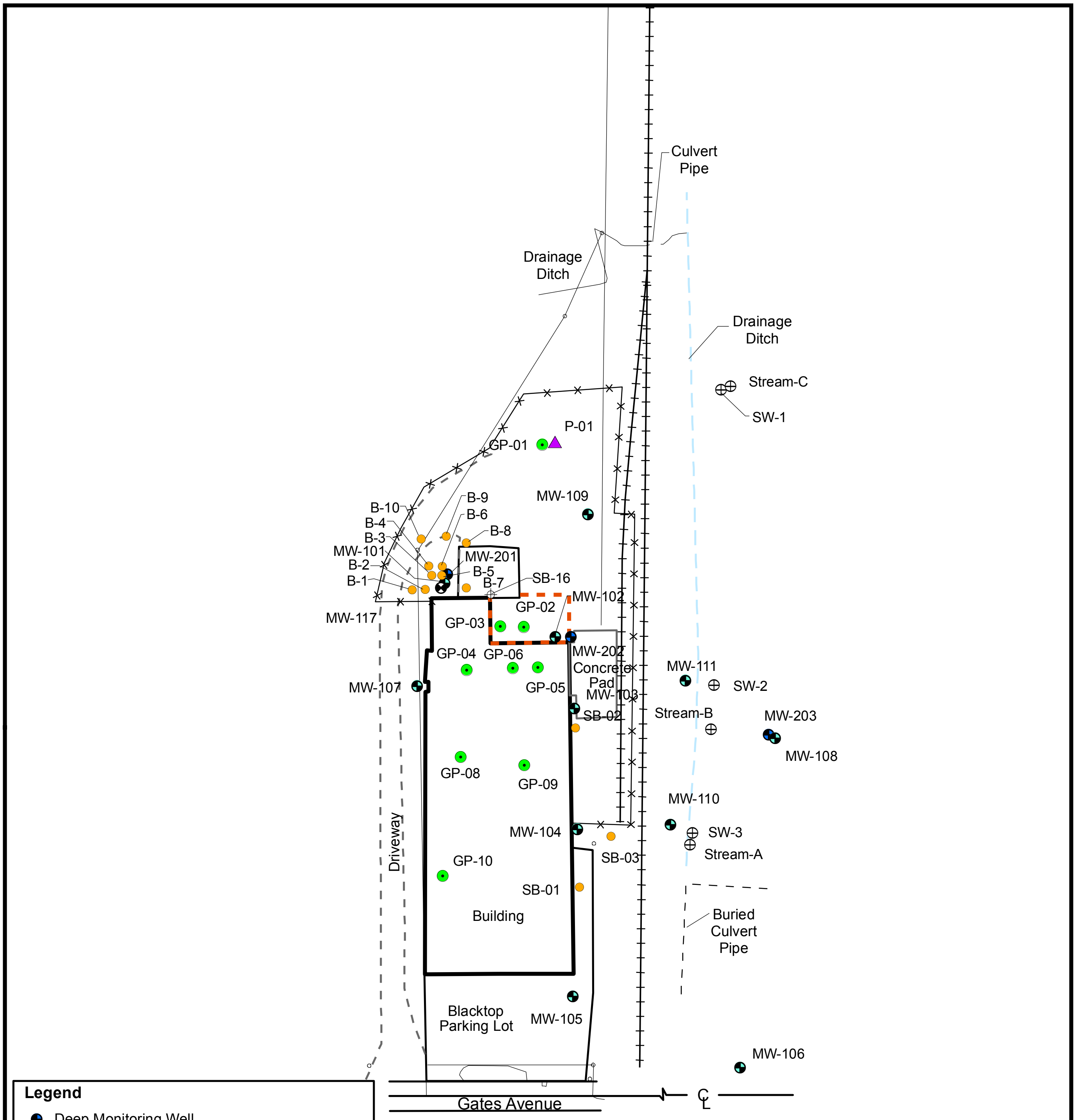
\Fig2-MWLM.mxd

Date:
11/23/2009

Figure 2
Monitoring Well Location Map

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



Legend

● Deep Monitoring Well
● Shallow Monitoring Well
⊕ Surface Water Sample Point
Note: SW's denote surface water sample points.
Stream's denote surface water gauge points.
● Geoprobe
▲ Piezometer
● Soil Boring
● VCP Monitoring Well Location
⊕ VCP Soil Boring Location
Fence
Railroad
AST Containment Area

0 60 120
Feet

N E S W

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File:
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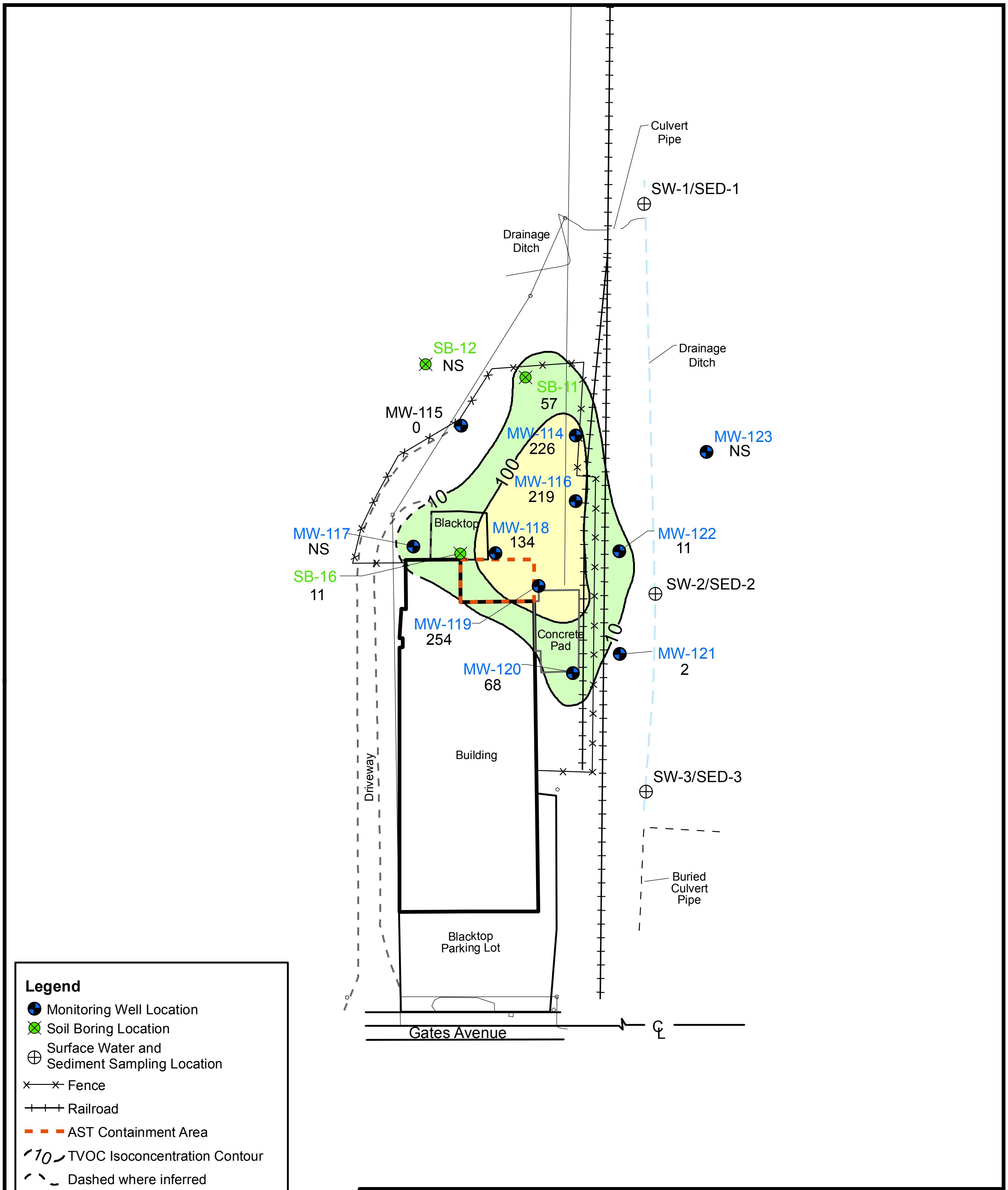
\Fig3-AbanWells.mxd

Date:
11/23/2009

Figure 3
Abandoned Monitoring Locations

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



Legend

● Monitoring Well Location

⊗ Soil Boring Location

⊕ Surface Water and Sediment Sampling Location

Fence

Railroad

AST Containment Area

10 TVOC Isoconcentration Contour

Dashed where inferred

🟩 10-100 ug/kg

🟨 100-1000 ug/kg

68	Total VOC Concentration Detected, July 2005
NS	Not Sampled

0 60 120 Feet

N E S W

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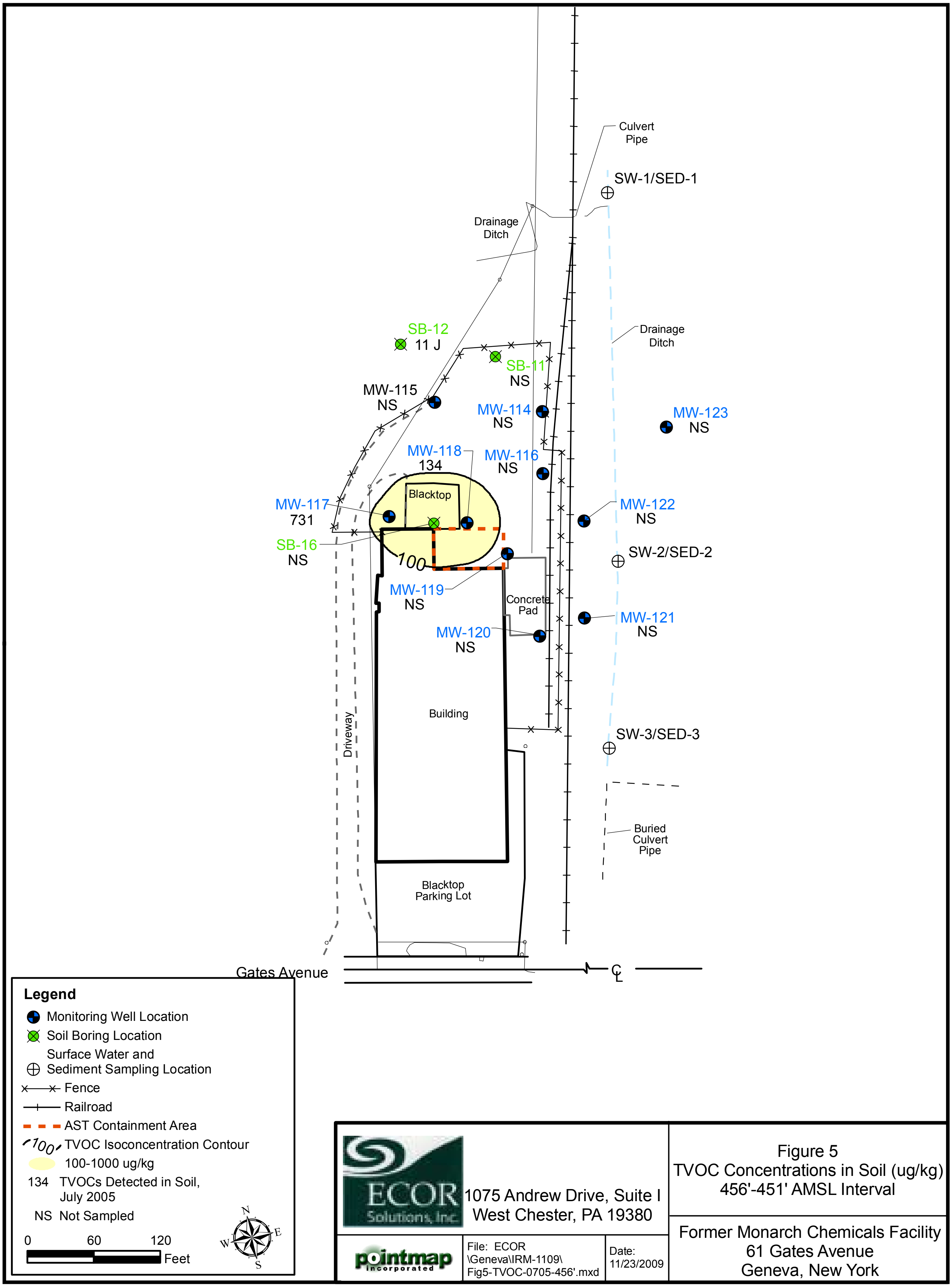
File: ECOR \Geneva\IRM-1109\ Fig4-TVOC-0705-460'.mxd

Date: 11/23/2009

Figure 4
TVOC Concentrations in Soil (ug/kg)
460'-456' AMSL Interval

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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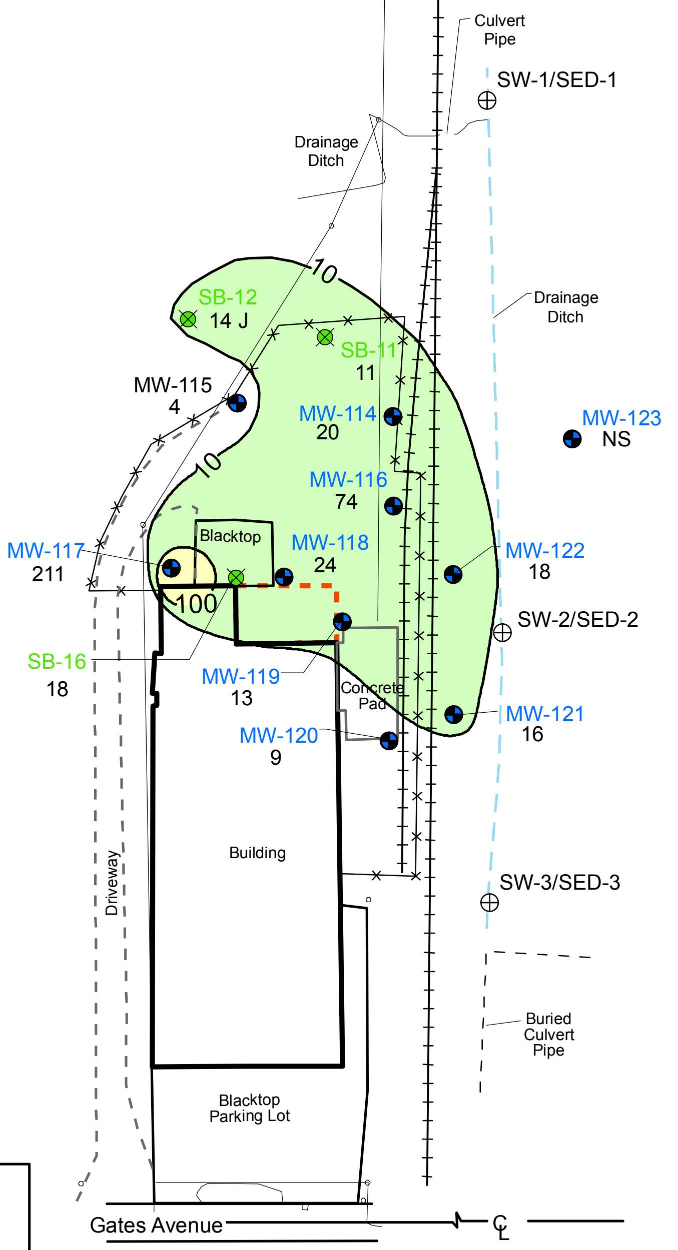
File: ECOR
\Geneva\IRM-1109\
Fig5-TVOC-0705-456'.mxd

Date:
11/23/2009

Figure 5
TVOC Concentrations in Soil (ug/kg)
456'-451' AMSL Interval

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



Legend

● Monitoring Well Location

⊗ Soil Boring Location

⊕ Surface Water and Sediment Sampling Location

—×—×— Fence

—+—+— Railroad

- - - AST Containment Area

10 TVOC-Fig7

🟩 10-100 ug/kg

🟨 100-1000 ug/kg

211 TVOCs Detected in Soil, July 2005

NS Not Sampled

0 60 120 Feet

N E S W

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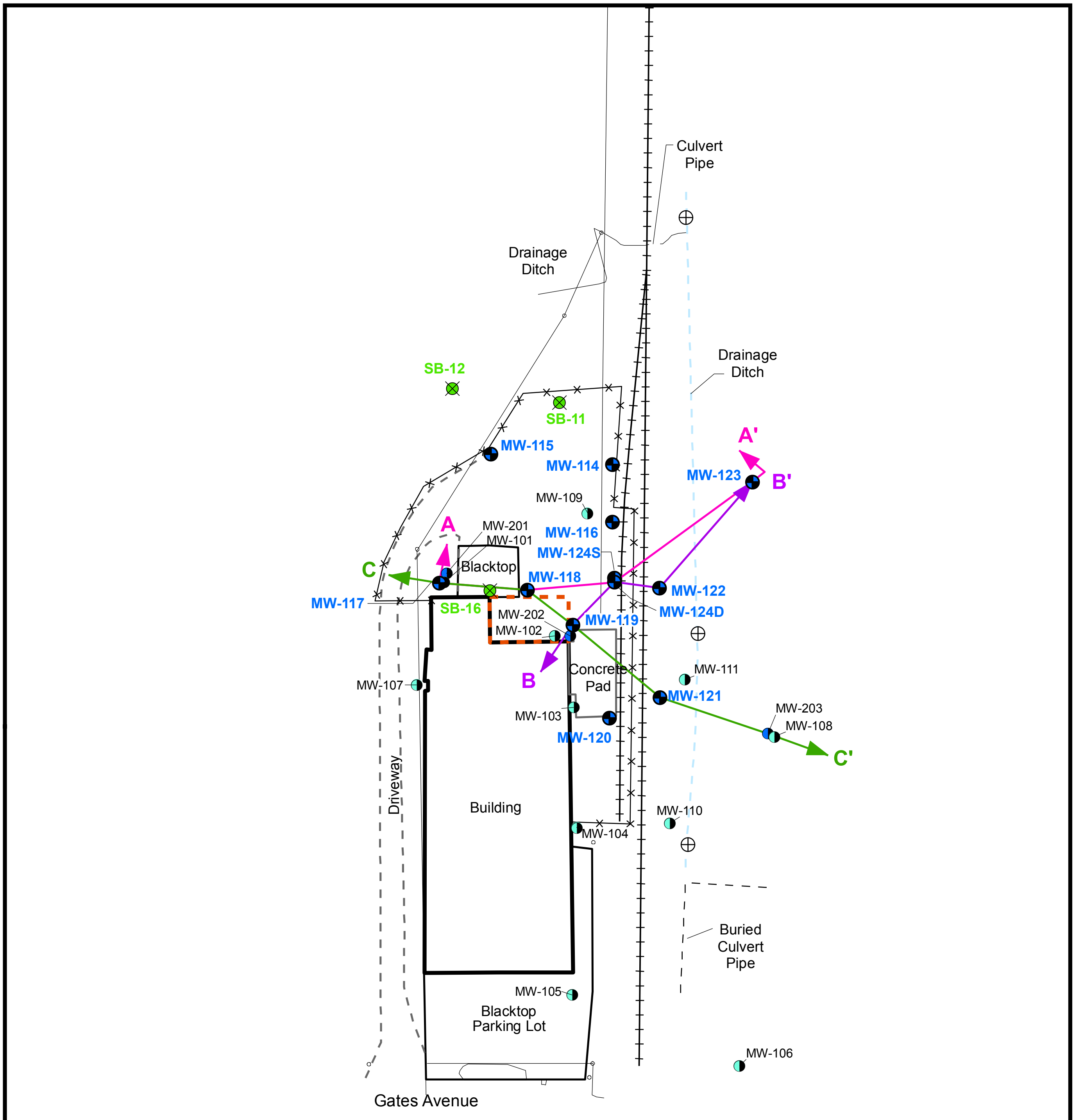
Figure 6
TVOC Concentrations in Soil (ug/kg)
451'-446' AMSL Interval

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

pointmap incorporated

File: ECOR \Geneva\IRM-1109\Fig6-TVOC-0705-451'.mxd

Date: 11/23/2009



Legend

⊕	Monitoring Well Location
⊗	Soil Boring Location
⊕	Surface Water and Sediment Sampling Location
◐	Abandoned Deep Monitoring Well
◐	Abandoned Shallow Monitoring Well
⟷	A - A' Cross Section Location
⟷	B - B' Cross Section Location
⟷	C - C' Cross Section Location
—×—×—	Fence
—+—+—	Railroad
- - -	AST Containment Area

0 60 120
Feet

N E S W

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File:
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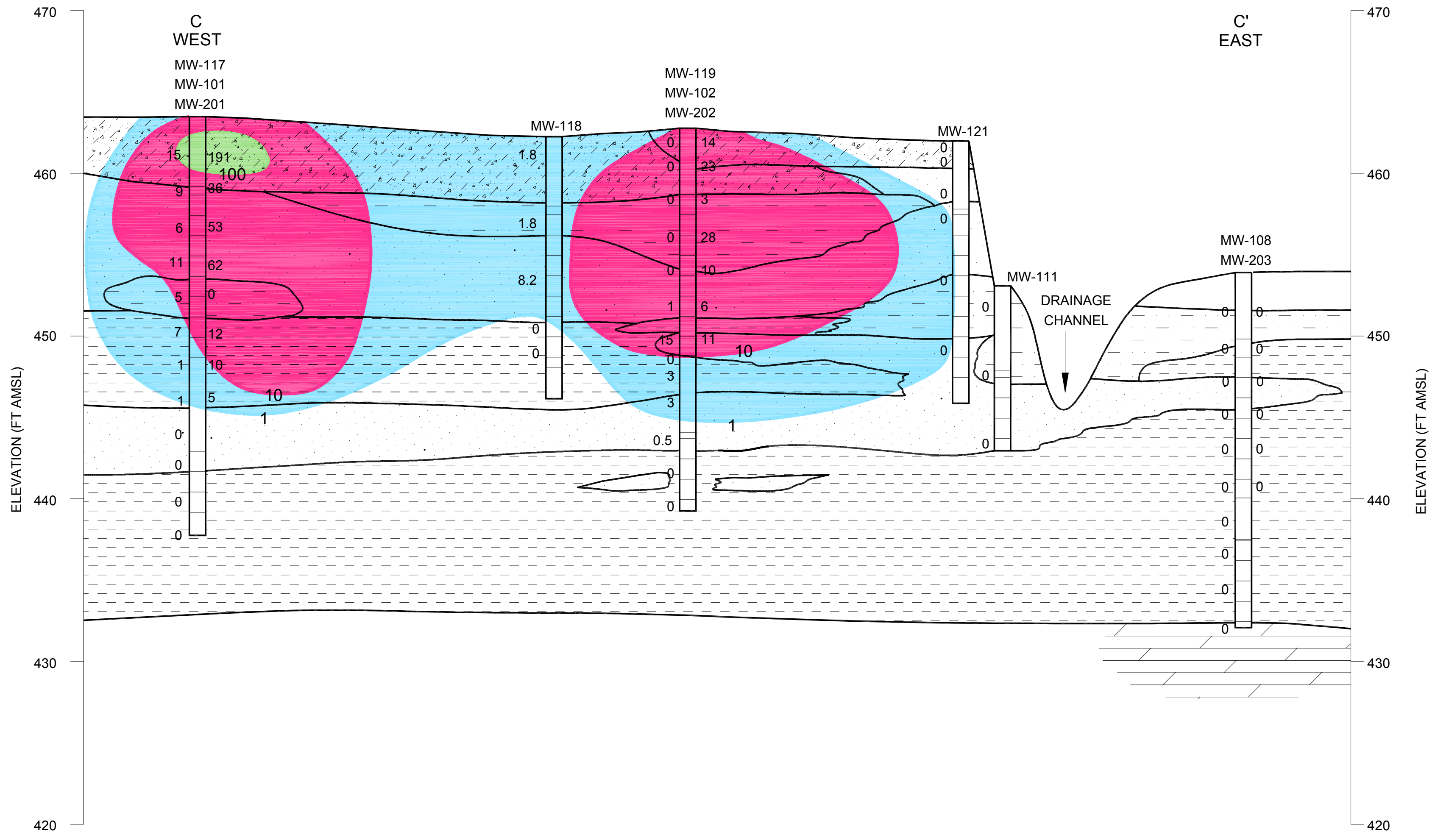
\Fig7-XS-ABC.mxd

Date:
11/23/2009

Figure 7
Cross Section Location Map
A-A', B-B', C-C'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



LEGEND

SCREENED INTERVAL

53 PID MEASUREMENT DURING DRILLING (ppm)

VOC CONCENTRATIONS IN SOIL

- 1-10
- 10-100
- 100+

☐	TOPSOIL
▨	SILT TO GRAVEL FILL
☒	FILL
▤	SILT & CLAY
░	SAND
▤	CLAY
▨	SILTY SAND
▤	TILL

VERTICAL SCALE (IN FEET) 10

20

HORIZONTAL SCALE (IN FEET)

VERTICAL EXAGGERATION 4X

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Figure 8
Historical VOCs Detected in Soil During Drilling Via Photoionization Detector (PID); in ppm
Cross Section C - C'

pointmap incorporated

File: ECOR\Geneva
\IRM-1109\drawings
\Fig8-Hist-VOC-XS.dwg

Date:
11/23/2009

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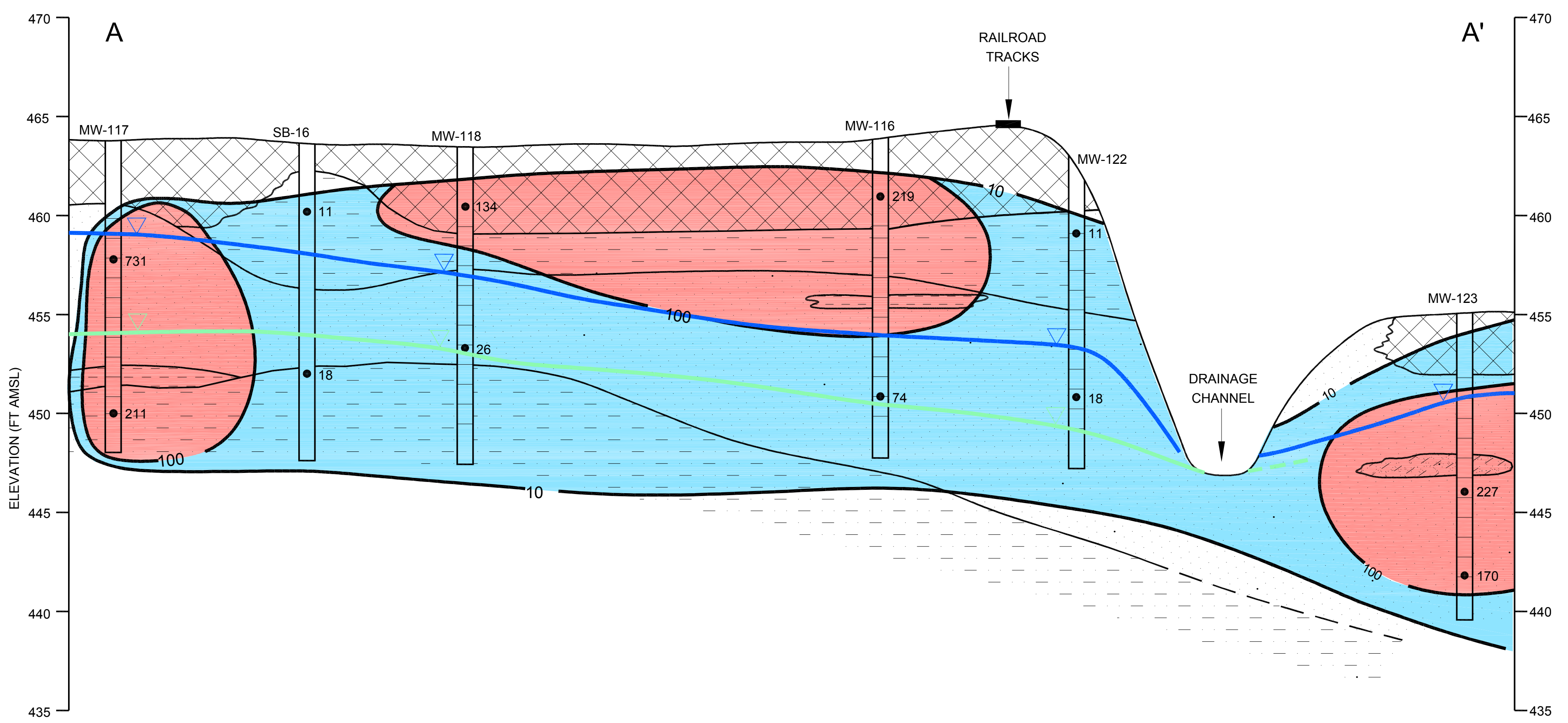


LEGEND

SCREENED INTERVAL

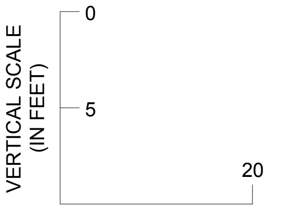
WATER TABLE, JANUARY 2006

WATER TABLE, SEPTEMBER 2007

● 731 TVOCs DETECTED IN SOIL; JANUARY 2006

—10— TVOC ISOCONCENTRATION

▨	FILL
▨	SILT & CLAY
▨	SAND
▨	CLAY
▨	SILTY SAND



HORIZONTAL SCALE (IN FEET)
VERTICAL EXAGGERATION 4X

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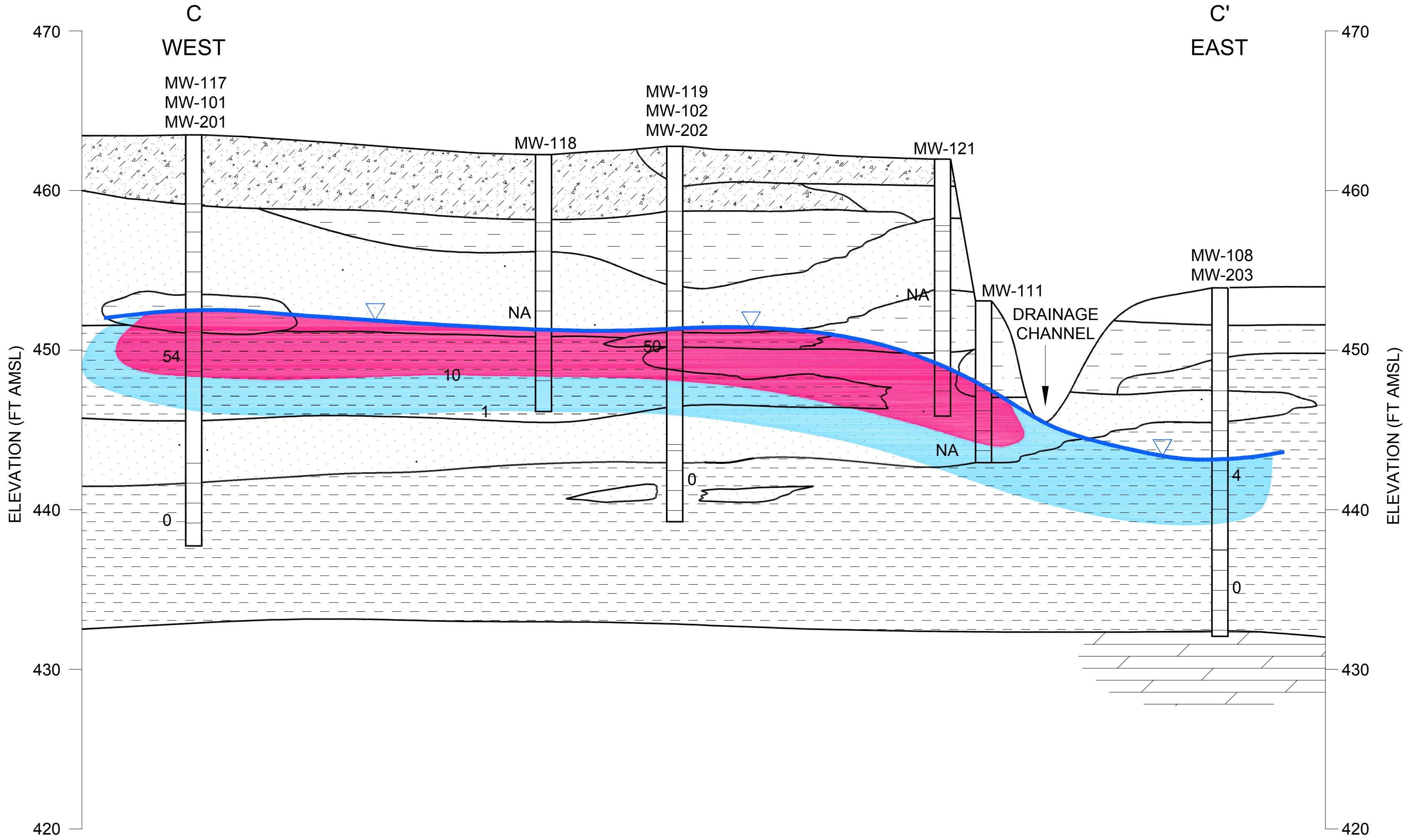
File: ECOR\Geneva\
IRM-1109\drawings\
Fig9-TVOCs-0705-A-A'.dwg

Date:
12/16/2009

Figure 9
TVOCs Detected in Groundwater
July 2005
Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



LEGEND

SCREENED INTERVAL

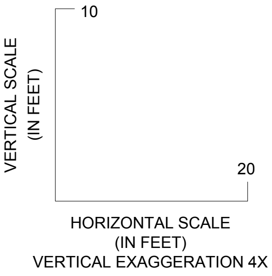
▽ WATER LEVEL DATA FROM AUGUST 15, 1997

54 TVOC CONCENTRATIONS IN GROUNDWATER

TVOC-JULY 1997 (ug/l)

- 1-10
- 10+

☐ **TOPSOIL**
▨ **SILT TO GRAVEL FILL**
☒ **FILL**
▤ **SILT & CLAY**
☐ **SAND**
▤ **CLAY**
▨ **SILTY SAND**
▤ **TILL**



HORIZONTAL SCALE
(IN FEET)
VERTICAL EXAGGERATION 4X

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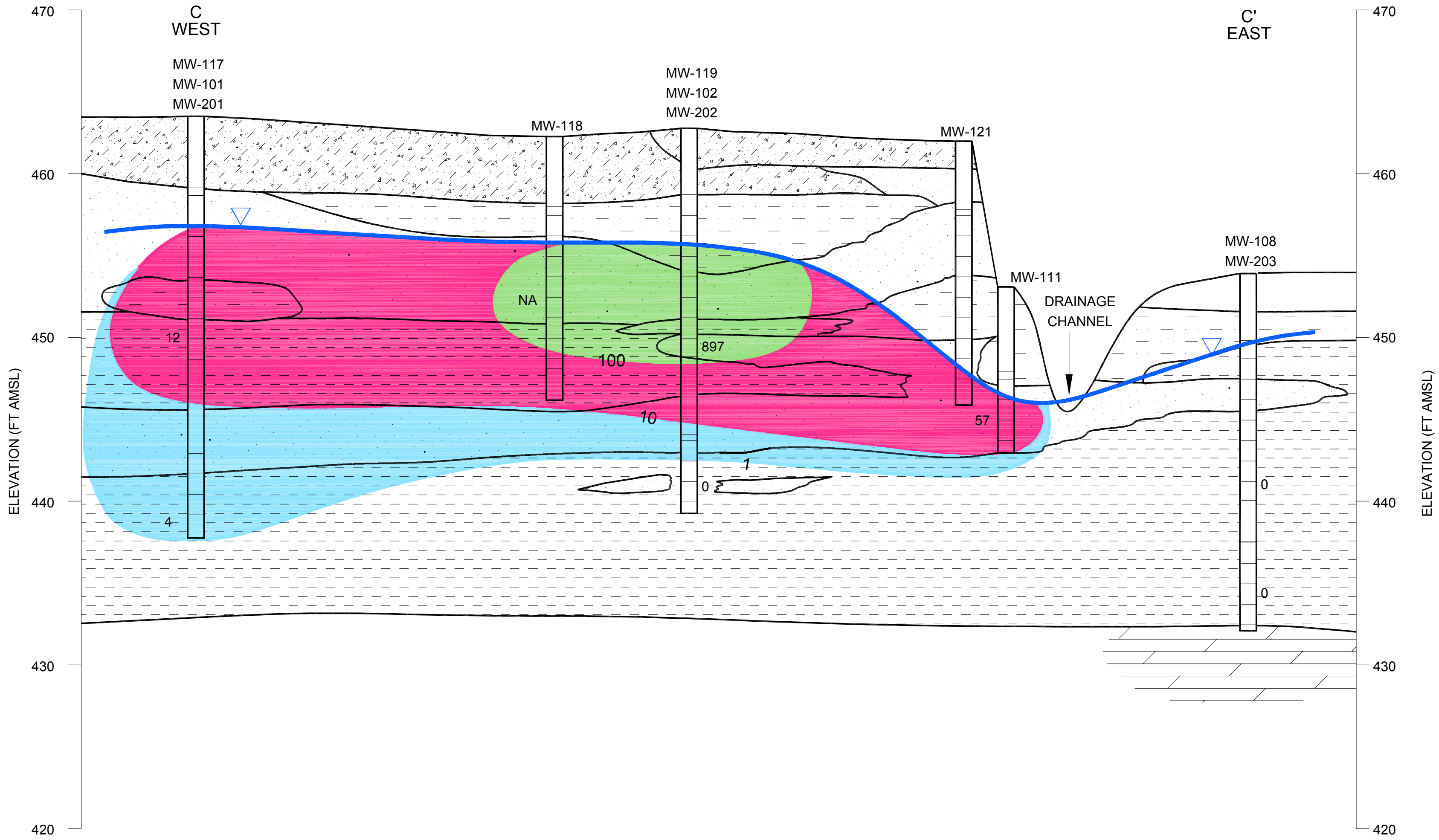
File: ECOR\Geneva\IRM-1109\drawings\Fig10-TVOCs-0797-C-C'.dwg

Date: 11/23/2009

Figure 10
Total VOCs Detected in Groundwater - July 1997
Cross Section C - C'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

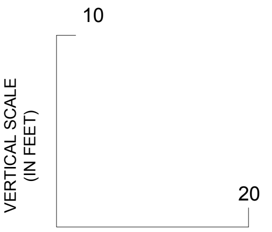


LEGEND

▯	SCREENED INTERVAL	☐	TOPSOIL
▽	WATER LEVEL DATA FROM AUGUST 15, 1997	▨	SILT TO GRAVEL FILL
4	TOTAL VOCs (ug/l)	☒	FILL
		▤	SILT & CLAY
		░	SAND
		▤	CLAY
		▨	SILTY SAND
		▤	TILL

TOTAL VOC CONCENTRATIONS IN GROUNDWATER (FEBRUARY 1998)

- 🟦 1-10
- 🟥 10-100
- 🟩 100+



HORIZONTAL SCALE
(IN FEET)
VERTICAL EXAGGERATION 4X

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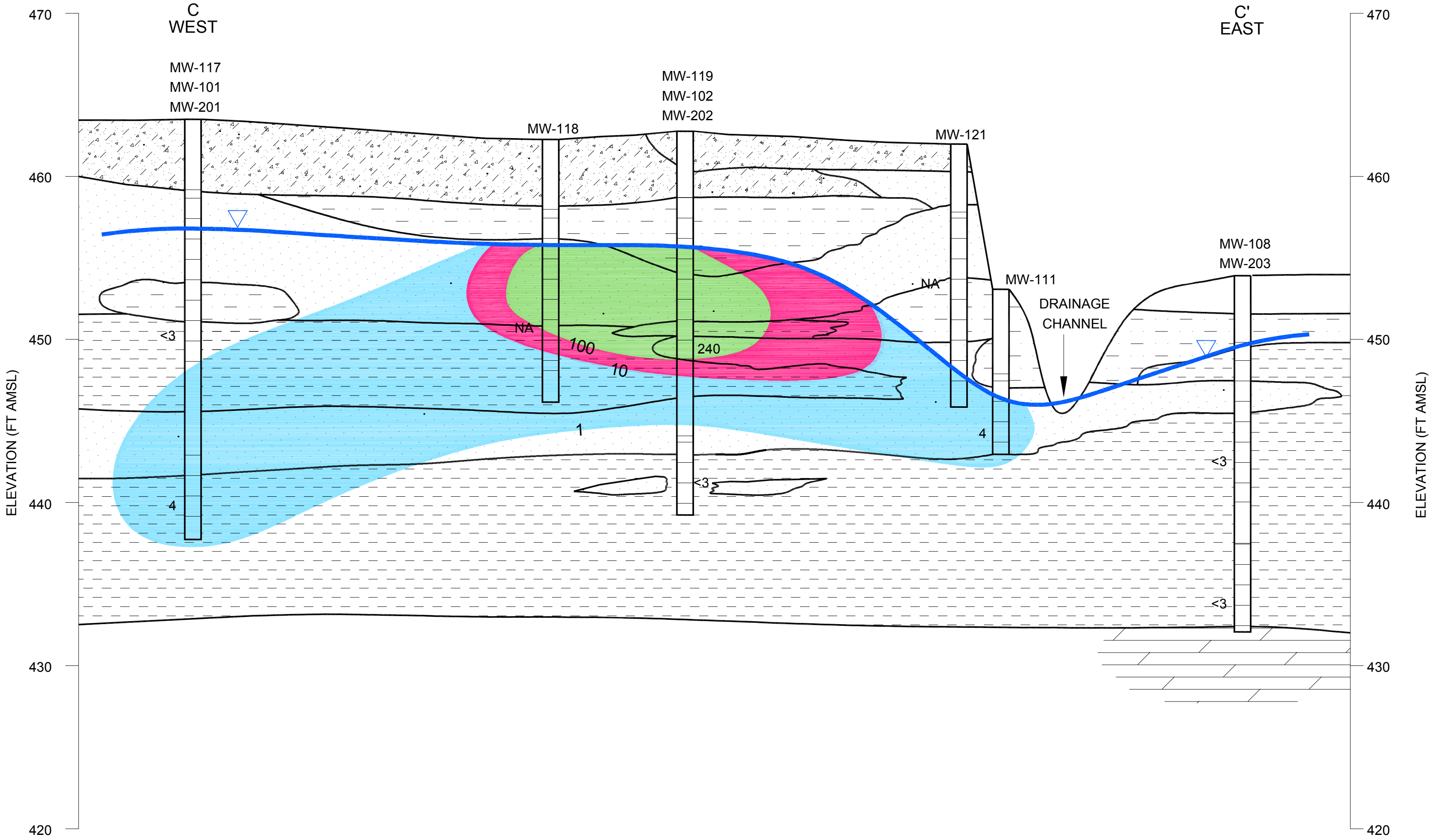
pointmap
incorporated

File: ECOR\Geneva\
IRM-1109\drawings\
Fig11-TVOCs-0298-C-C'.dwg

Date:
11/23/2009

Figure 11
Total VOCs Detected in Groundwater - February 1998
Cross Section C - C'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

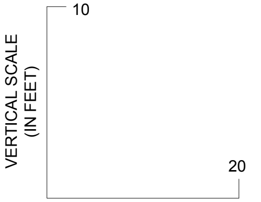


LEGEND

SCREENED INTERVAL	TOPSOIL
▽ WATER LEVEL DATA FROM AUGUST 15, 1997	SILT TO GRAVEL FILL
<3 TCE CONCETRATIONS IN GROUNDWATER (ug/l)	FILL
	SILT & CLAY
	SAND
	CLAY
	SILTY SAND
	TILL

TCE - FEBRUARY 1998 (ug/l)

- 1-10
- 10-100
- 100+



HORIZONTAL SCALE
(IN FEET)
VERTICAL EXAGGERATION 4X

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Figure 12
Trichloroethene Concentrations in Groundwater - February 1998
Cross Section C - C'

pointmap incorporated

File: ECOR\Geneva\IRM-1109\drawings\Fig10-TVOCs-0797-C-C'.dwg

Date: 11/23/2009

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61 Gates Avenue
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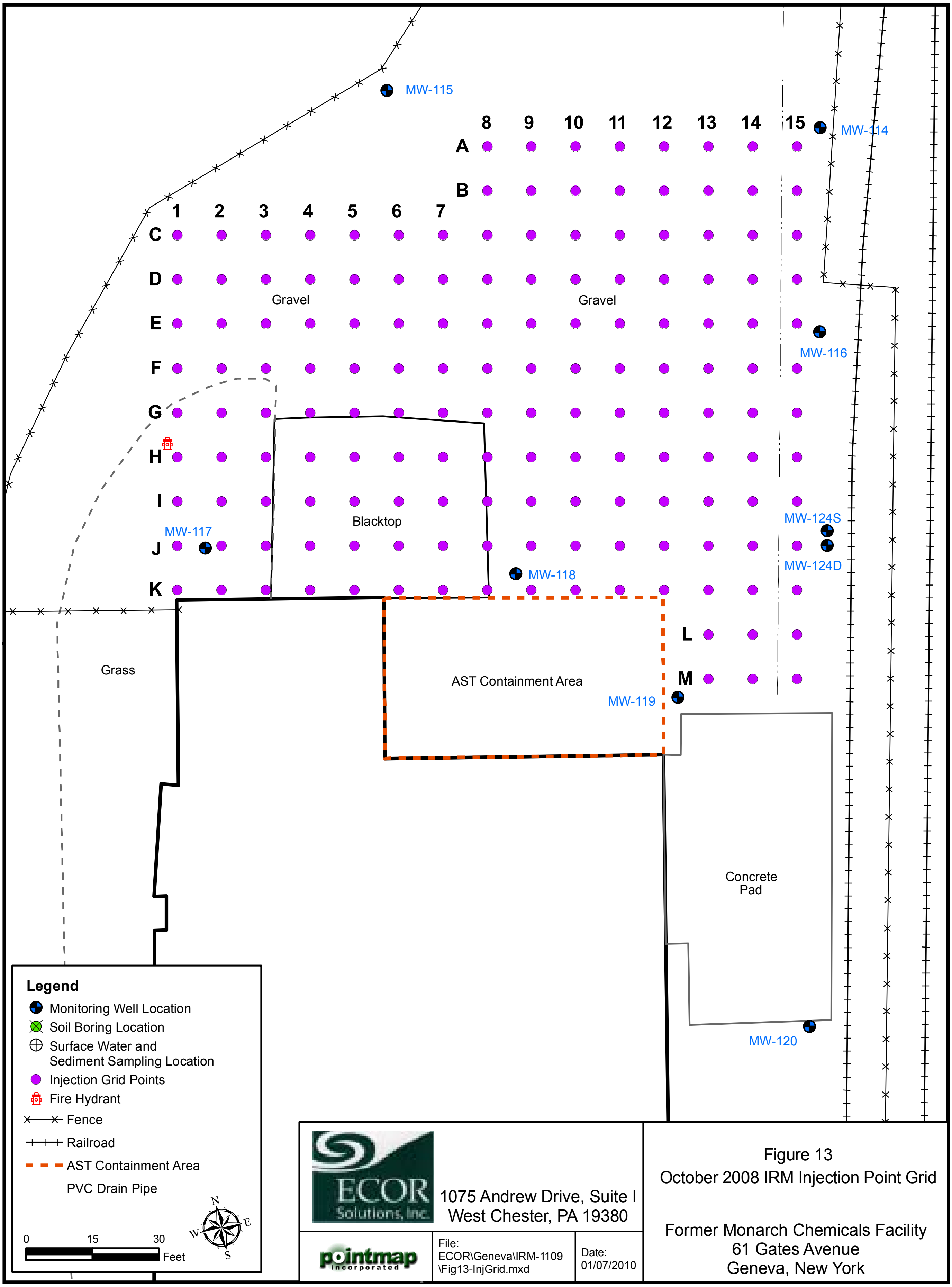

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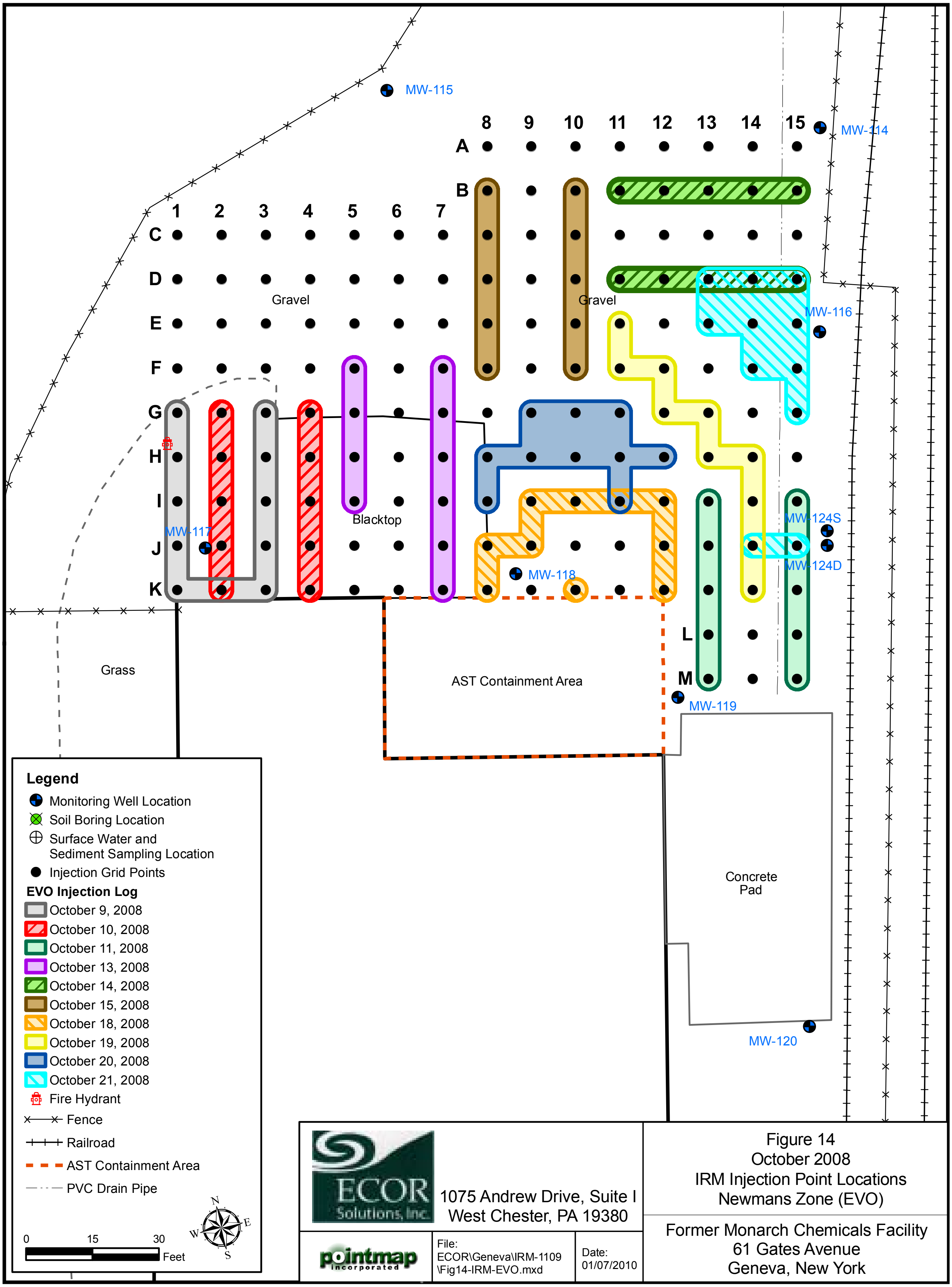
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig13-InjGrid.mxd

Date:
01/07/2010

Figure 13
October 2008 IRM Injection Point Grid

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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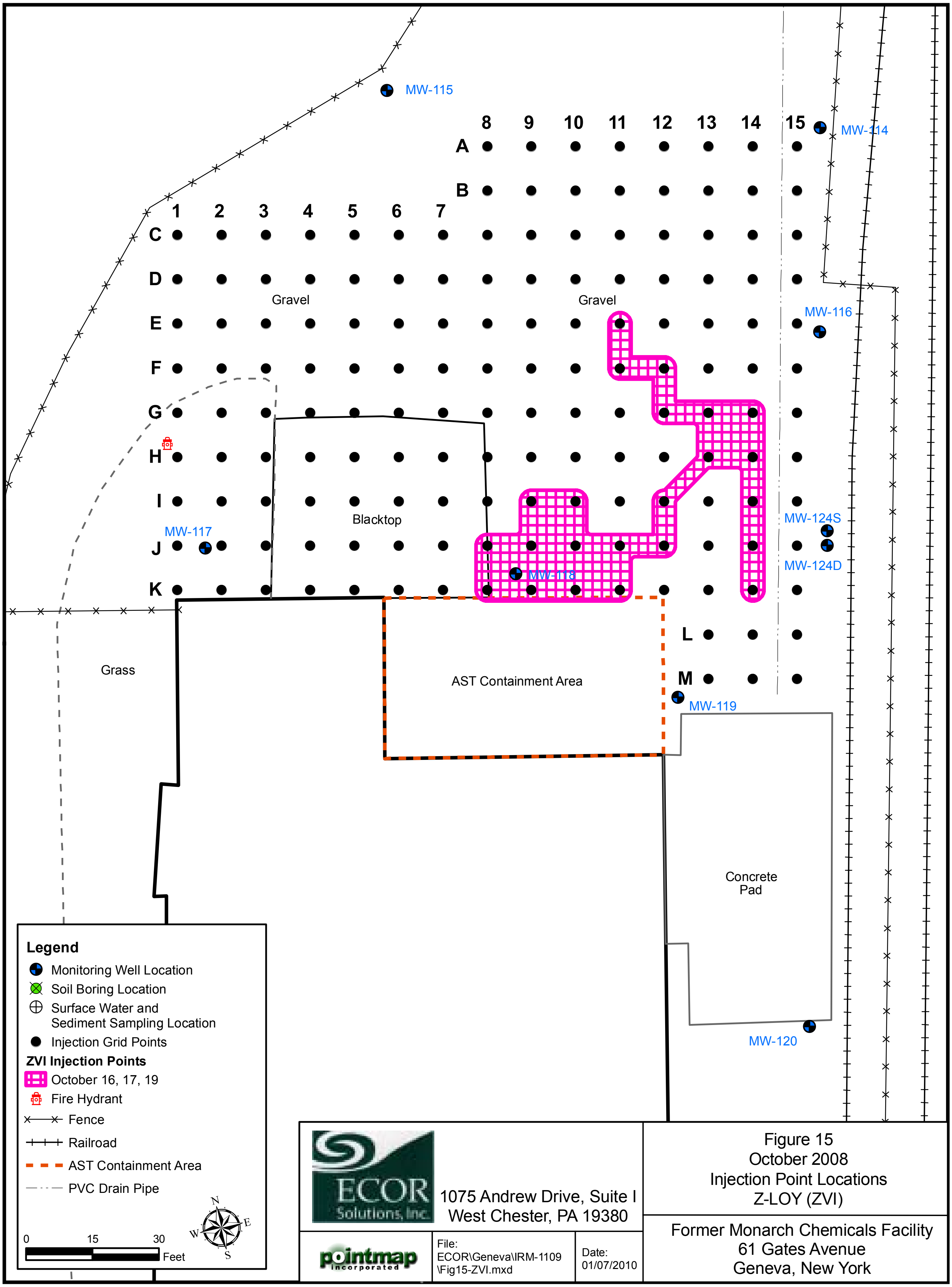
File:
ECOR\Geneva\IRM-1109
\Fig14-IRM-EVO.mxd

Date:
01/07/2010

Figure 14
October 2008
IRM Injection Point Locations
Newmans Zone (EVO)

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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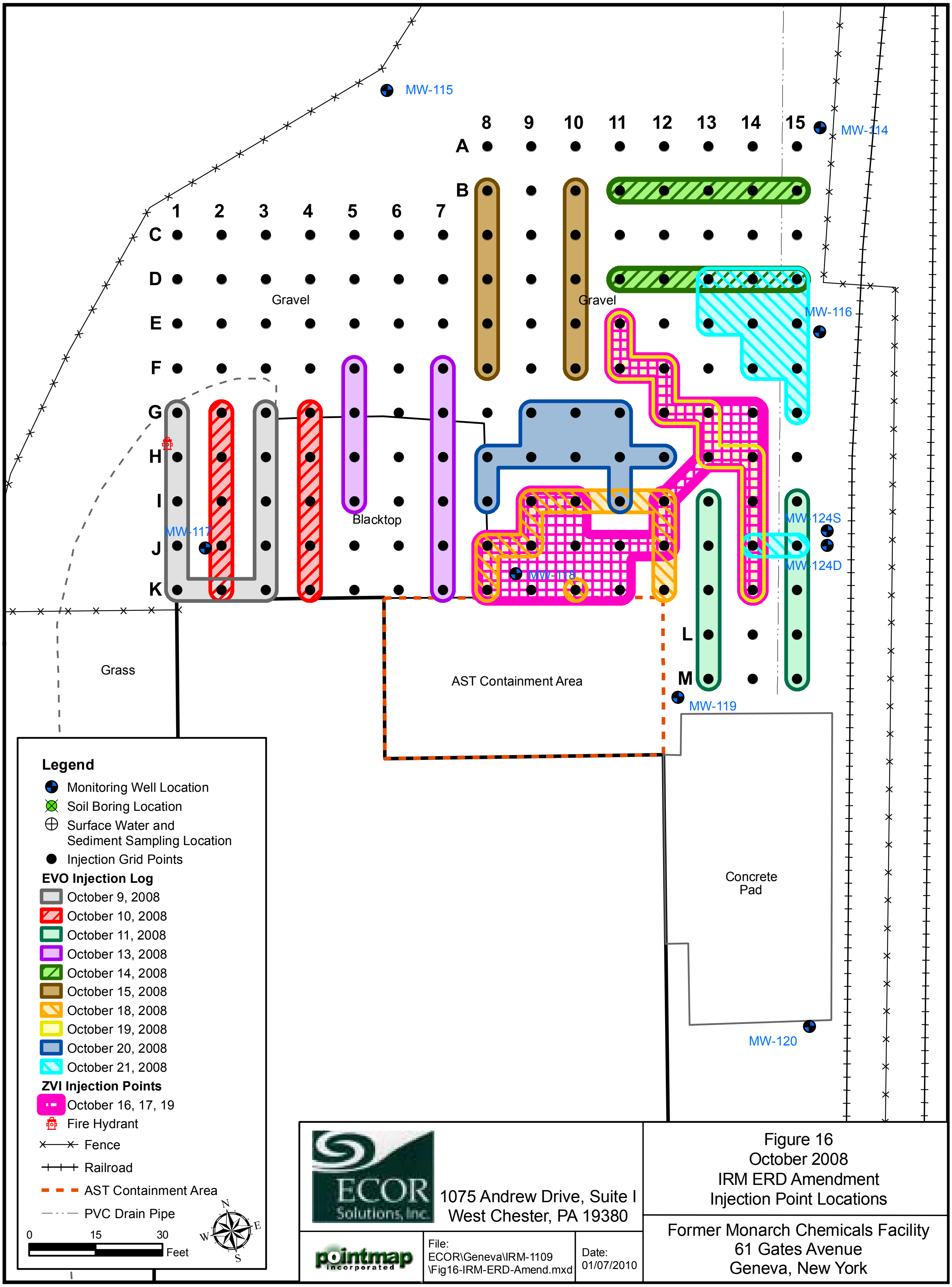
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig15-ZVI.mxd

Date:
01/07/2010

Figure 15
October 2008
Injection Point Locations
Z-LOY (ZVI)

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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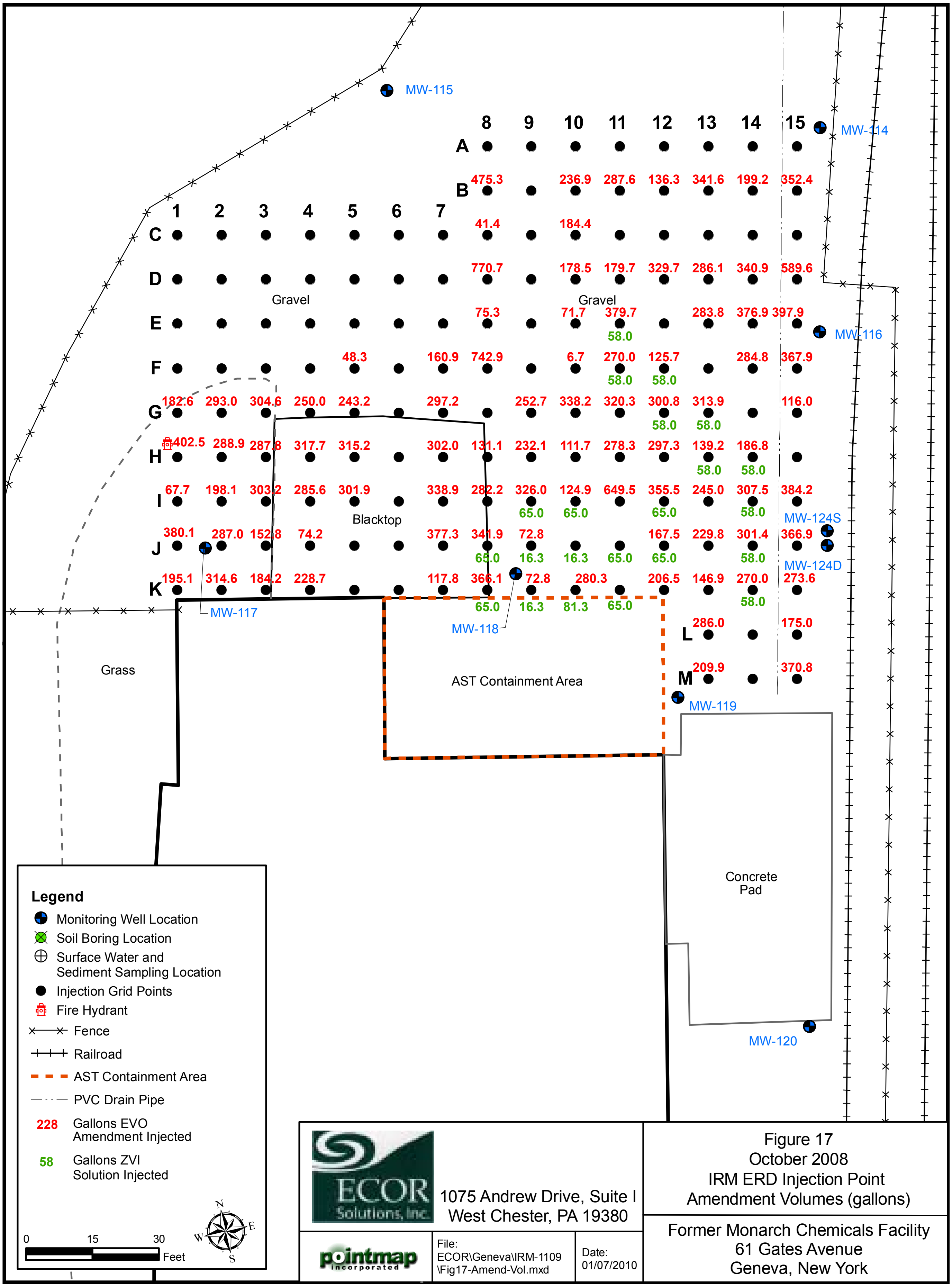
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig16-IRM-ERD-Amend.mxd

Date:
01/07/2010

Figure 16
October 2008
IRM ERD Amendment
Injection Point Locations

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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West Chester, PA 19380

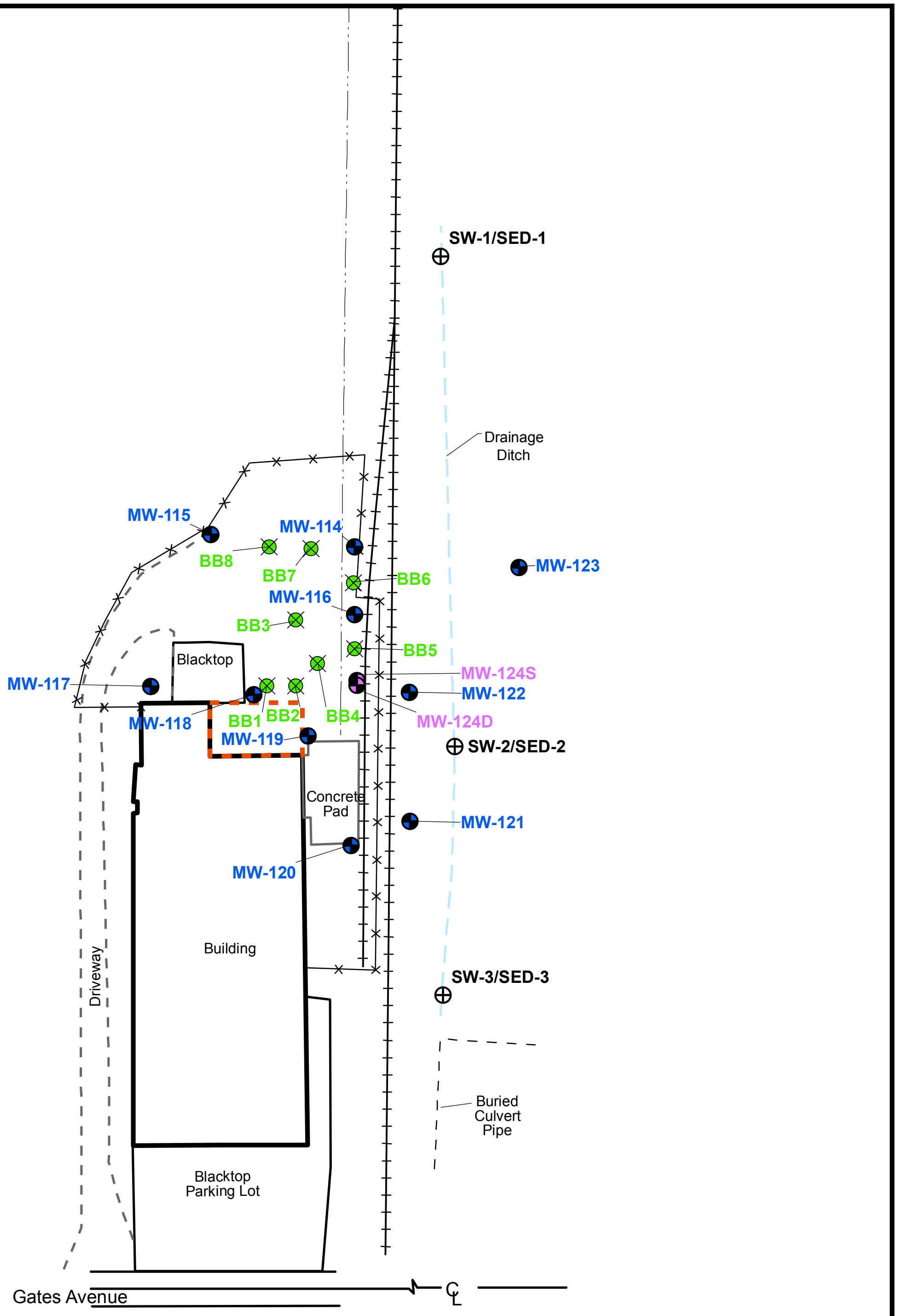
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig17-Amend-Vol.mxd

Date:
01/07/2010

Figure 17
October 2008
IRM ERD Injection Point
Amendment Volumes (gallons)

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



Legend

- ● Monitoring Well Location
- ● Nested Monitoring Well Location (Installed August 2008)
- ⊕ Surface Water and Sediment Sampling Location
- ⊗ Soil Boring Location (Completed October 2008)
- ×—×— Fence
- +++++ Railroad
- - - - AST Containment Area
- —·—· PVC Drain Pipe

0 60 120 Feet

N E S W

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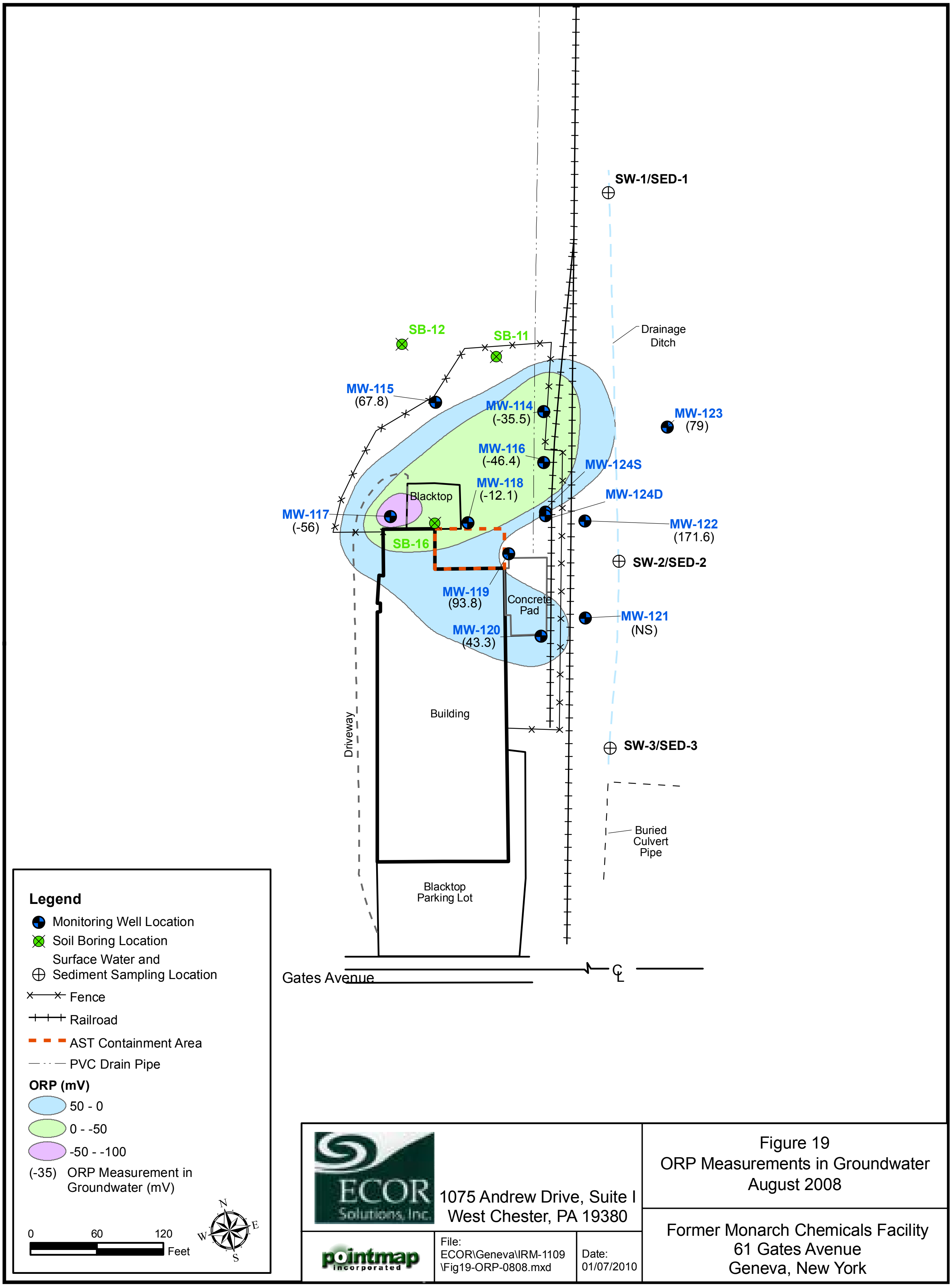
Figure 18
Nested Monitoring Wells MW-124 and
IRM Soil Boring Locations
August - October 2008

pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig18-MW124-IRM-SB.mxd

Date:
01/07/2010

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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West Chester, PA 19380

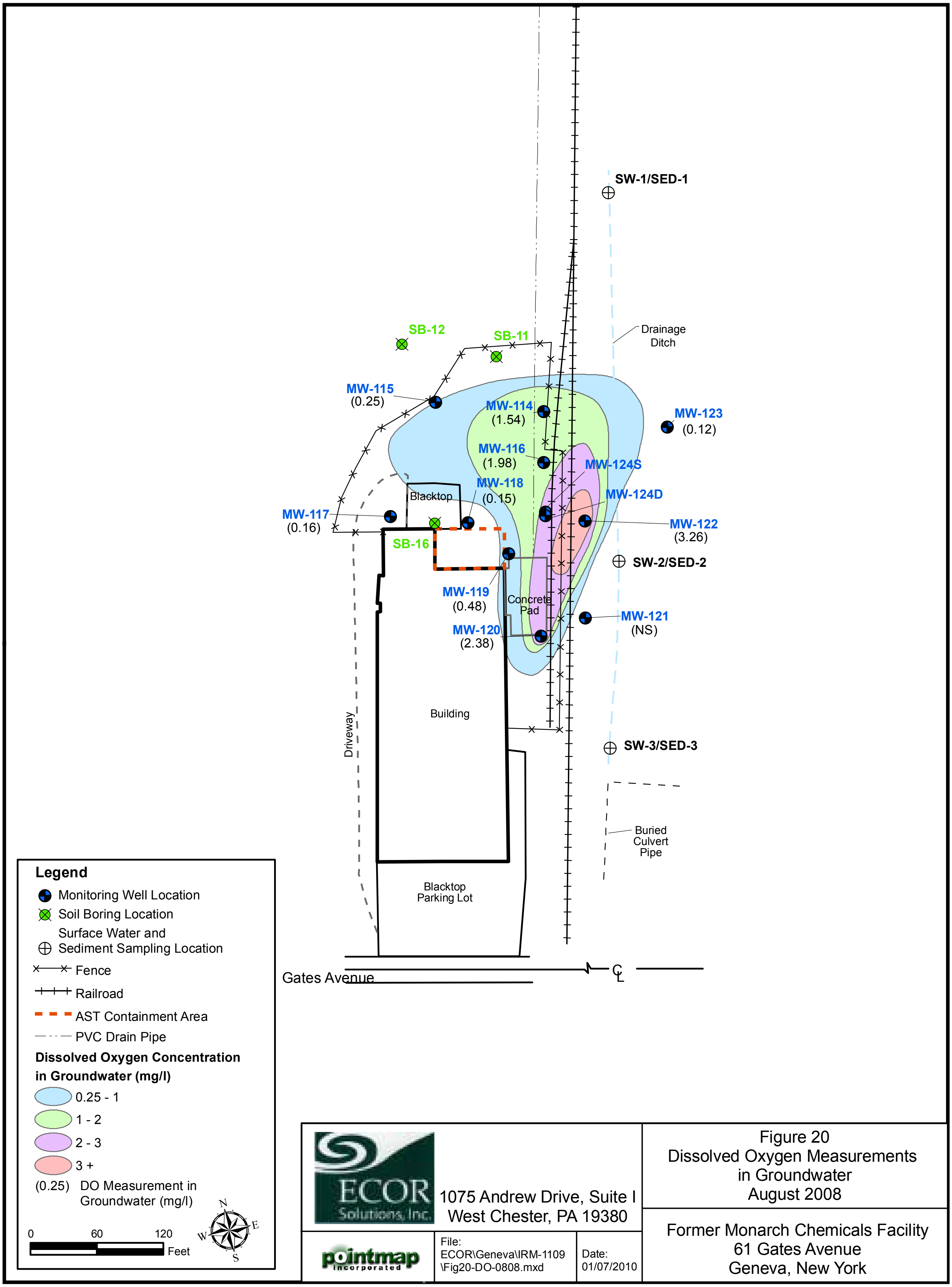
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig19-ORP-0808.mxd

Date:
01/07/2010

Figure 19
ORP Measurements in Groundwater
August 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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West Chester, PA 19380

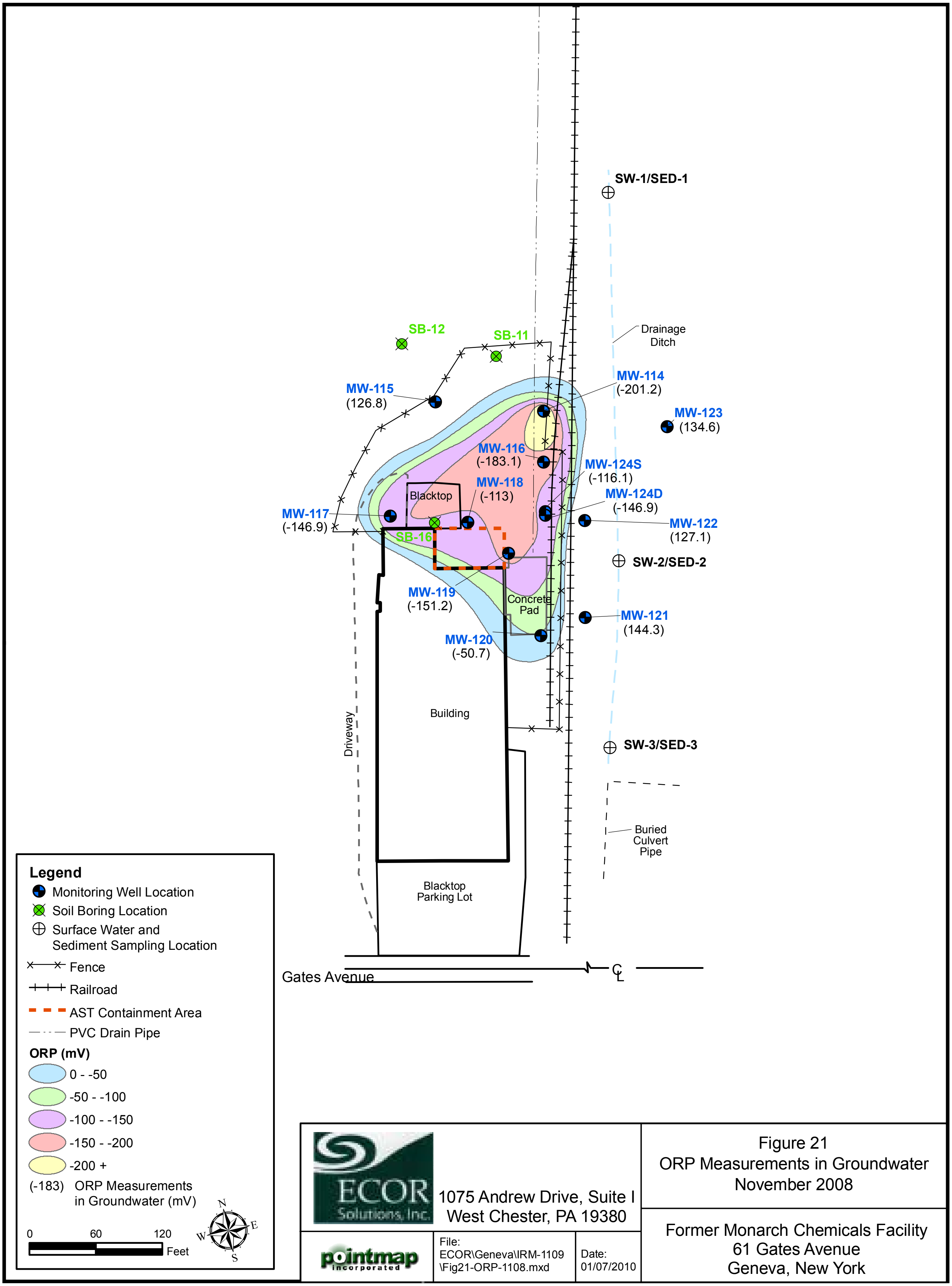
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig20-DO-0808.mxd

Date:
01/07/2010

Figure 20
Dissolved Oxygen Measurements
in Groundwater
August 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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West Chester, PA 19380

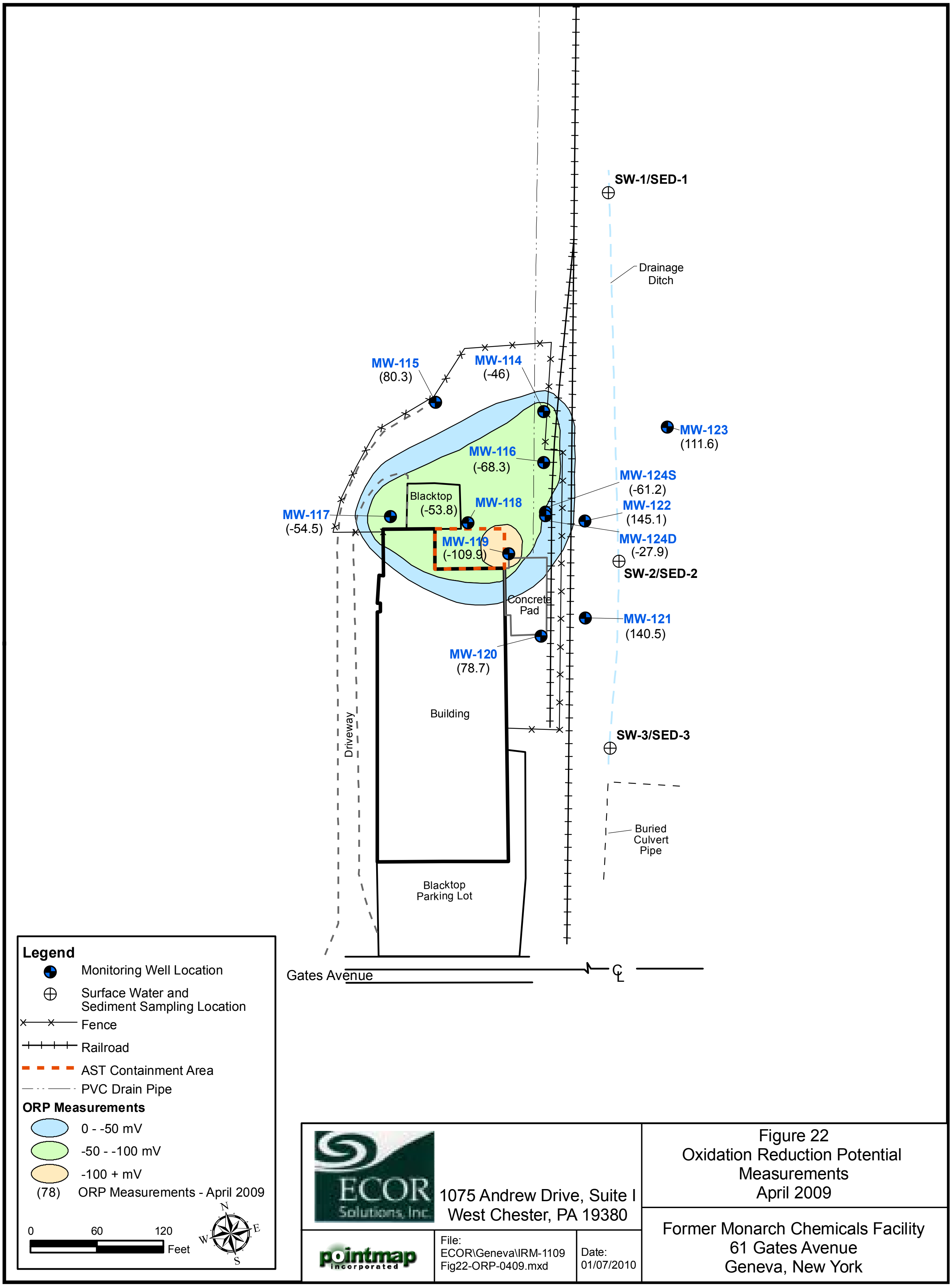
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig21-ORP-1108.mxd

Date:
01/07/2010

Figure 21
ORP Measurements in Groundwater
November 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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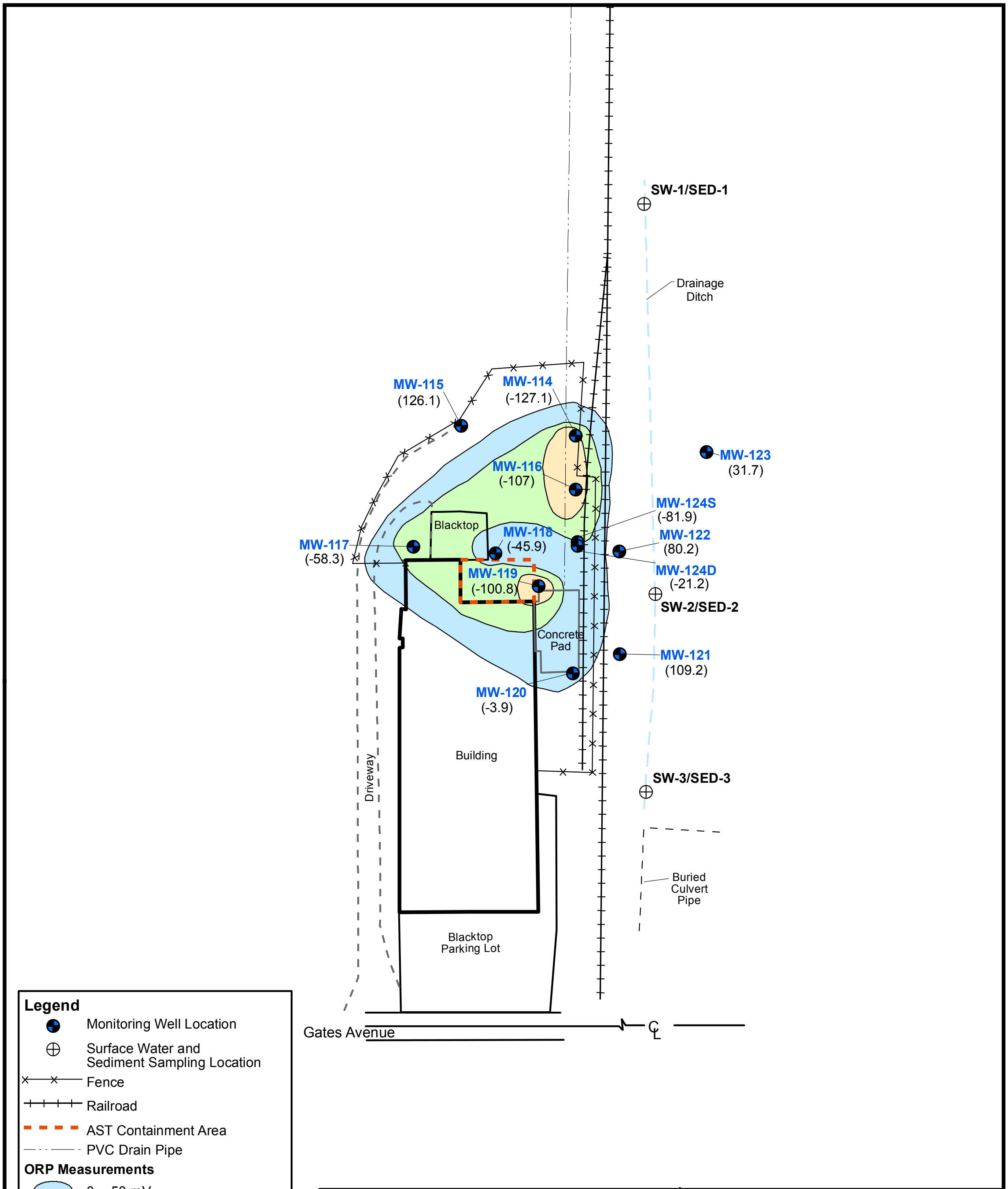
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
Fig22-ORP-0409.mxd

Date:
01/07/2010

Figure 22
Oxidation Reduction Potential
Measurements
April 2009

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



Legend

● Monitoring Well Location

⊕ Surface Water and Sediment Sampling Location

—×—×— Fence

┼┼┼┼ Railroad

- - - AST Containment Area

—·— PVC Drain Pipe

ORP Measurements

0 - -50 mV

-50 - -100 mV

-100 + mV

(-3) ORP Measurements- August 2009

0 60 120 Feet

N E S W

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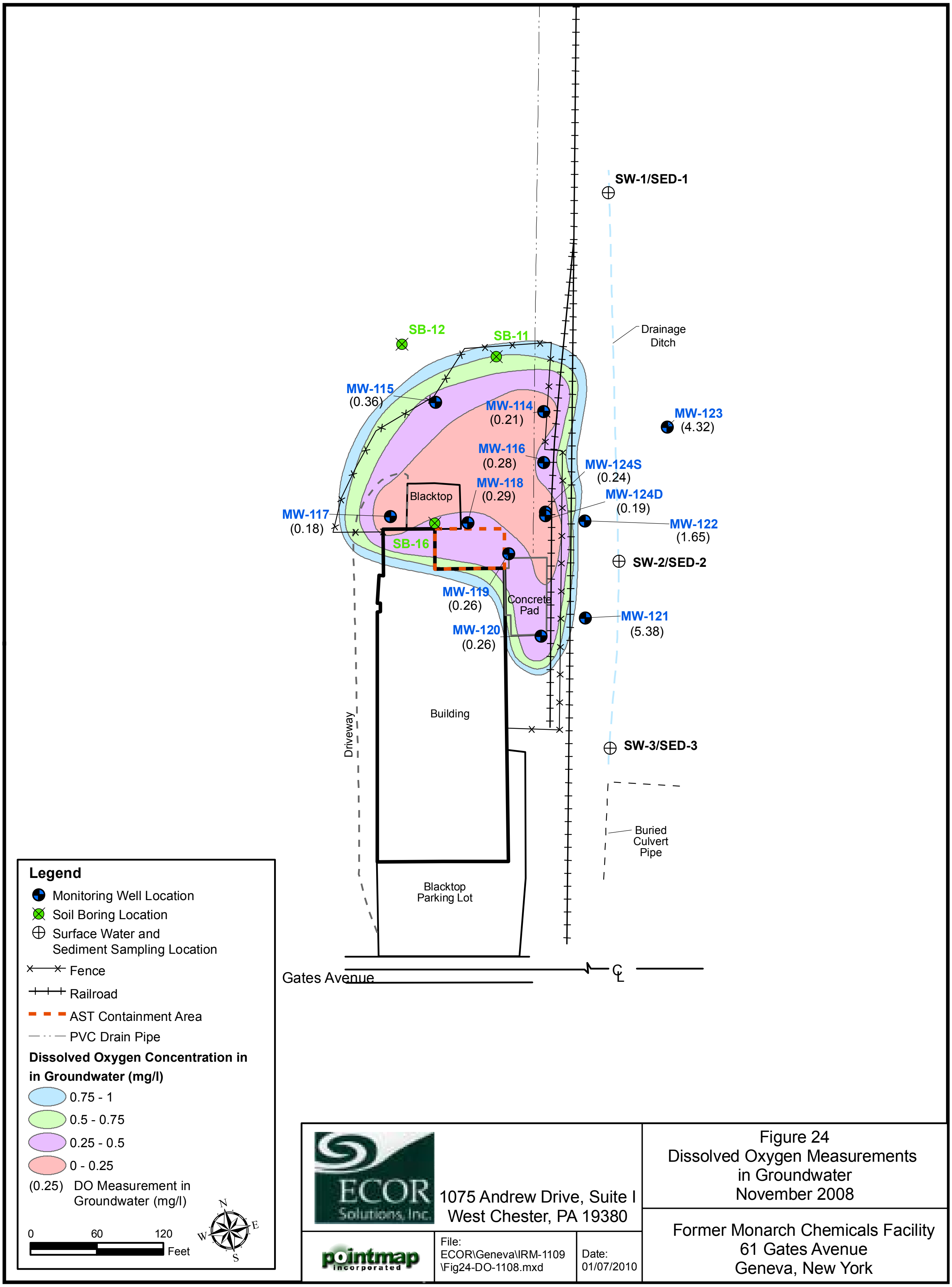
Figure 23
Oxidation Reduction Potential Measurements
August 2009

pointmap incorporated

File:
ECOR\Geneva\IRM-1109
Fig23-ORP-0809.mxd

Date:
01/07/2010

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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West Chester, PA 19380

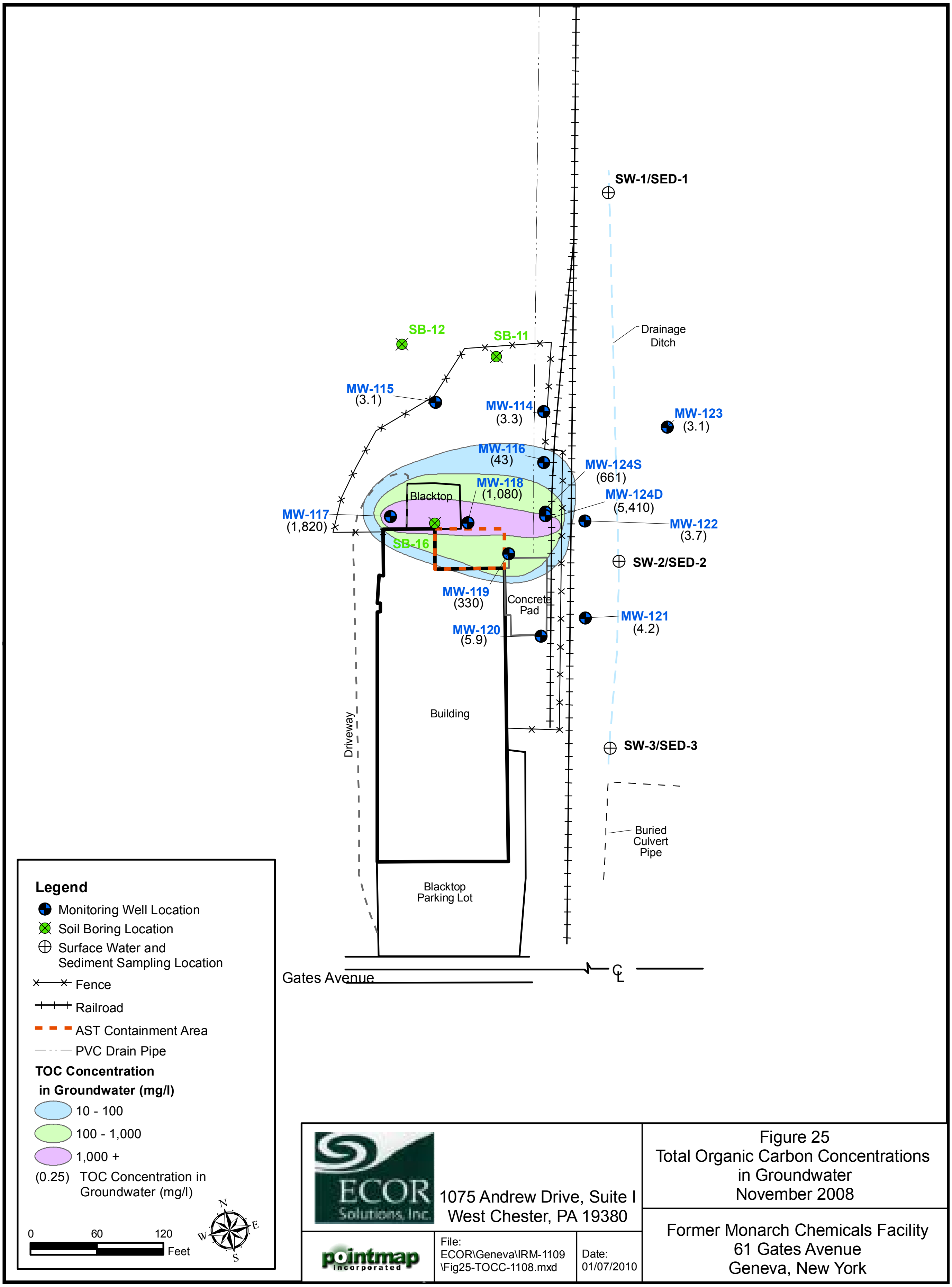
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig24-DO-1108.mxd

Date:
01/07/2010

Figure 24
Dissolved Oxygen Measurements
in Groundwater
November 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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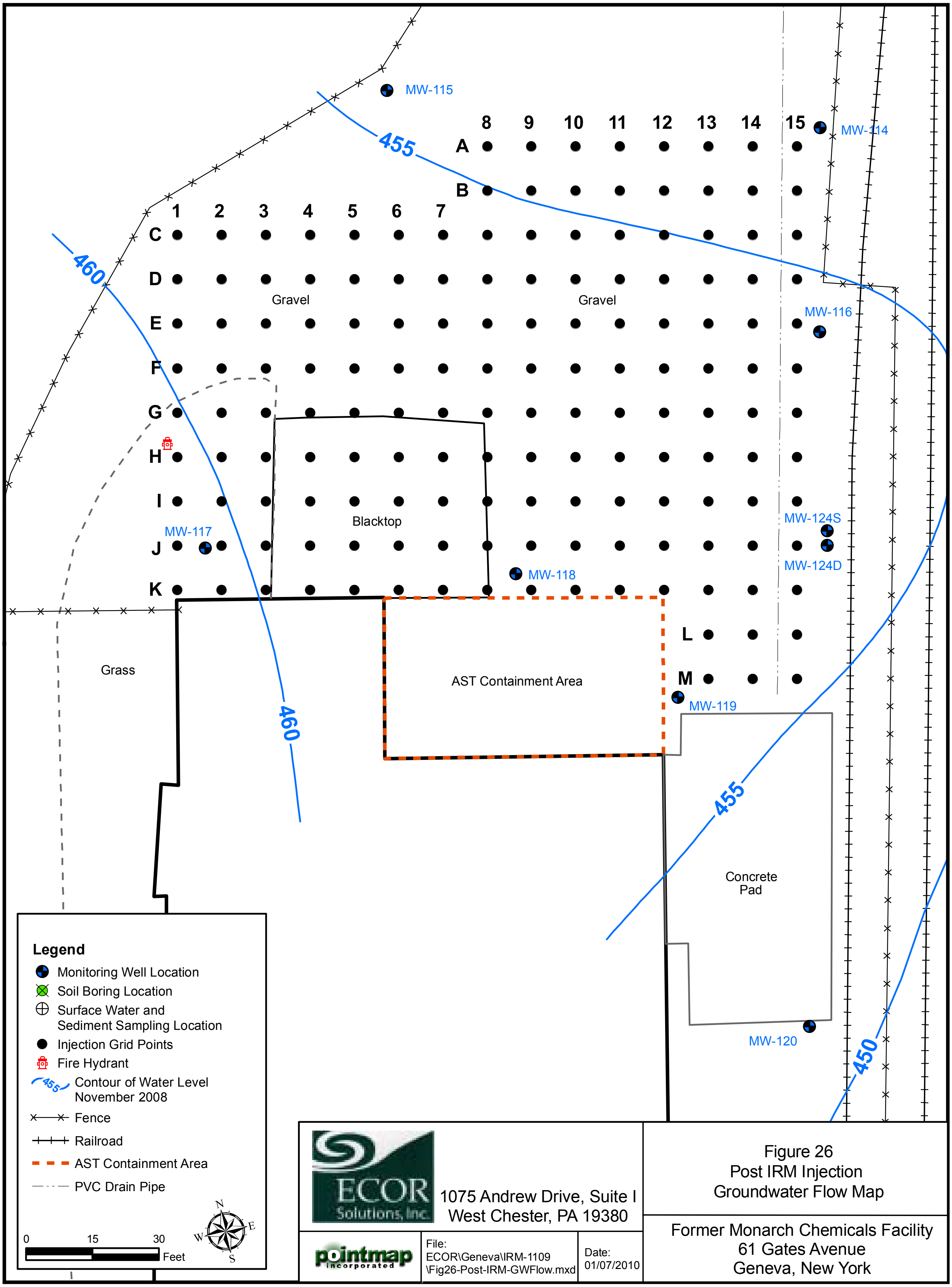
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig25-TOCC-1108.mxd

Date:
01/07/2010

Figure 25
Total Organic Carbon Concentrations
in Groundwater
November 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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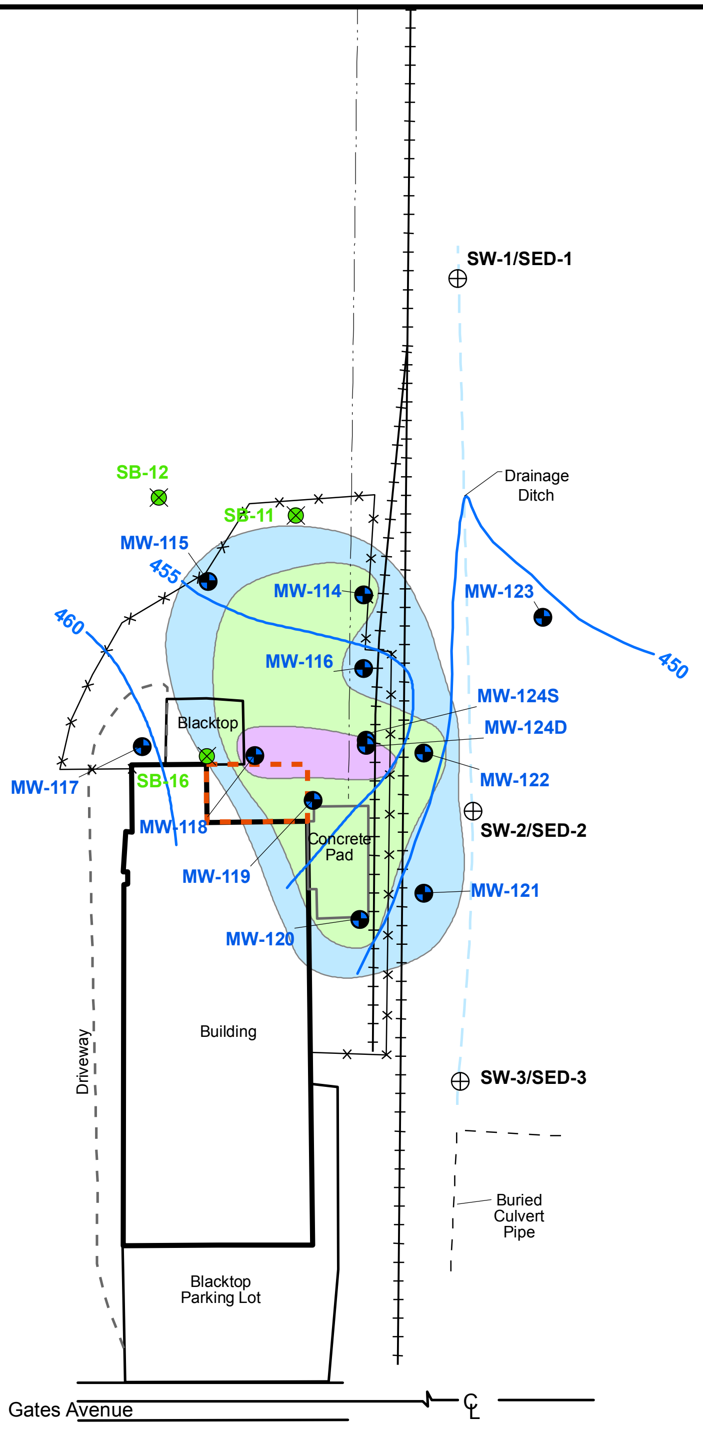
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig26-Post-IRM-GWFlow.mxd

Date:
01/07/2010

Figure 26
Post IRM Injection
Groundwater Flow Map

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



Legend

- ● Monitoring Well Location
- ⊗ Soil Boring Location
- ⊕ Surface Water and Sediment Sampling Location
- ～ Contour of Water Level November 2008
- ×—× Fence
- ┼┼┼ Railroad
- ▬ ▬ AST Containment Area
- —·· PVC Drain Pipe

TCE Concentration in Groundwater (ug/l)
November 2008

- 🟦 1 - 10
- 🟩 10 - 100
- 🟪 100 - 1,000

0 60 120
Feet

N E S W

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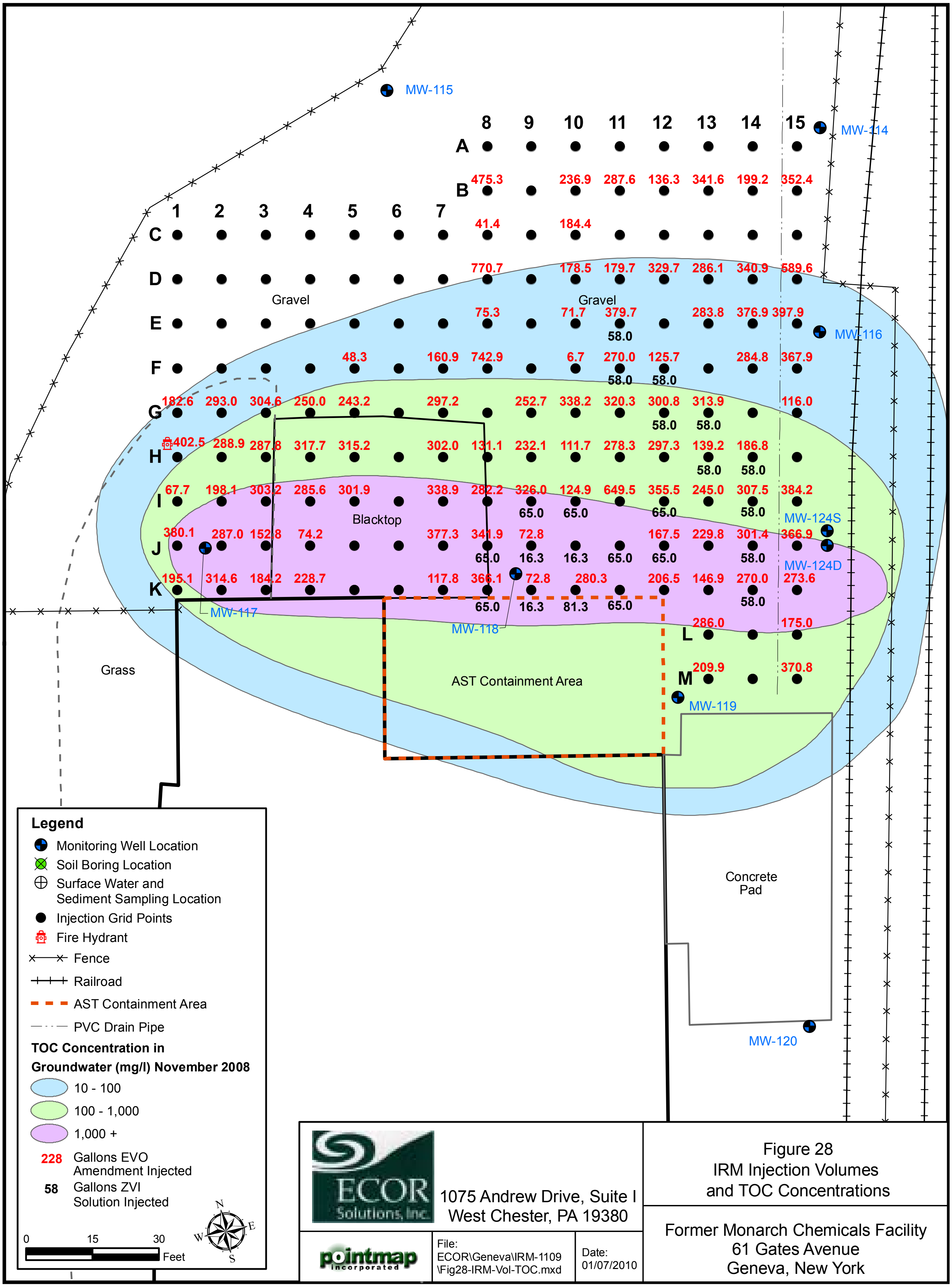
Figure 27
Post IRM Trichloroethene Concentrations
and Groundwater Flow
November 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig27-Post-TCE-GW.mxd

Date:
01/07/2010



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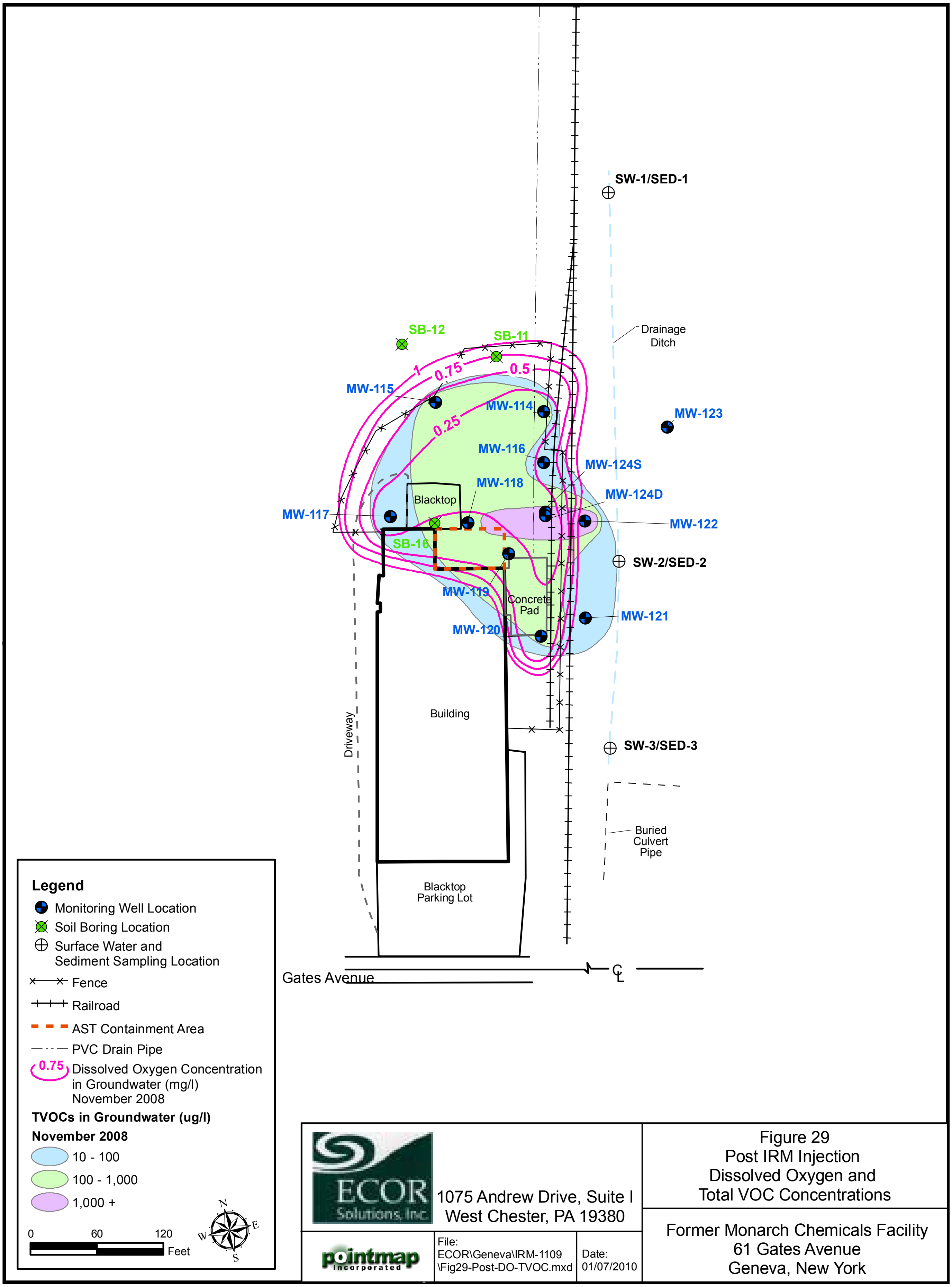
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig28-IRM-Vol-TOC.mxd

Date:
01/07/2010

Figure 28
IRM Injection Volumes
and TOC Concentrations

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig29-Post-DO-TVOC.mxd

Date:
01/07/2010

Figure 29
Post IRM Injection
Dissolved Oxygen and
Total VOC Concentrations

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

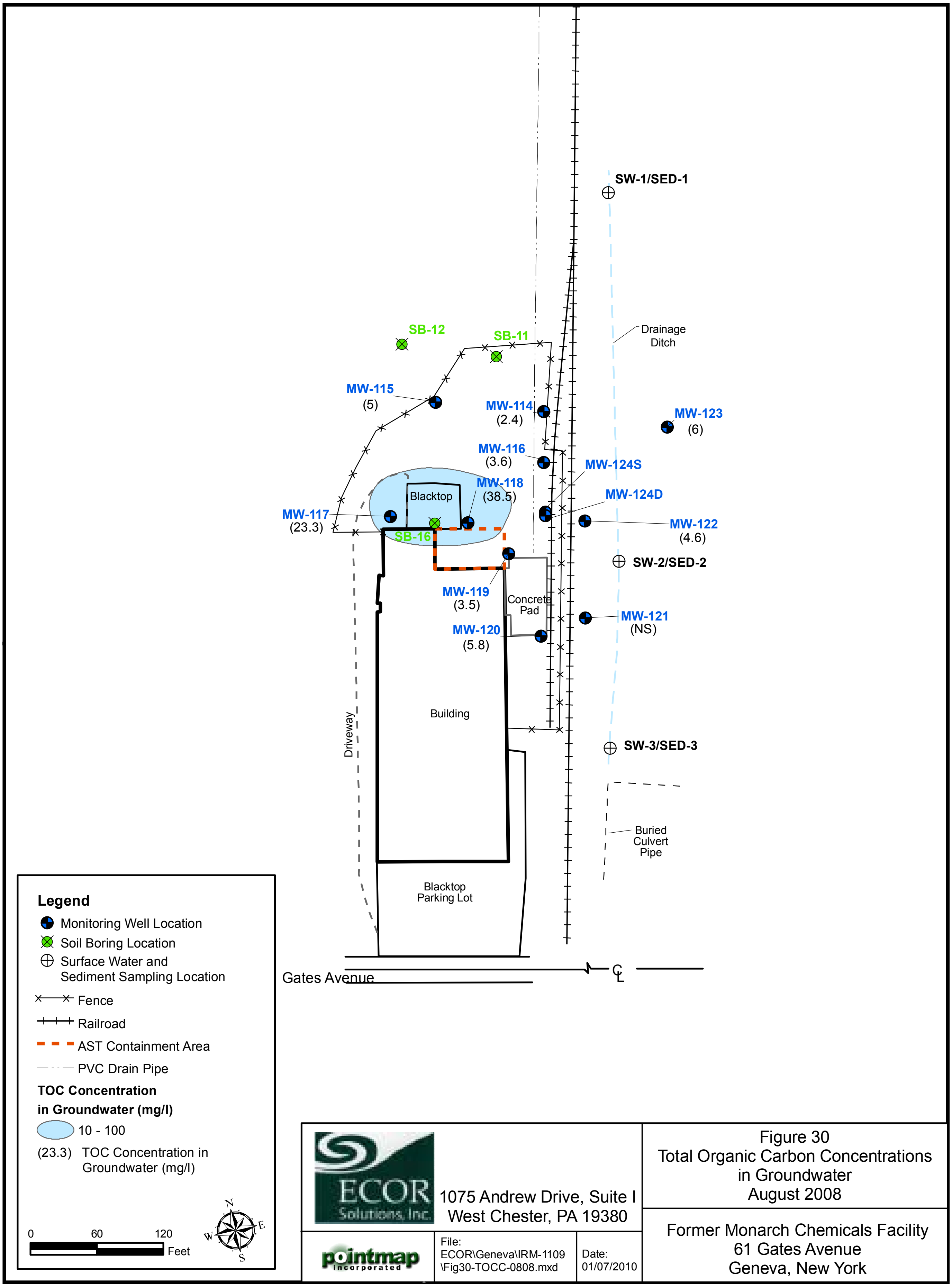

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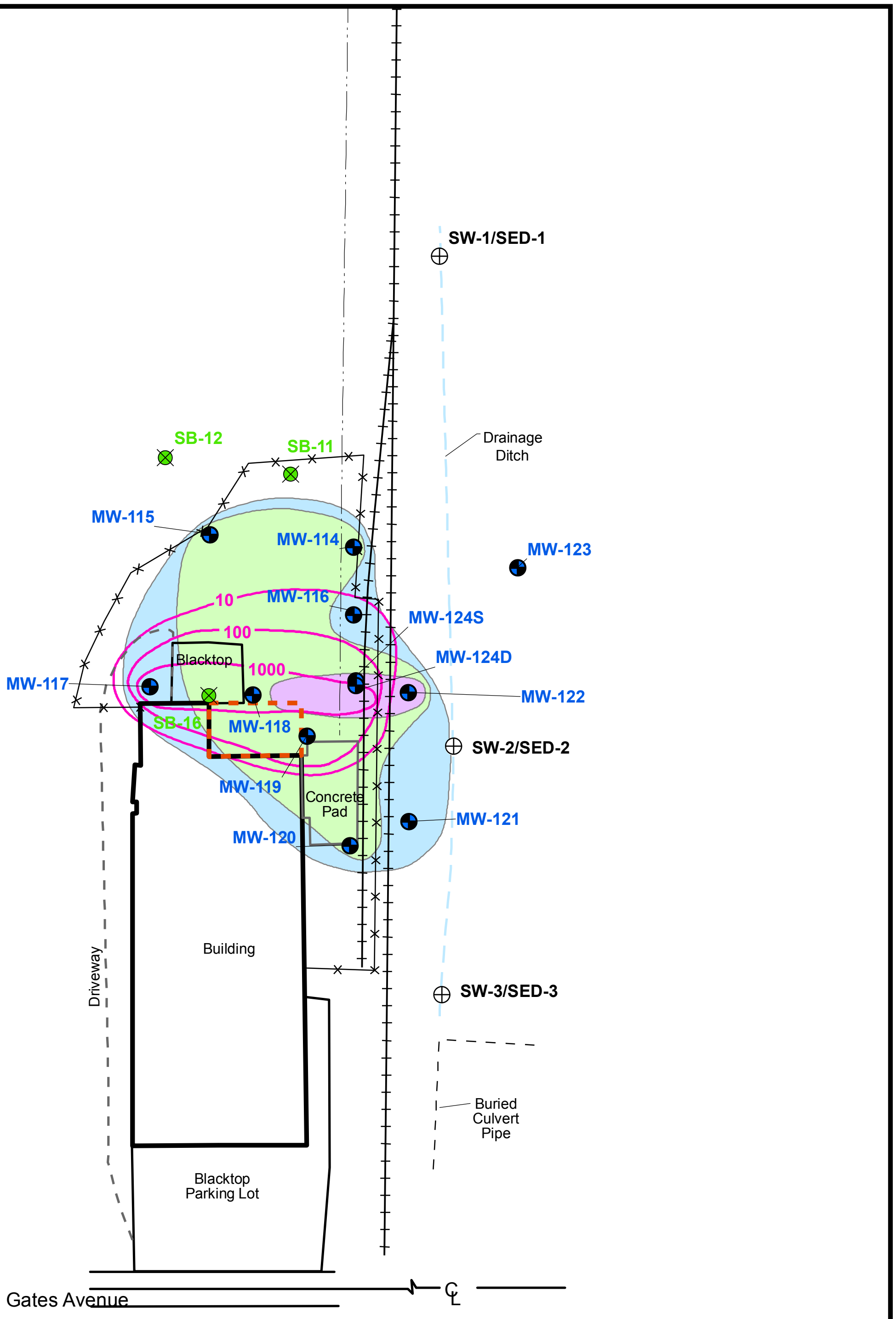
Figure 30
Total Organic Carbon Concentrations in Groundwater
August 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig30-TOCC-0808.mxd

Date:
01/07/2010



Legend

- ● Monitoring Well Location
- ☒ Soil Boring Location
- ⊕ Surface Water and Sediment Sampling Location
- ×—× Fence
- +++ Railroad
- - - AST Containment Area
- — · — PVC Drain Pipe
- (10) TOC Concentration in Groundwater (mg/l) November 2008

TVOCs in Groundwater (ug/l)

November 2008

- 10 - 100
- 100 - 1,000
- 1,000 +

0 60 120
Feet

N E S W

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West Chester, PA 19380

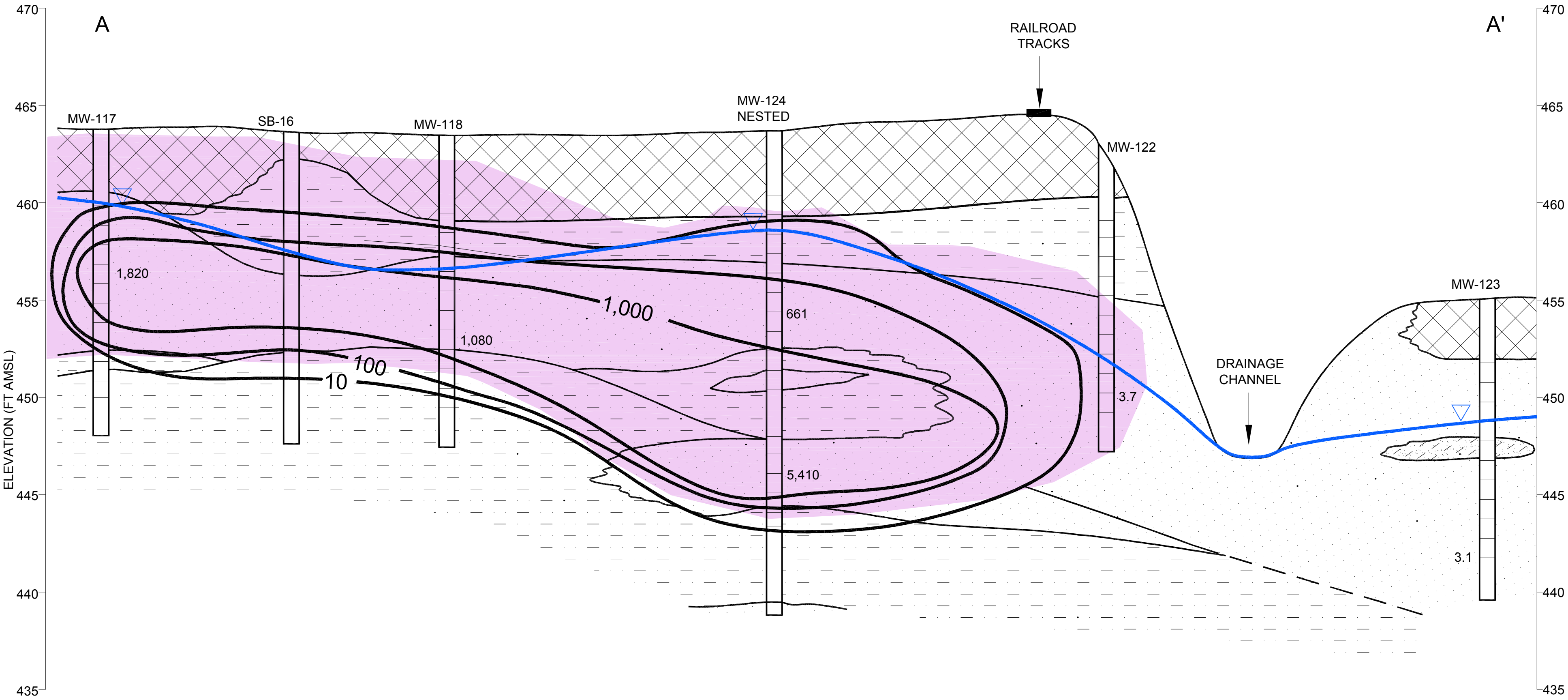
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig31-Post-TOC-TVOC.mxd

Date:
01/07/2010

Figure 31
Post IRM Injection
Total Organic Carbon
and Total VOC Concentrations

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



LEGEND

SCREENED INTERVAL

▽ NOVEMBER 2008 POTENTIOMETRIC ELEVATIONS (FT-AMSL)

TOTAL ORGANIC CARBON CONCENTRATIONS (NOVEMBER 2008)

— CONTOUR OF TOTAL ORGANIC CONCENTRATION

▨ AREA OF IRM AMENDMENTS IMPACTING SUBSURFACE (OCT 2008)

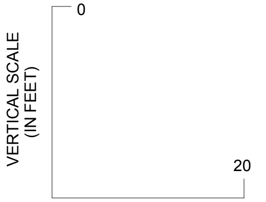
▨ FILL

▨ SILT & CLAY

▨ SAND

▨ CLAY

▨ SILTY SAND



HORIZONTAL SCALE (IN FEET)
VERTICAL EXAGGERATION 4X

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pointmap incorporated

File: ECOR\Geneva\IRM-1109\drawings\Fig32-TOCC1108-AA.dwg

Date: 01/07/2010

Figure 32
Total Organic Carbon Concentrations in IRM Injection Area November 2008 Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

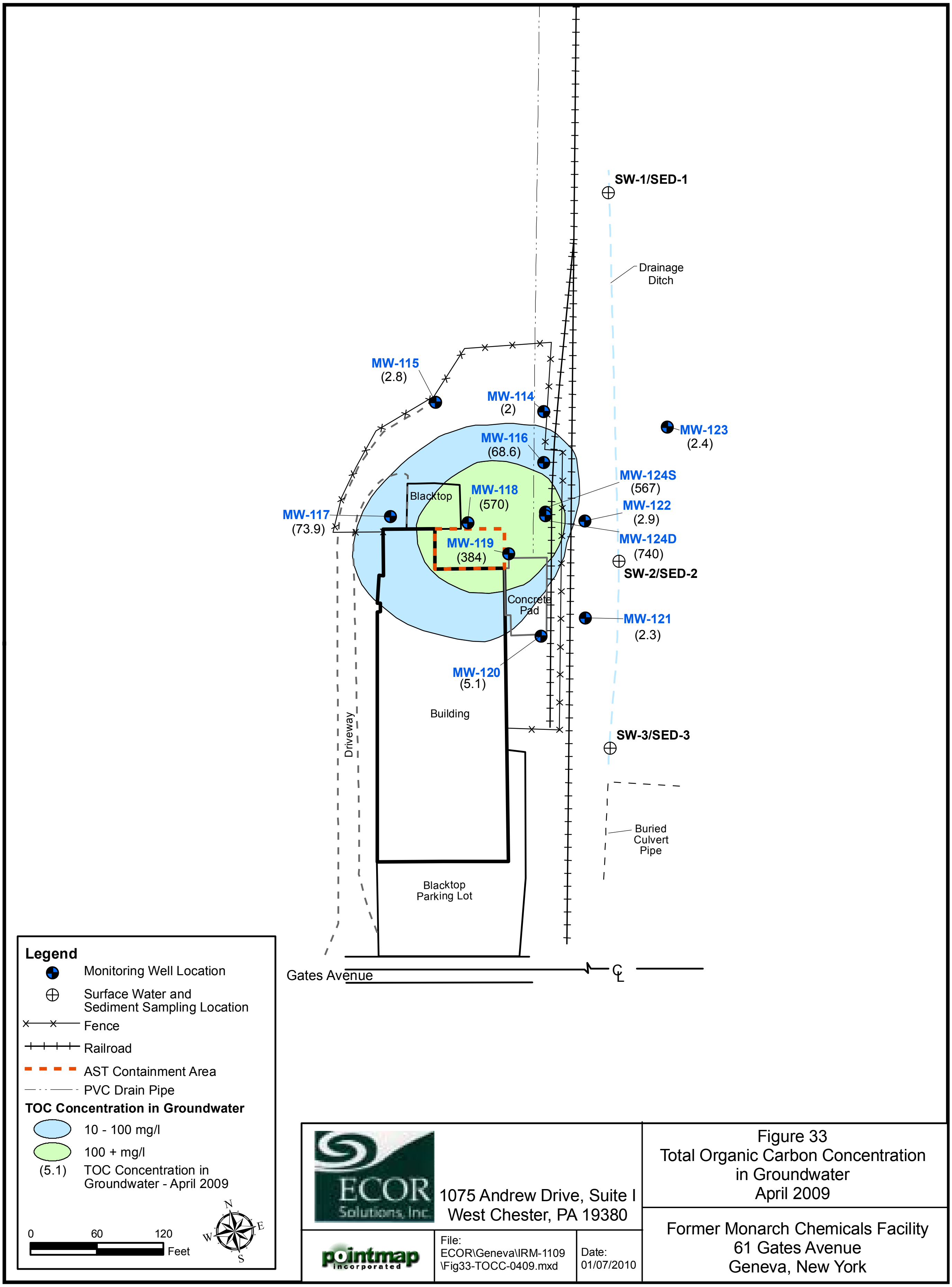

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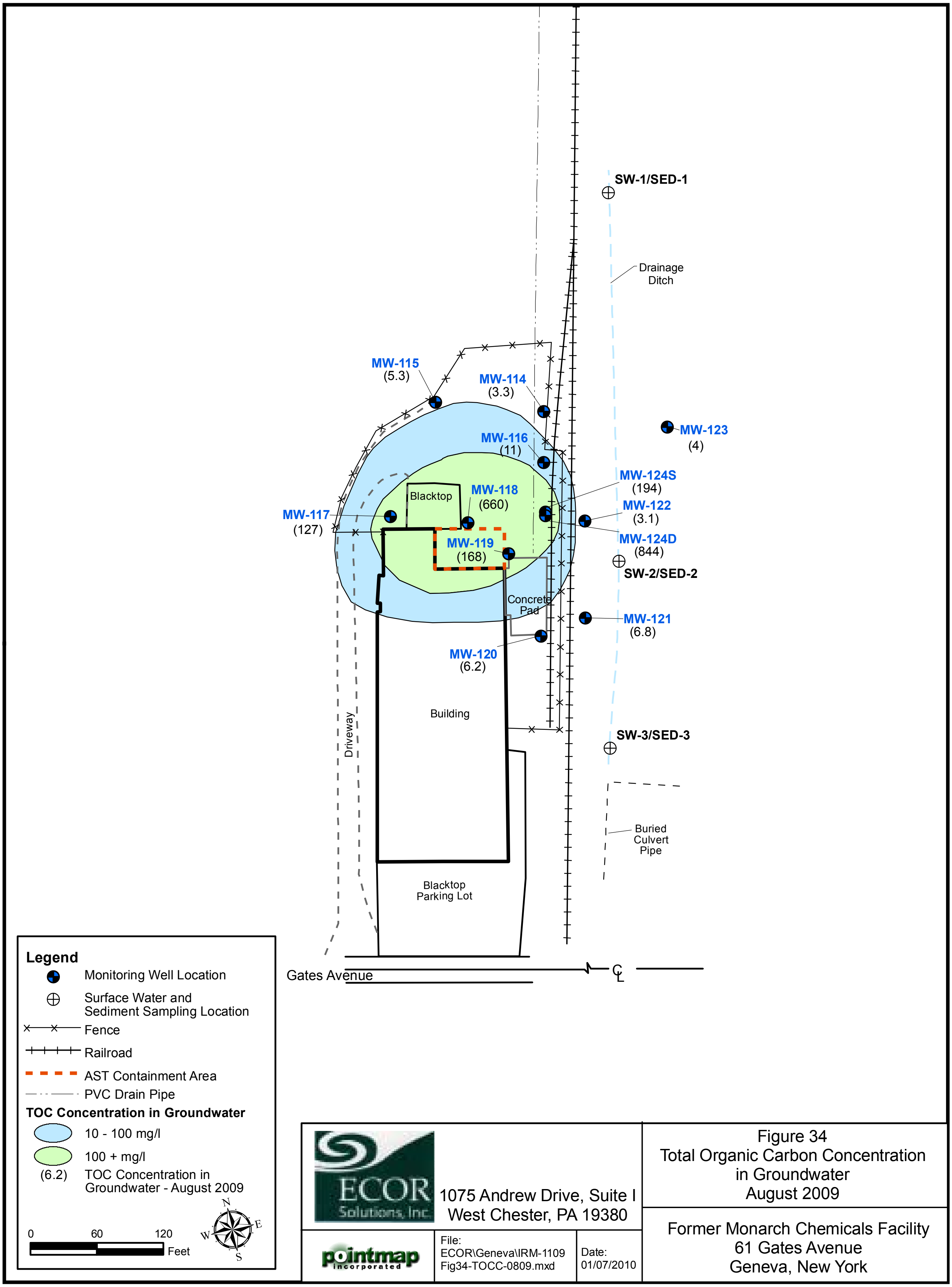
Figure 33
Total Organic Carbon Concentration in Groundwater
April 2009

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig33-TOCC-0409.mxd

Date:
01/07/2010



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West Chester, PA 19380

pointmap incorporated

File:
ECOR\Geneva\IRM-1109
Fig34-TOCC-0809.mxd

Date:
01/07/2010

Figure 34
Total Organic Carbon Concentration
in Groundwater
August 2009

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

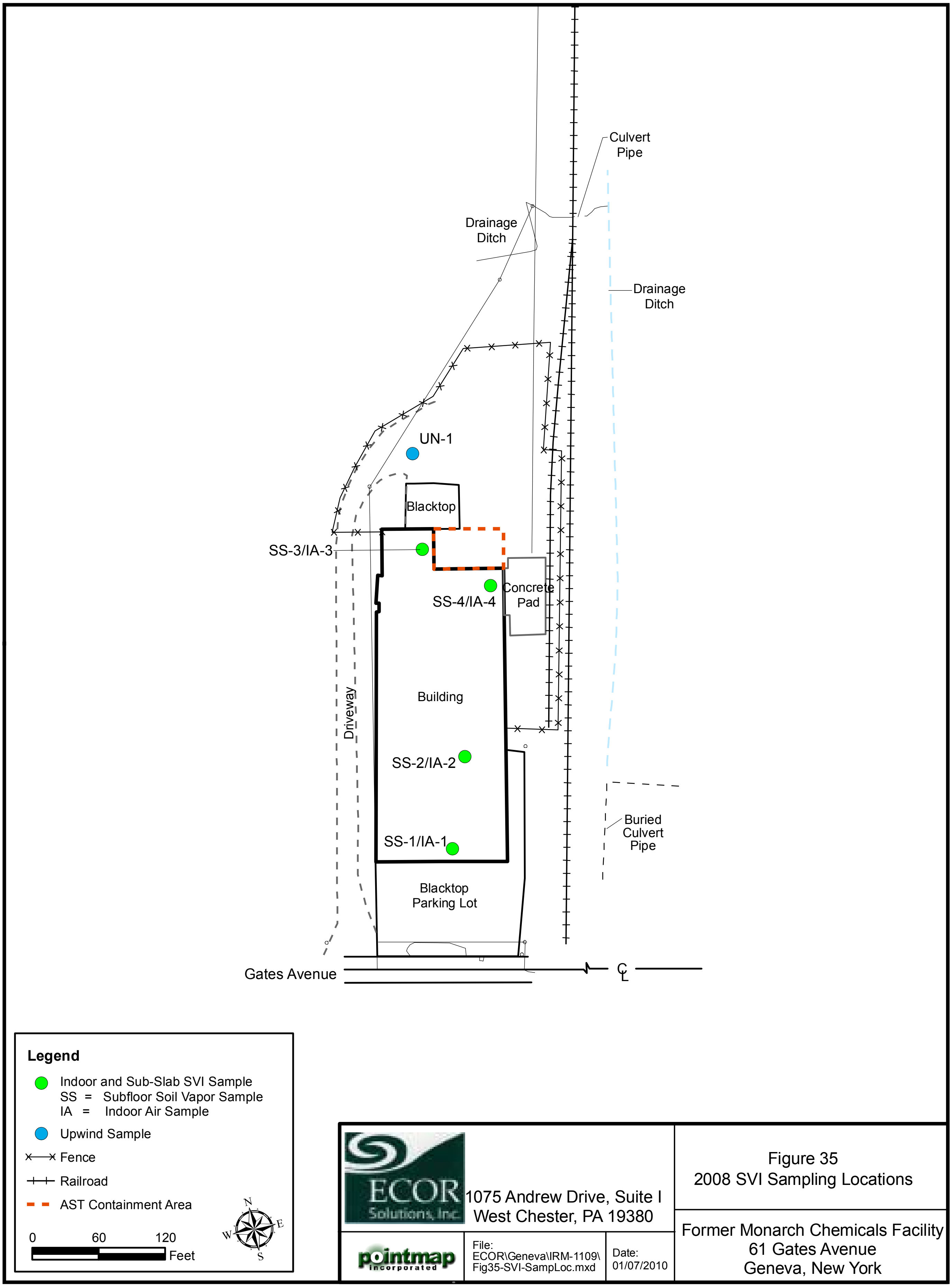

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Figure 35
2008 SVI Sampling Locations

pointmap incorporated

File:
ECOR\Geneva\IRM-1109\
Fig35-SVI-SampLoc.mxd

Date:
01/07/2010

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

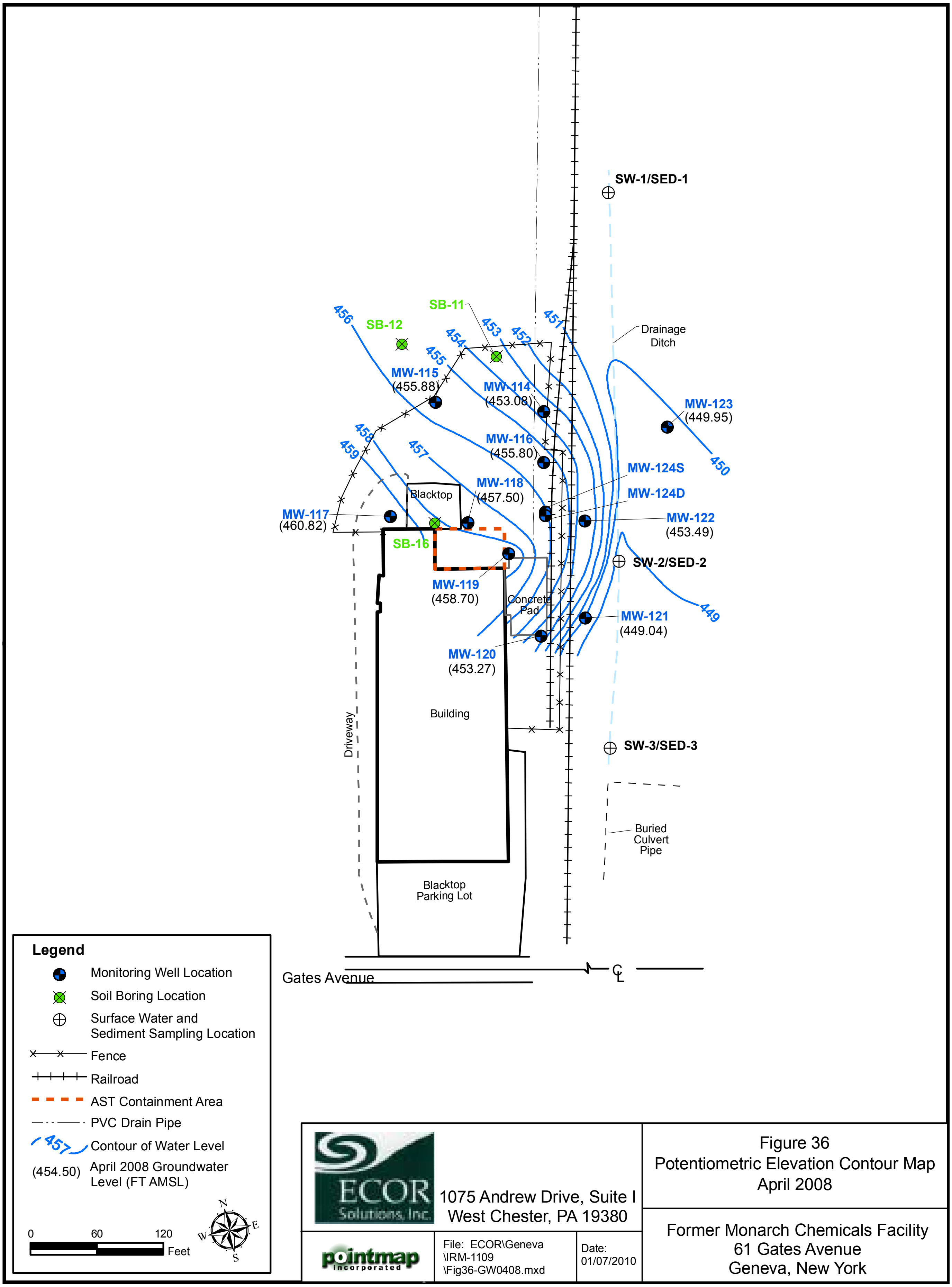

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Figure 36
Potentiometric Elevation Contour Map
April 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

pointmap incorporated

File: ECOR\Geneva
\IRM-1109
\Fig36-GW0408.mxd

Date:
01/07/2010

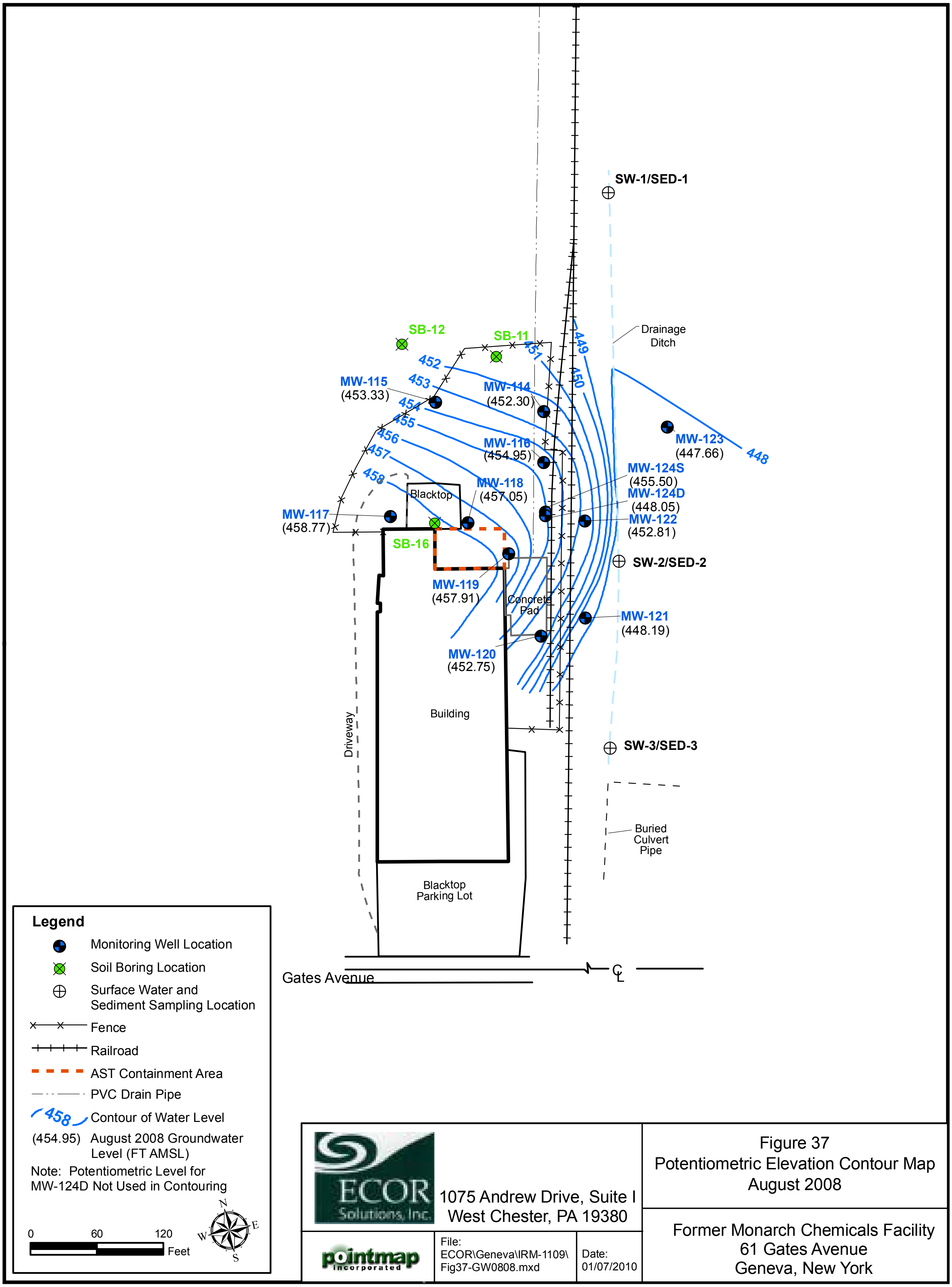

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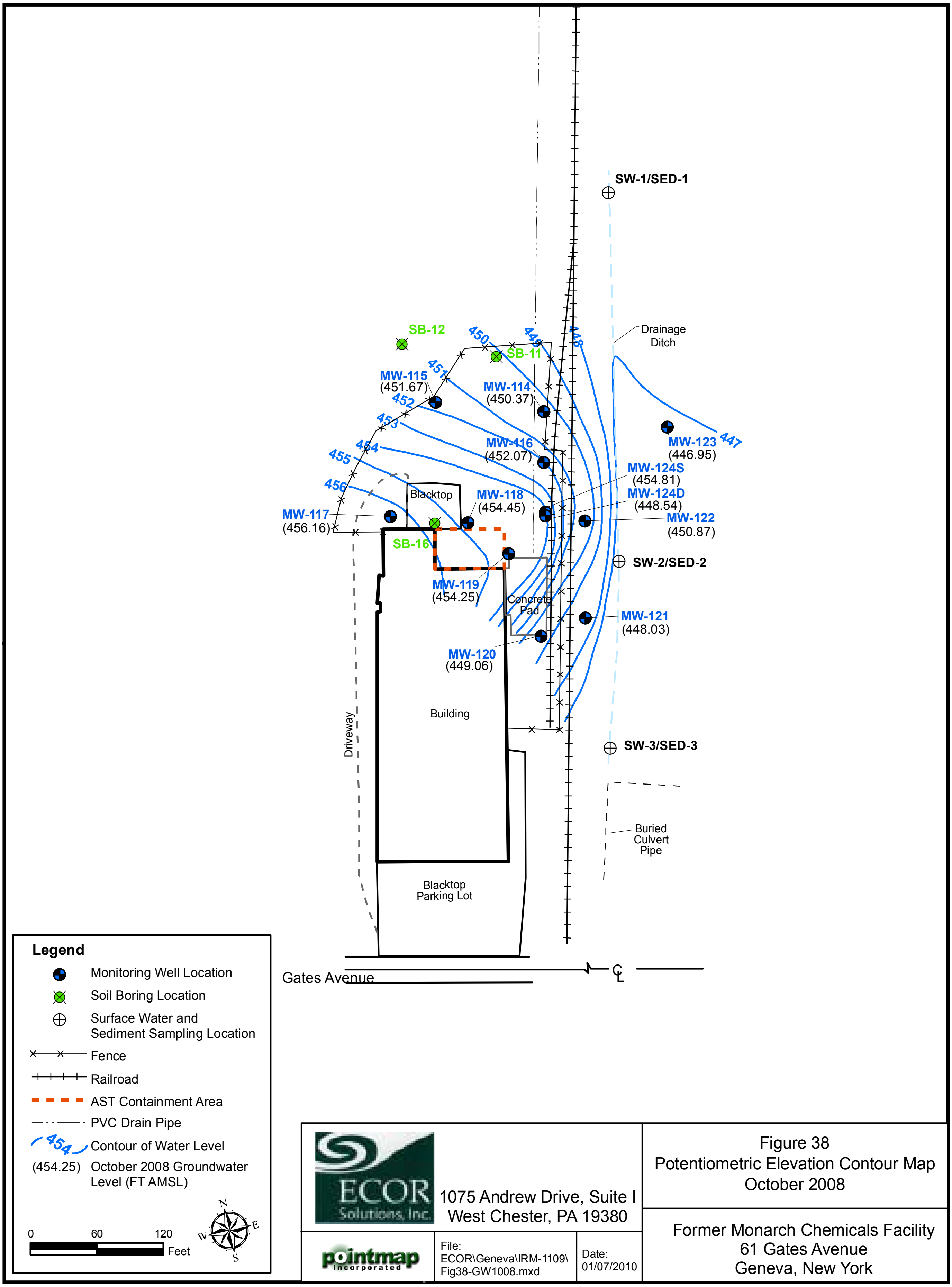
Figure 37
Potentiometric Elevation Contour Map
August 2008

pointmap incorporated

File:
ECOR\Geneva\IRM-1109\
Fig37-GW0808.mxd

Date:
01/07/2010

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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West Chester, PA 19380

Figure 38
Potentiometric Elevation Contour Map
October 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

pointmap incorporated

File:
ECOR\Geneva\IRM-1109\
Fig38-GW1008.mxd

Date:
01/07/2010

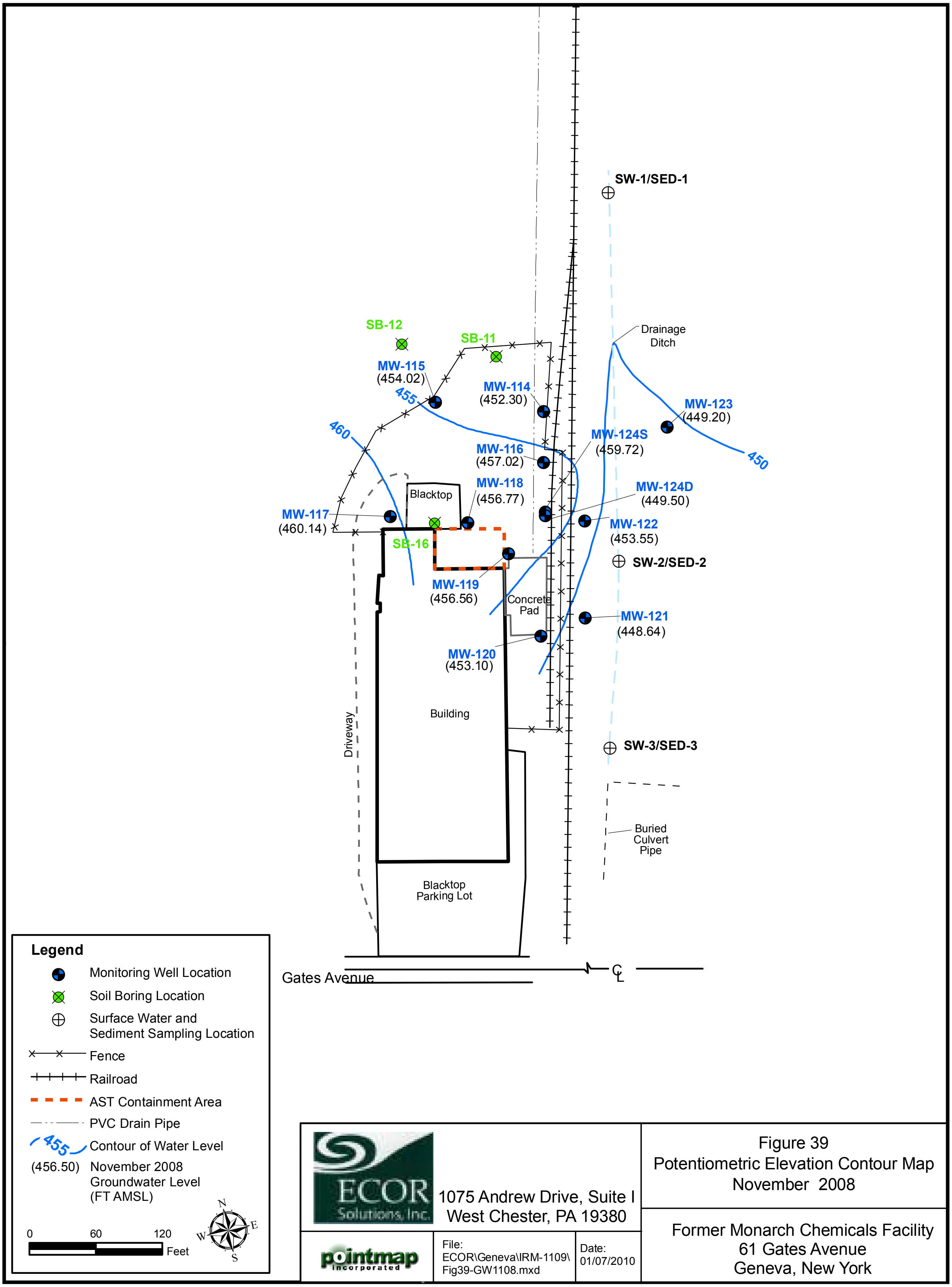

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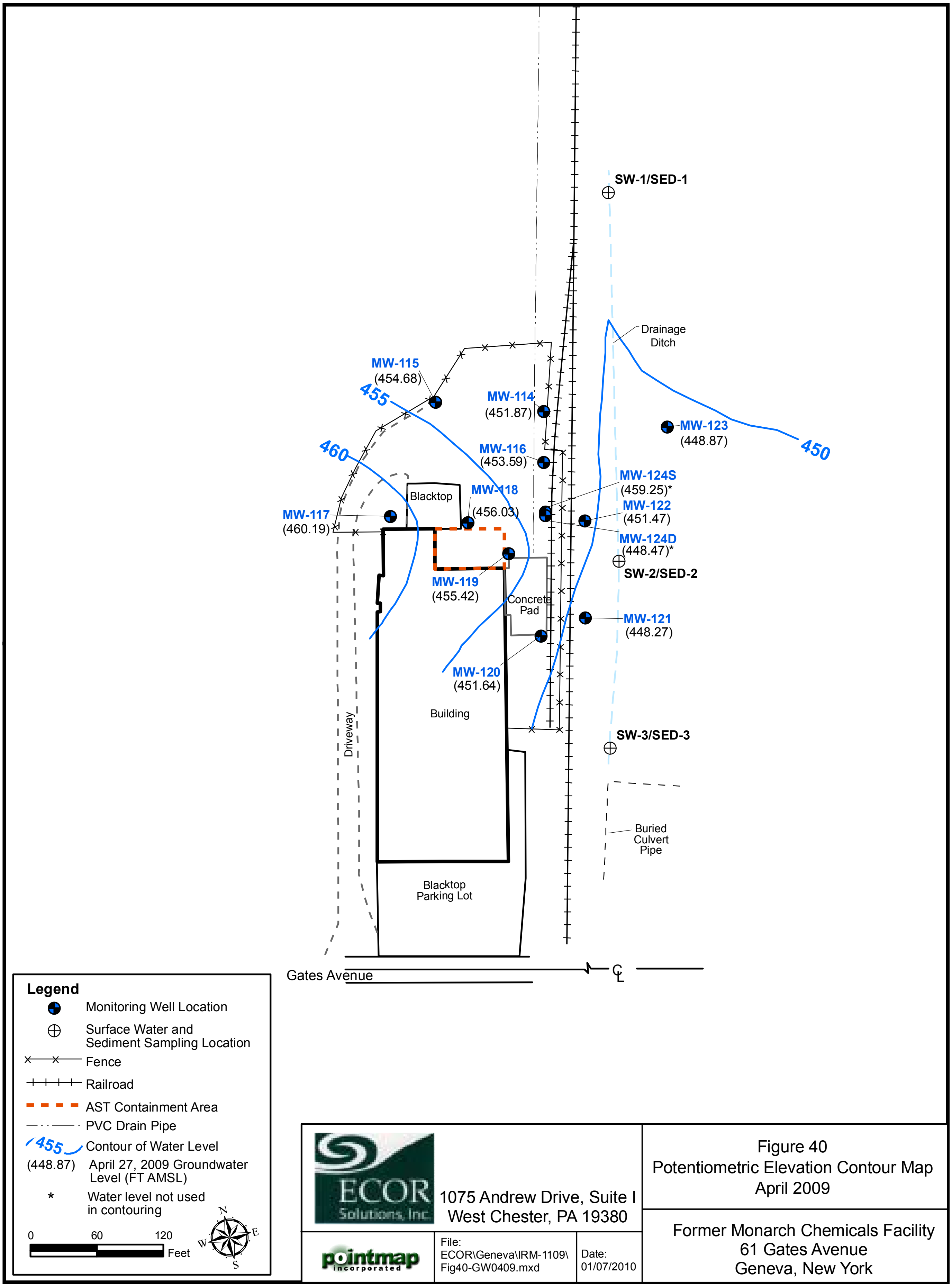
Figure 39
Potentiometric Elevation Contour Map
November 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

pointmap incorporated

File:
ECOR\Geneva\IRM-1109\
Fig39-GW1108.mxd

Date:
01/07/2010



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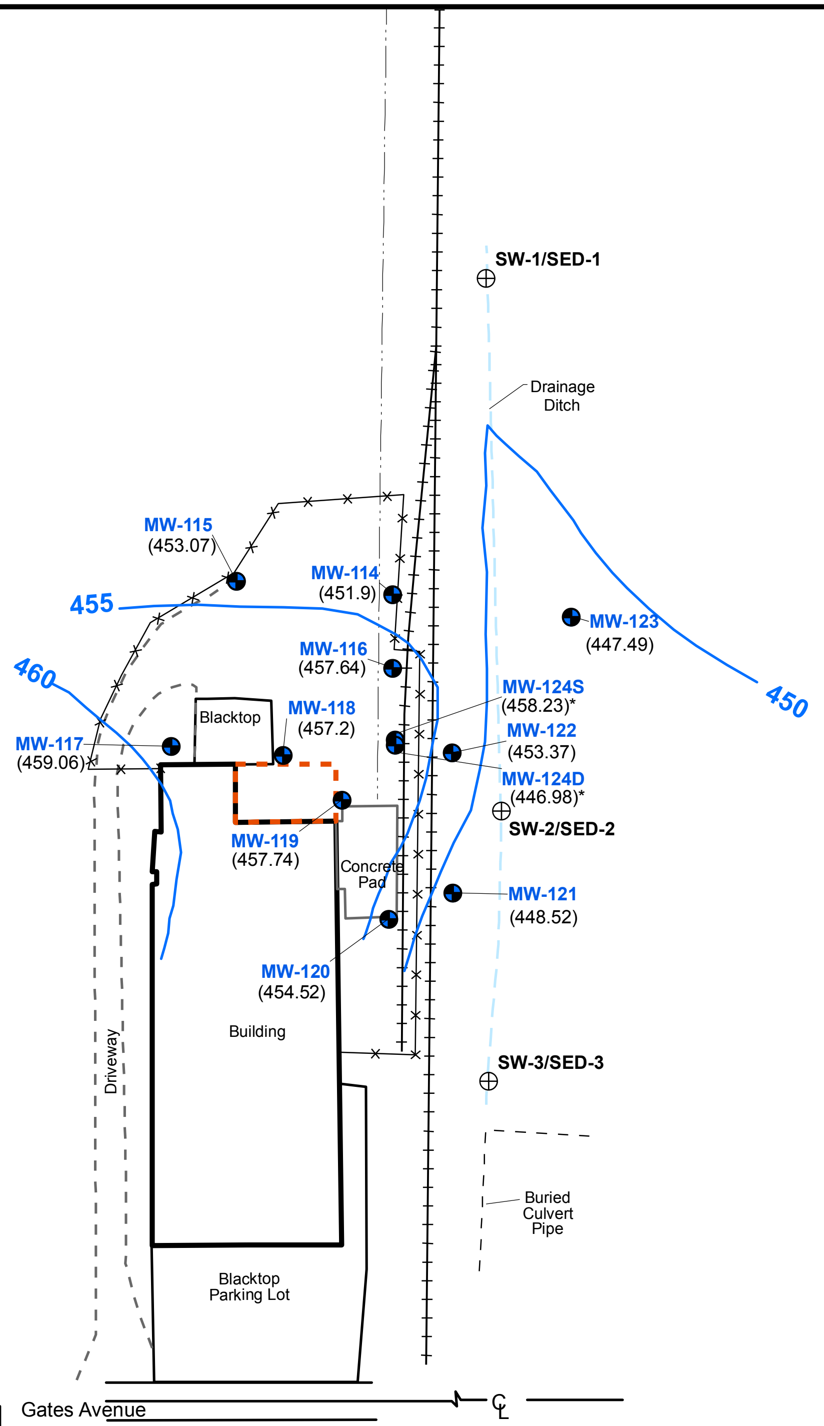
pointmap incorporated

File:
ECOR\Geneva\IRM-1109\
Fig40-GW0409.mxd

Date:
01/07/2010

Figure 40
Potentiometric Elevation Contour Map
April 2009

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



Legend

● Monitoring Well Location
⊕ Surface Water and Sediment Sampling Location
-×—×- Fence
-+-+-+- Railroad
- - - AST Containment Area
—·—·— PVC Drain Pipe
455 Contour of Water Level
(448.87) August 3, 2009 Groundwater Level (FT AMSL)
* Water level not used in contouring

0 60 120
Feet

N E S W

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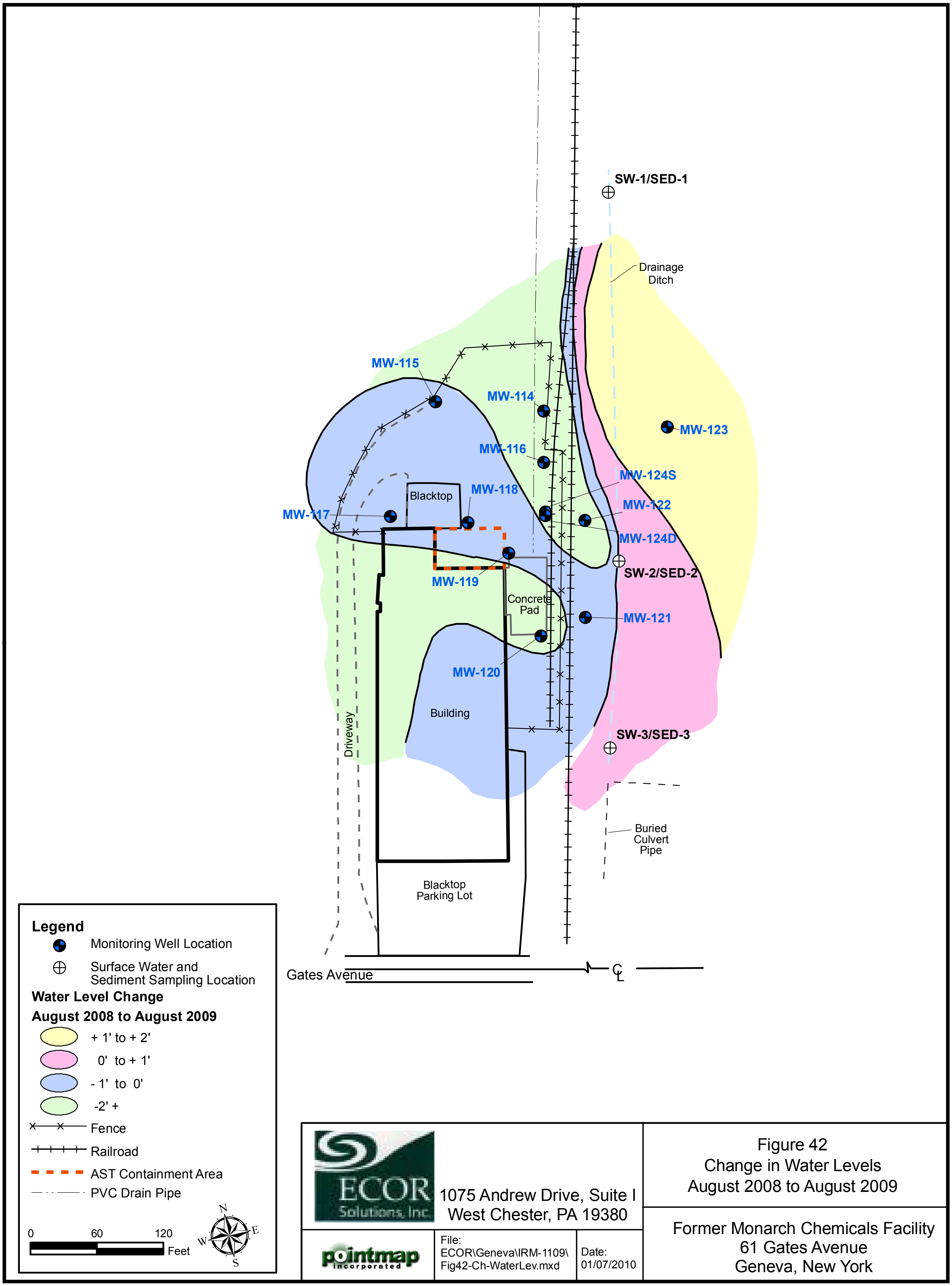
pointmap incorporated

File:
ECOR\Geneva\IRM-1109\Fig41-GW0809.mxd

Date:
01/07/2010

Figure 41
Potentiometric Elevation Contour Map
August 2009

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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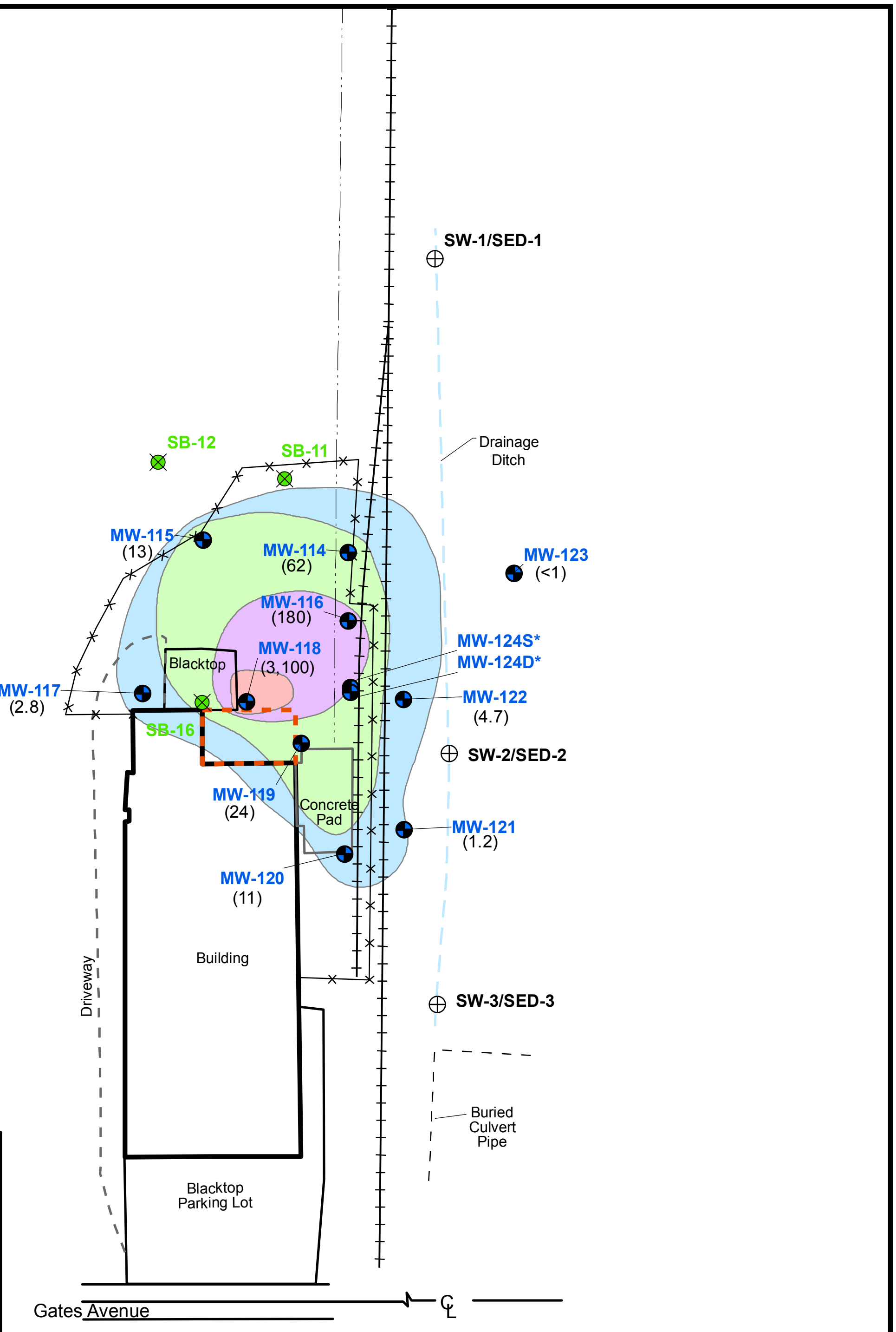
pointmap incorporated

File:
ECOR\Geneva\IRM-1109\
Fig42-Ch-WaterLev.mxd

Date:
01/07/2010

Figure 42
Change in Water Levels
August 2008 to August 2009

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



Legend

- ● Monitoring Well Location
- ☒ Soil Boring Location
- ⊕ Surface Water and Sediment Sampling Location
- ×—× Fence
- +++ Railroad
- - - AST Containment Area
- —·— PVC Drain Pipe

PCE Concentration in Groundwater (ug/l)

- 1 - 10
- 10 - 100
- 100 - 1,000
- 1,000 +
- (300) PCE Concentration in Groundwater (ug/l)
- * MW-124 Nest Installed August 2008

0 60 120
Feet

N
E
S
W

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West Chester, PA 19380

pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig43-PCE0408.mxd

Date:
01/07/2010

Figure 43
Tetrachloroethene Concentrations
in Groundwater
April 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

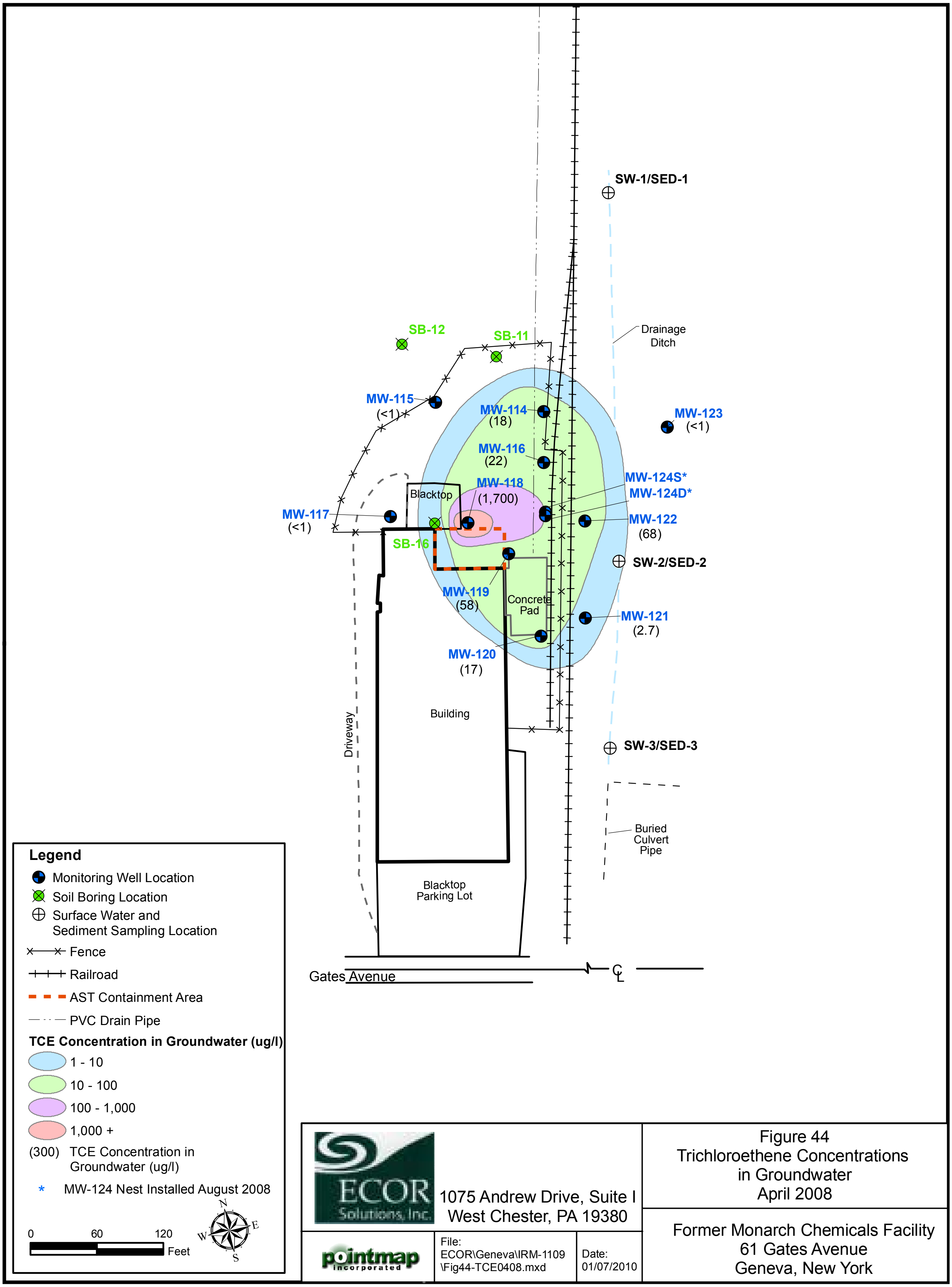

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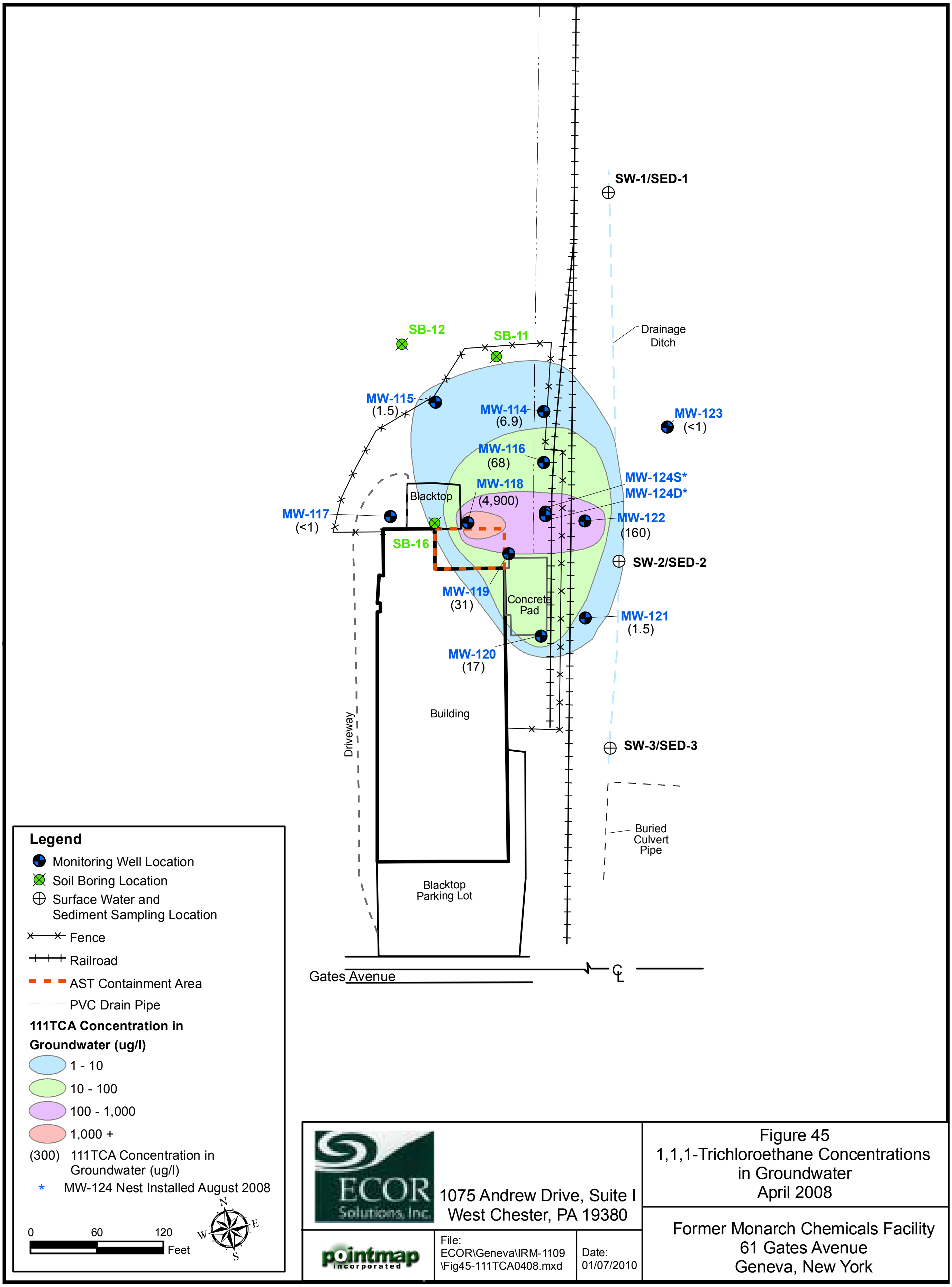
Figure 44
Trichloroethene Concentrations in Groundwater
April 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig44-TCE0408.mxd

Date:
01/07/2010



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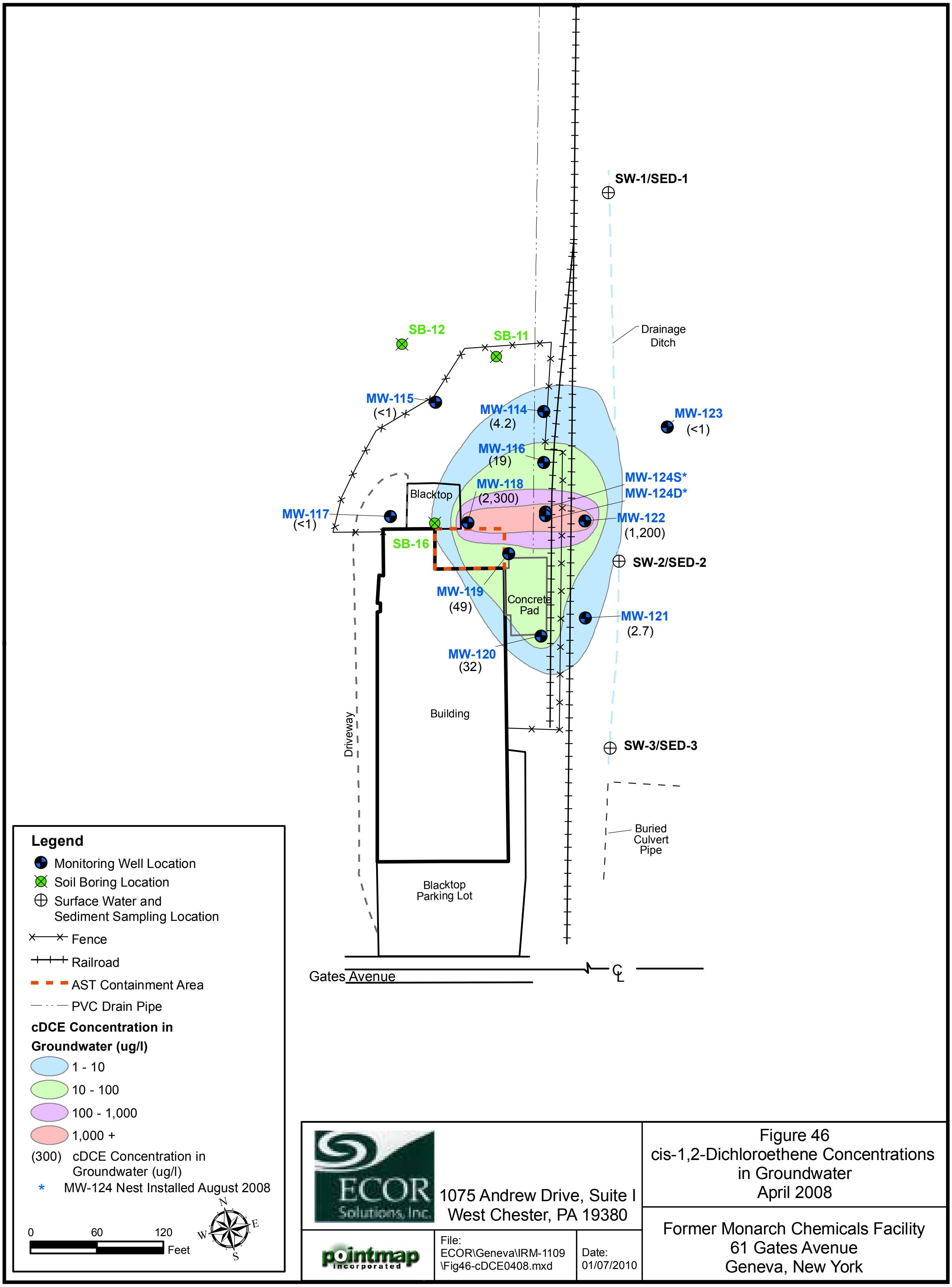
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig45-111TCA0408.mxd

Date:
01/07/2010

Figure 45
1,1,1-Trichloroethane Concentrations
in Groundwater
April 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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West Chester, PA 19380

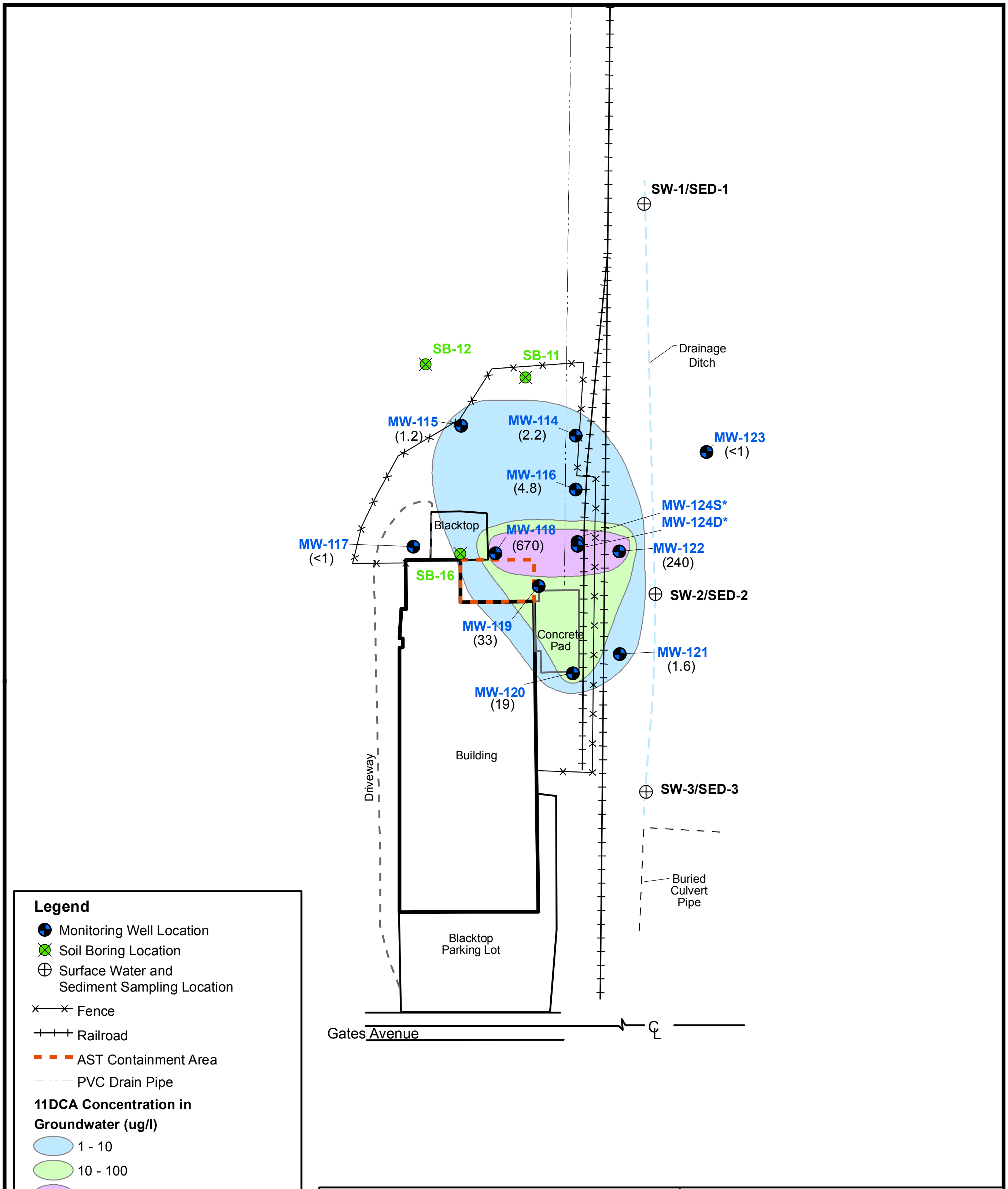
Figure 46
cis-1,2-Dichloroethene Concentrations in Groundwater
April 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig46-cDCE0408.mxd

Date:
01/07/2010



Legend

● Monitoring Well Location

⊗ Soil Boring Location

⊕ Surface Water and Sediment Sampling Location

×—× Fence

┼┼┼ Railroad

- - - AST Containment Area

—·—·— PVC Drain Pipe

11DCA Concentration in Groundwater (ug/l)

🟦	1 - 10
🟩	10 - 100
🟪	100 - 1,000
(300)	11DCA Concentration in Groundwater (ug/l)
*	MW-124 Nest Installed August 2008

0 60 120 Feet

N E S W

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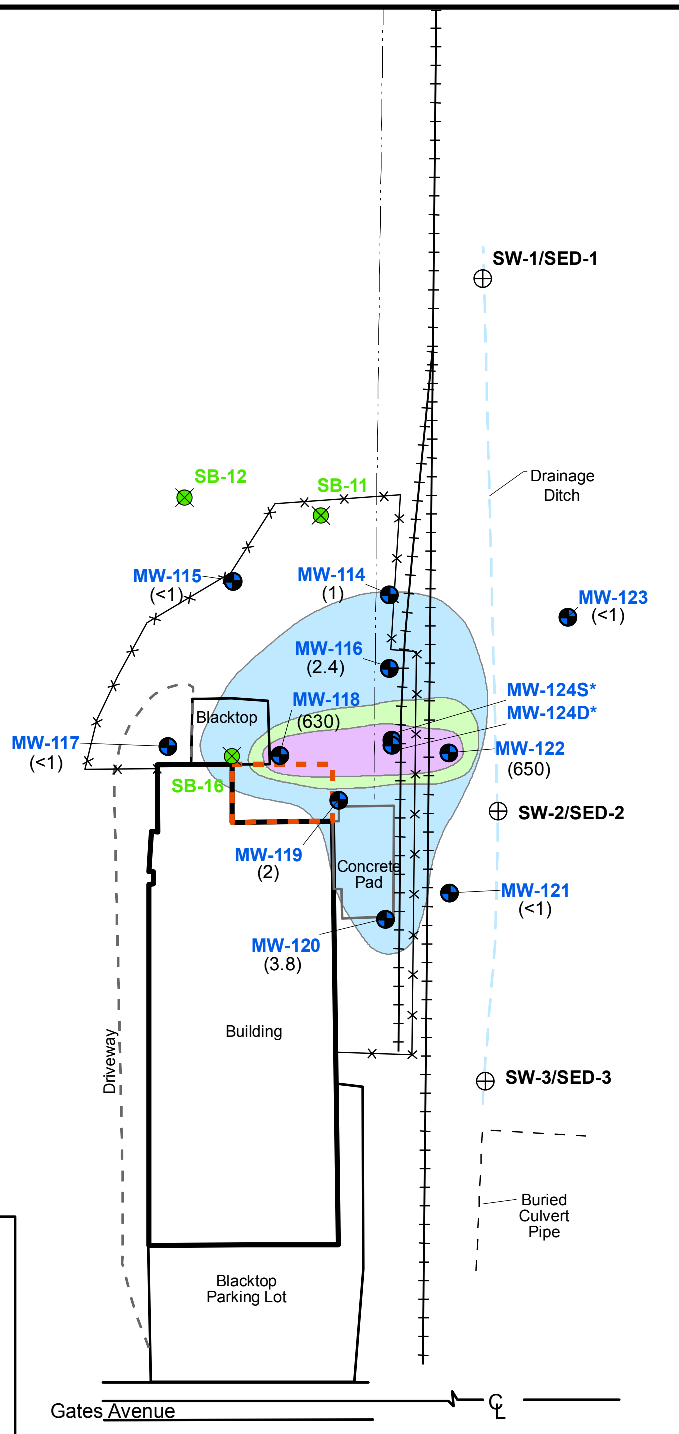
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig47-11DCA0408.mxd

Date:
01/07/2010

Figure 47
1,1-Dichloroethane Concentrations in Groundwater
April 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



Legend

- ● Monitoring Well Location
- ⊗ Soil Boring Location
- ⊕ Surface Water and Sediment Sampling Location
- ×—× Fence
- +++ Railroad
- - - AST Containment Area
- —·— PVC Drain Pipe

Vinyl Chloride Concentration in Groundwater (ug/l)

- 1 - 10
- 10 - 100
- 100 - 1,000
- (300) Vinyl Chloride Concentration in Groundwater (ug/l)
- * MW-124 Nest Installed August 2008

0 60 120 Feet

N E S W

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File:
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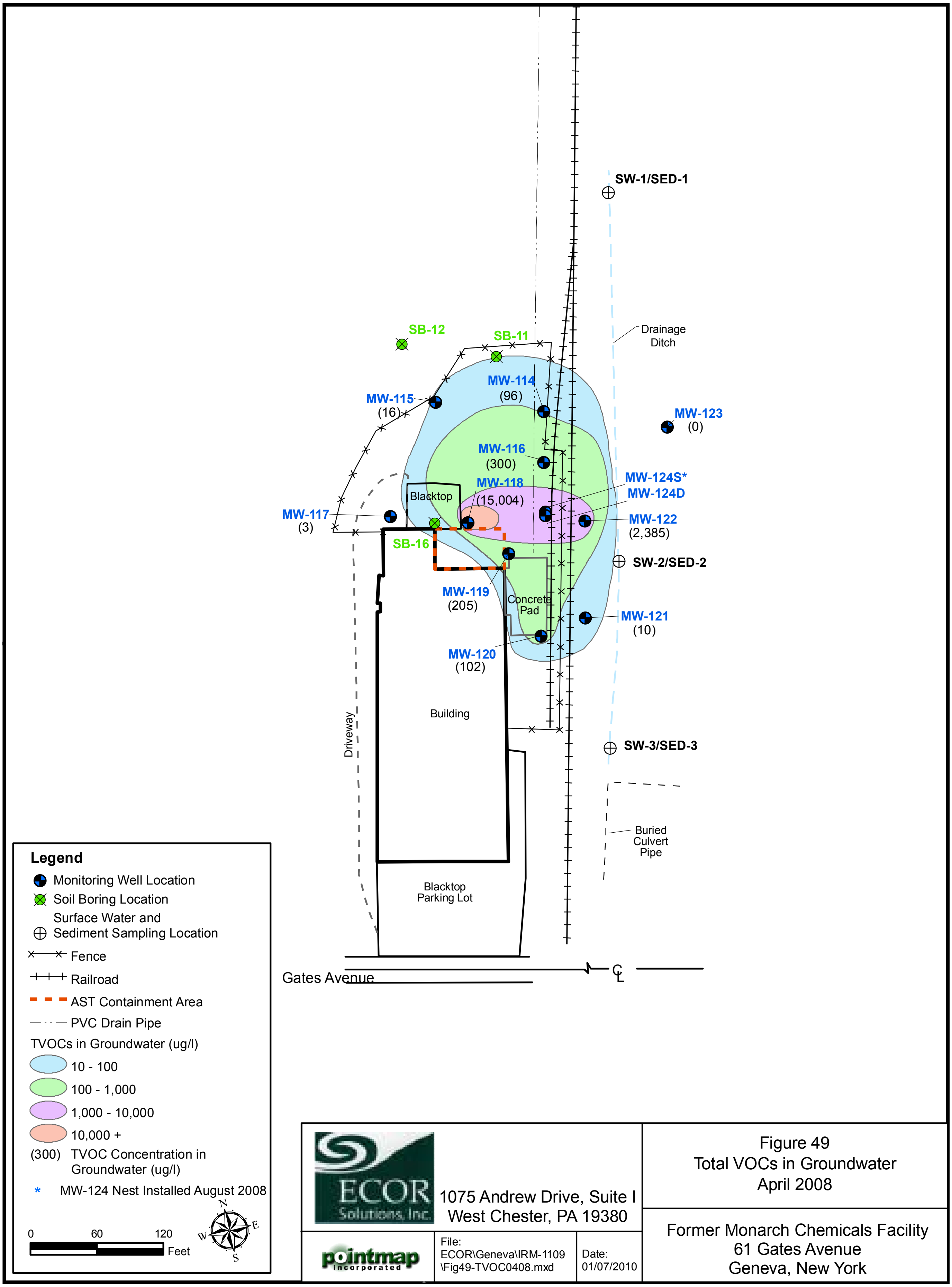
\Fig48-VC0408.mxd

Date:
01/07/2010

Figure 48
Vinyl Chloride Concentrations in Groundwater
April 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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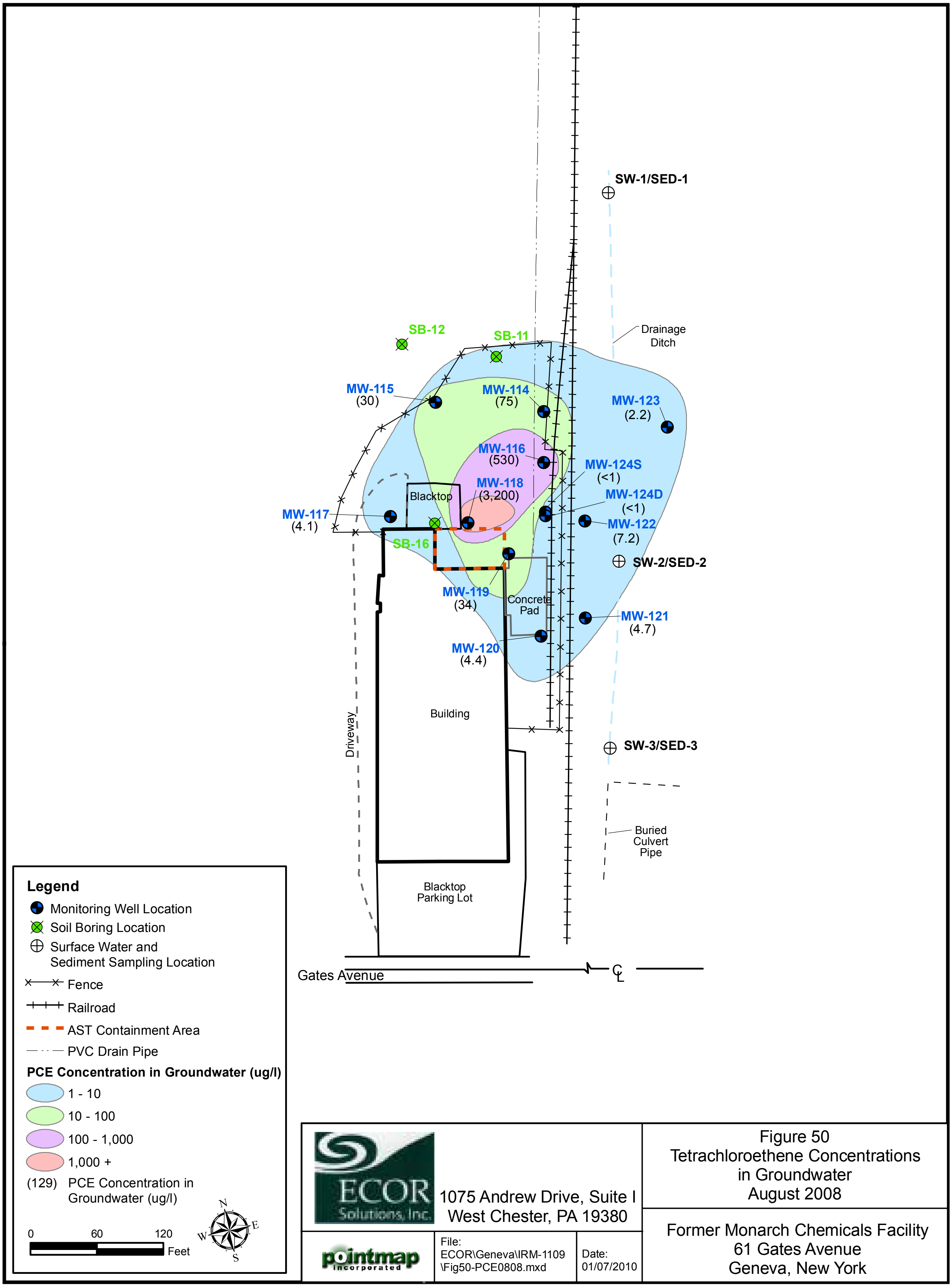
File:
ECOR\Geneva\IRM-1109
\Fig49-TVOC0408.mxd

Date:
01/07/2010

Figure 49
Total VOCs in Groundwater
April 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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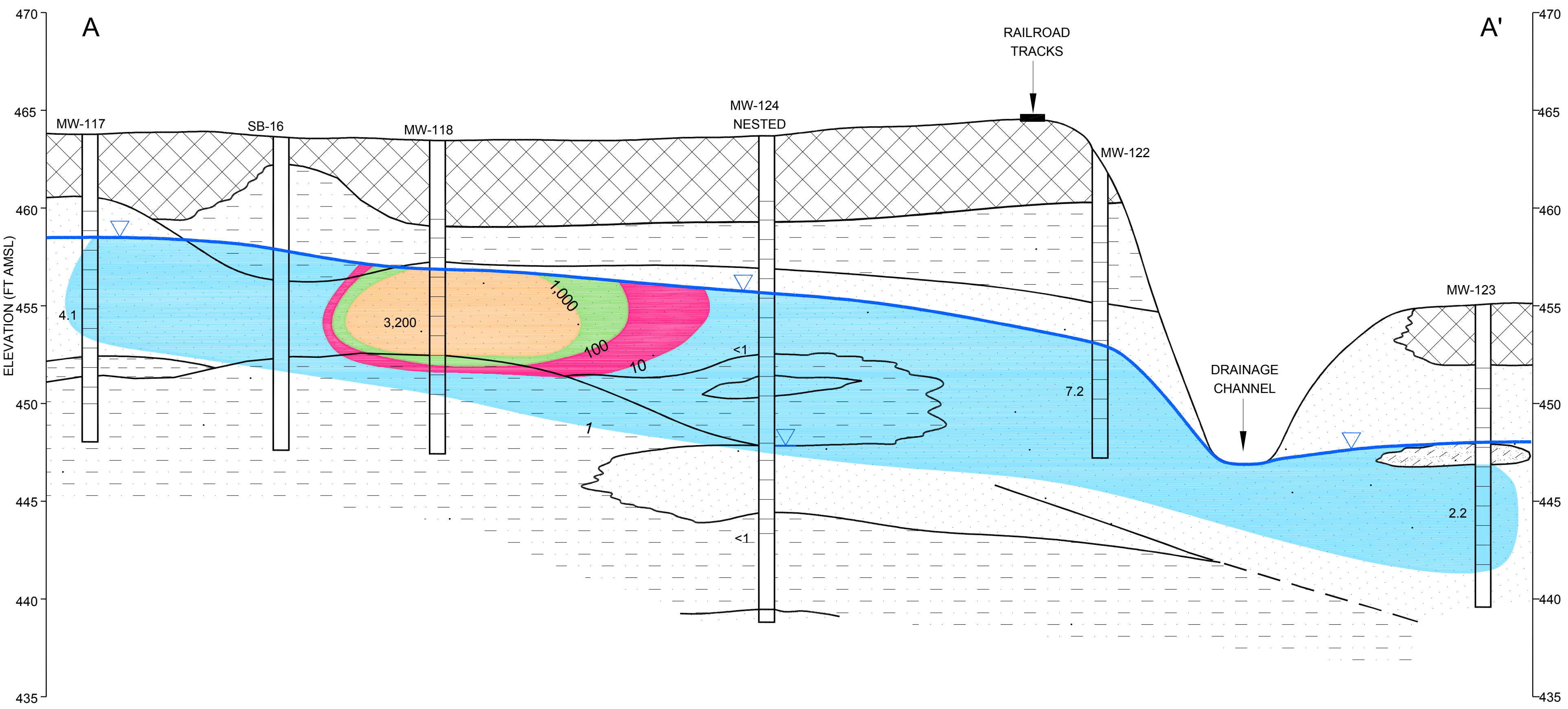
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig50-PCE0808.mxd

Date:
01/07/2010

Figure 50
Tetrachloroethene Concentrations
in Groundwater
August 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



LEGEND

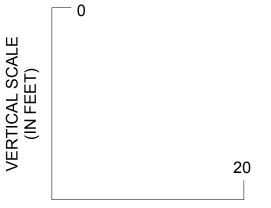
SCREENED INTERVAL

AUGUST 2008 POTENTIOMETRIC ELEVATIONS (FT-AMSL)

PCE CONCENTRATIONS IN GROUNDWATER (AUGUST 2008)

- 1-10 ug/l
- 10-100 ug/l
- 100-1,000 ug/l
- 1,000+ ug/l

- ▨ FILL
- ▭ SILT & CLAY
- ▭ SAND
- ▭ CLAY
- ▨ SILTY SAND



HORIZONTAL SCALE (IN FEET)
VERTICAL EXAGGERATION 4X

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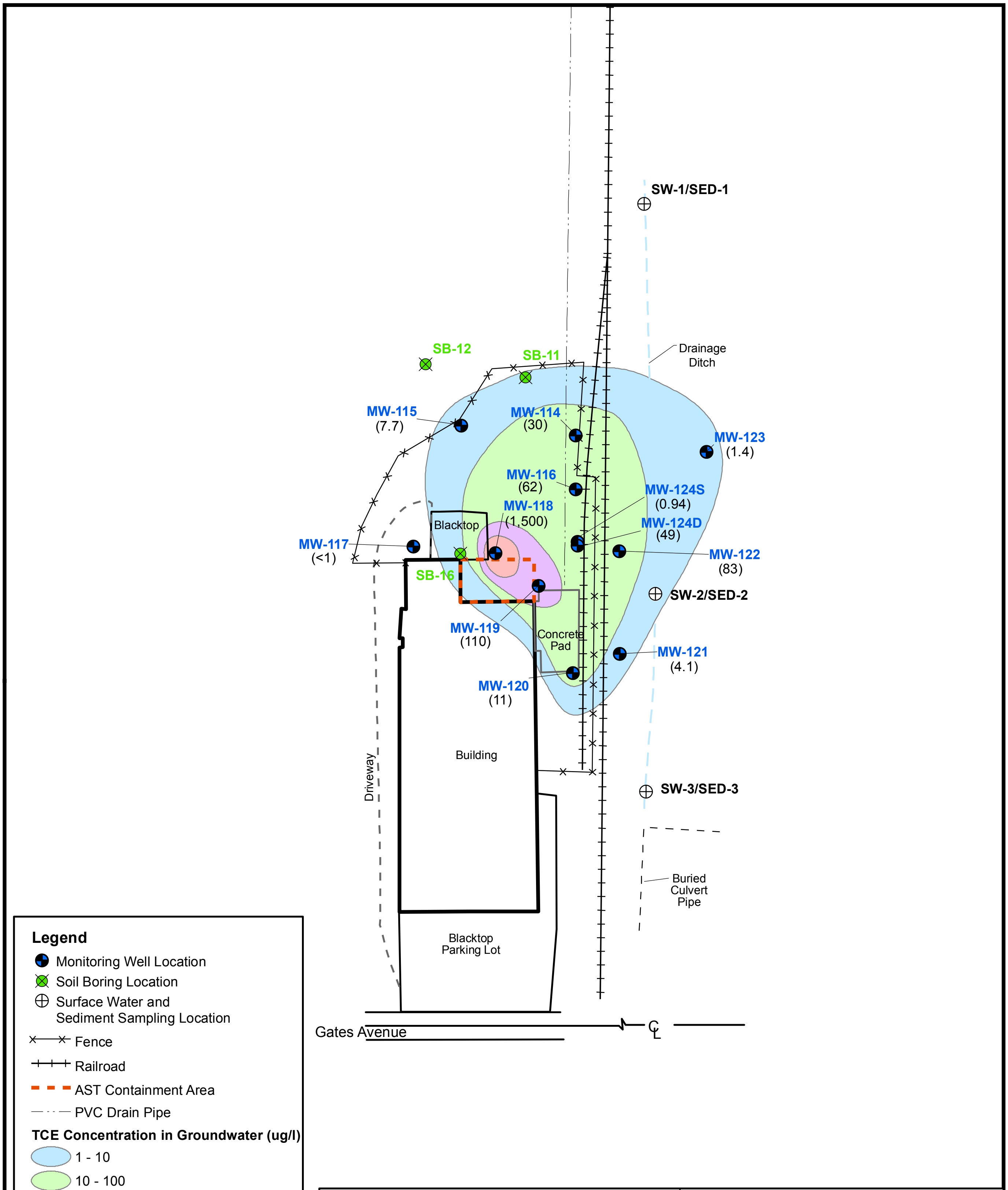
File: ECOR\Geneva\
IRM-1109\drawings\
Fig51-PCE-0808-A-A'.dwg

Date:
01/07/2010

Figure 51
Tetrachloroethene Concentrations in Groundwater - August 15, 2008
Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



Legend

● Monitoring Well Location
⊗ Soil Boring Location
⊕ Surface Water and Sediment Sampling Location
Fence
Railroad
AST Containment Area
PVC Drain Pipe

TCE Concentration in Groundwater (ug/l)

1 - 10
10 - 100
100 - 1,000
1,000 +
(129) TCE Concentration in Groundwater (ug/l)

0 60 120
Feet

N E S W

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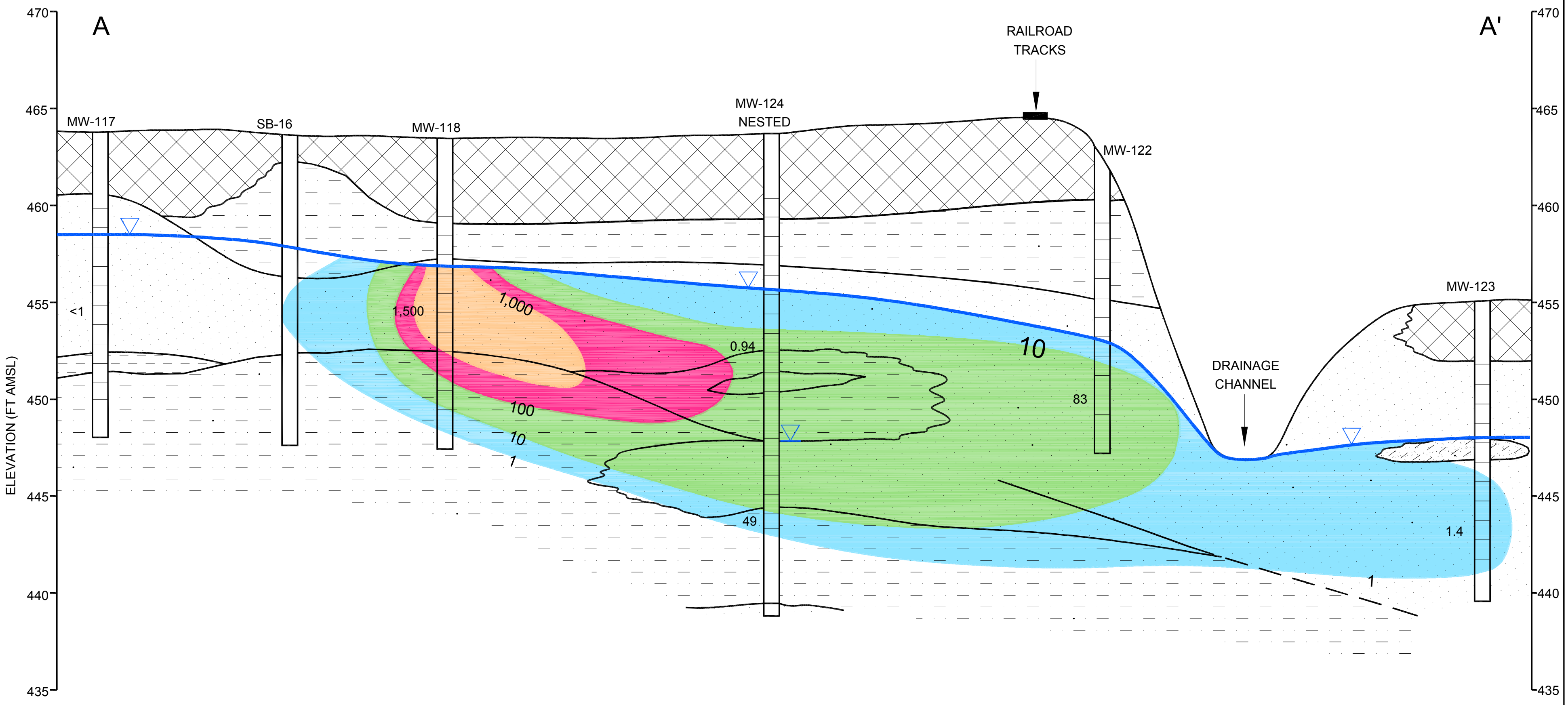
File:
ECOR\Geneva\IRM-1109
\Fig52-TCE0808.mxd

Date:
01/07/2010

Figure 52
Trichloroethene Concentrations
in Groundwater
August 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

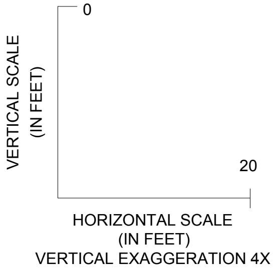


LEGEND

▯	SCREENED INTERVAL
▽	AUGUST 2008 POTENTIOMETRIC ELEVATIONS (FT-AMSL)
▨	FILL
▨	SILT & CLAY
▨	SAND
▨	CLAY
▨	SILTY SAND

TCE CONCENTRATIONS IN GROUNDWATER (AUGUST 2008)

🟦	1-10 ug/l
🟥	10-100 ug/l
🟩	100-1,000 ug/l
🟧	1,000+ ug/l



VERTICAL EXAGGERATION 4X

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1075 Andrew Drive, Suite I
West Chester, PA 19380

pointmap incorporated

File: ECOR\Geneva\IRM-1109\drawings\Fig53-TCE-0808-A-A'.dwg

Date: 01/07/2010

Figure 53
Trichloroethane Concentrations in Groundwater
August 15, 2008
Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

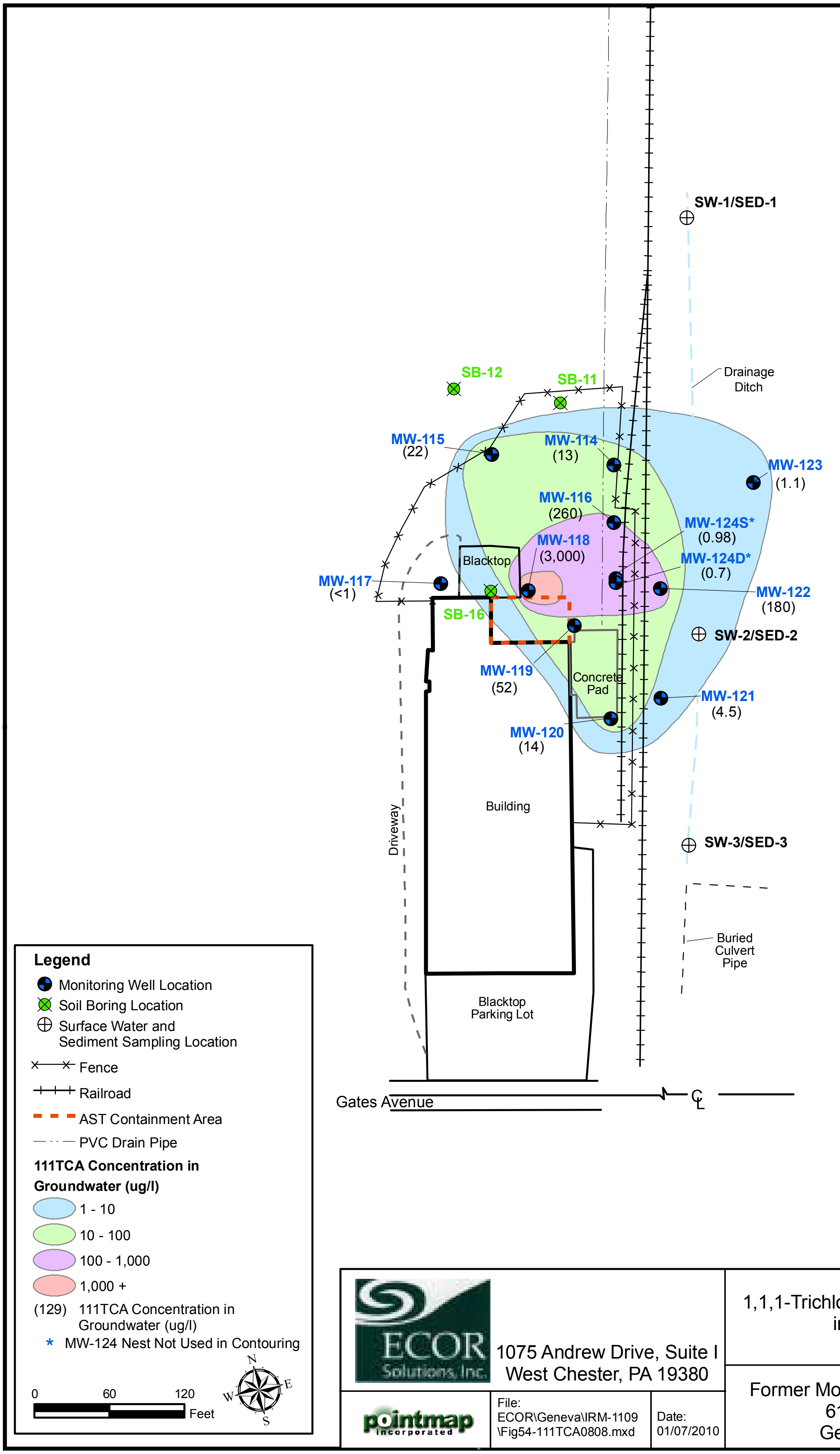

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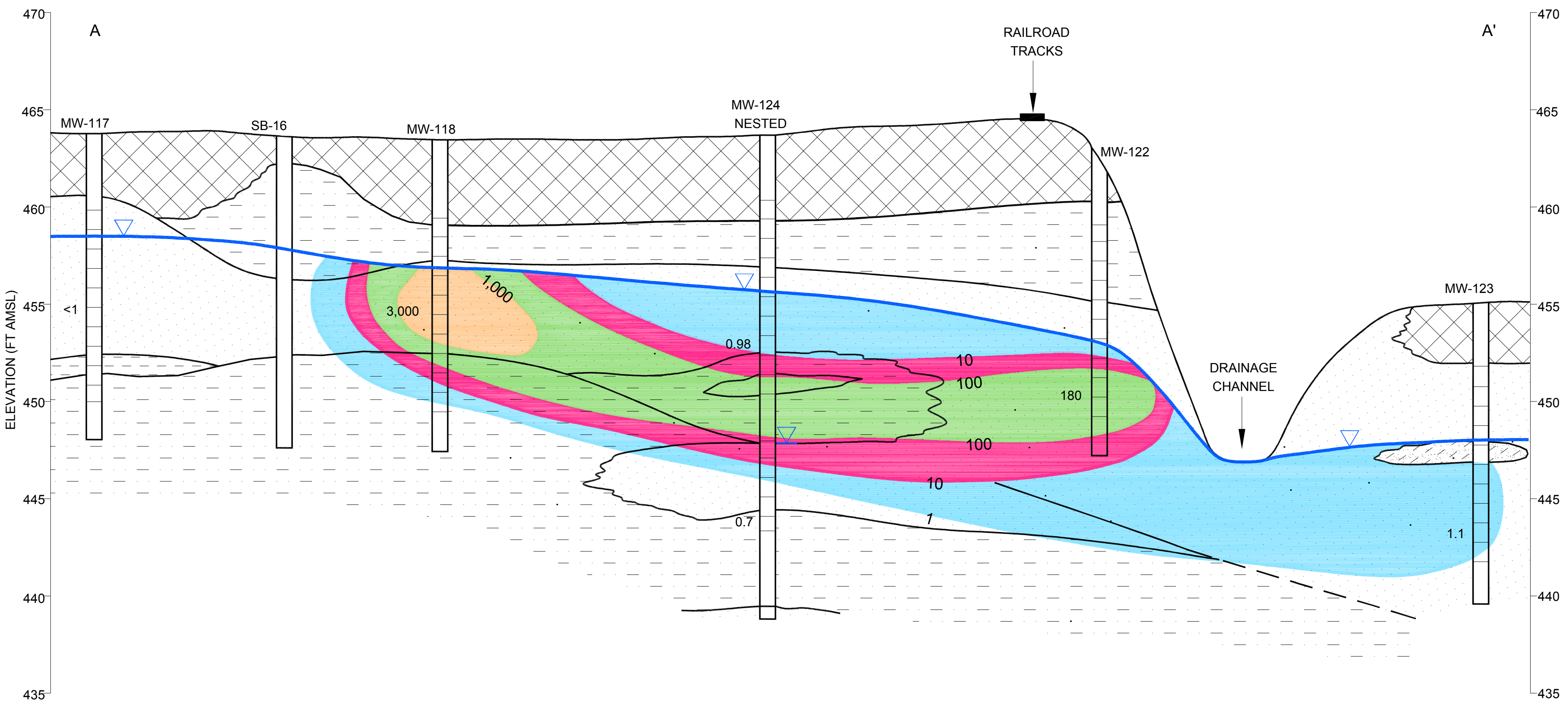
Figure 54
1,1,1-Trichloroethane Concentrations in Groundwater
August 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig54-111TCA0808.mxd

Date:
01/07/2010



LEGEND

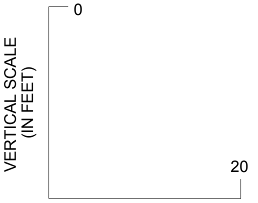
SCREENED INTERVAL

AUGUST 2008 POTENTIOMETRIC ELEVATIONS (FT-AMSL)

111TCA CONCENTRATIONS IN GROUNDWATER (AUGUST 2008)

- 1-10 ug/l
- 10-100 ug/l
- 100-1,000 ug/l
- 1,000+ ug/l

- ▨ FILL
- SILT & CLAY
- SAND
- CLAY
- SILTY SAND



HORIZONTAL SCALE (IN FEET)
VERTICAL EXAGGERATION 4X

ECOR Solutions, Inc.

1075 Andrew Drive, Suite I
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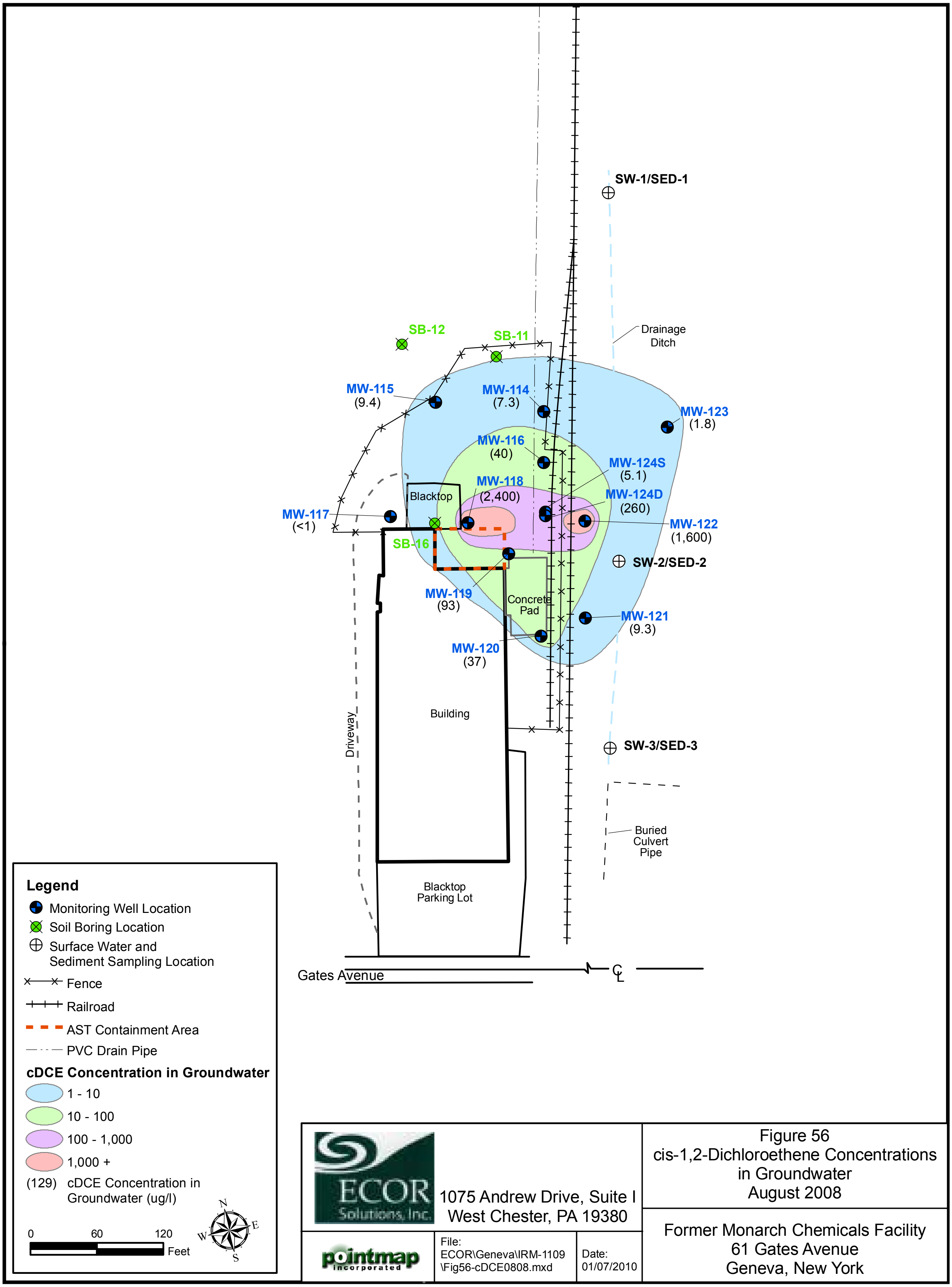
pointmap incorporated

File: ECOR\Geneva\
IRM-1109\drawings\
Fig55-111TCA-0808-A-A'.dwg

Date:
01/07/2010

Figure 55
1,1,1-Trichloroethane Concentrations in Groundwater
August 2008
Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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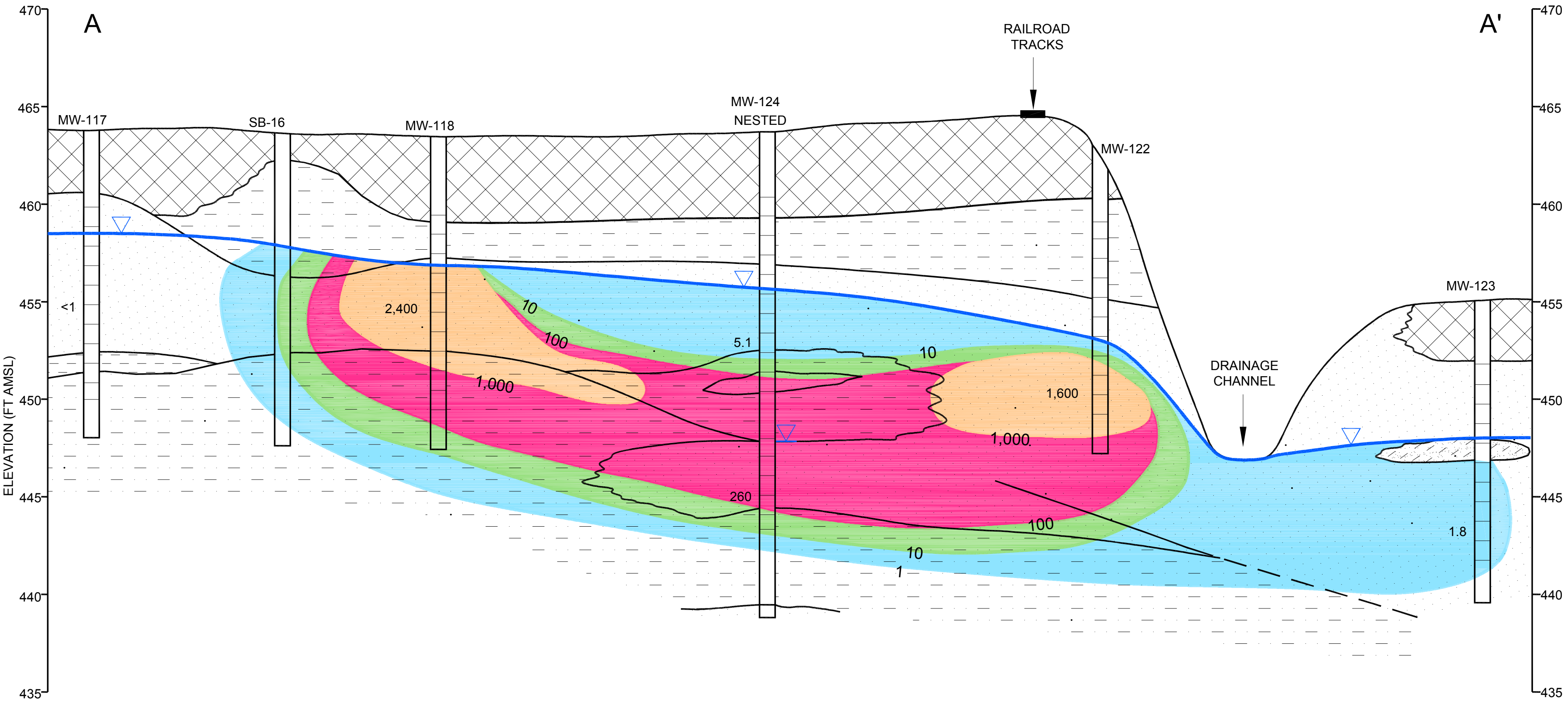
File:
ECOR\Geneva\IRM-1109
\Fig56-cDCE0808.mxd

Date:
01/07/2010

Figure 56
cis-1,2-Dichloroethene Concentrations
in Groundwater
August 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



LEGEND

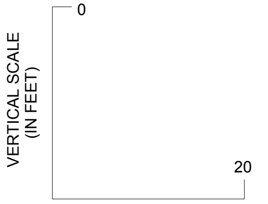
SCREENED INTERVAL

▽ AUGUST 2008 POTENTIOMETRIC ELEVATIONS (FT-AMSL)

cDCE CONCENTRATIONS IN GROUNDWATER (AUGUST 2008)

- 1-10 ug/l
- 10-100 ug/l
- 100-1,000 ug/l
- 1,000+ ug/l

- ▨ FILL
- ▨ SILT & CLAY
- ▨ SAND
- ▨ CLAY
- ▨ SILTY SAND



HORIZONTAL SCALE (IN FEET)
VERTICAL EXAGGERATION 4X

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West Chester, PA 19380

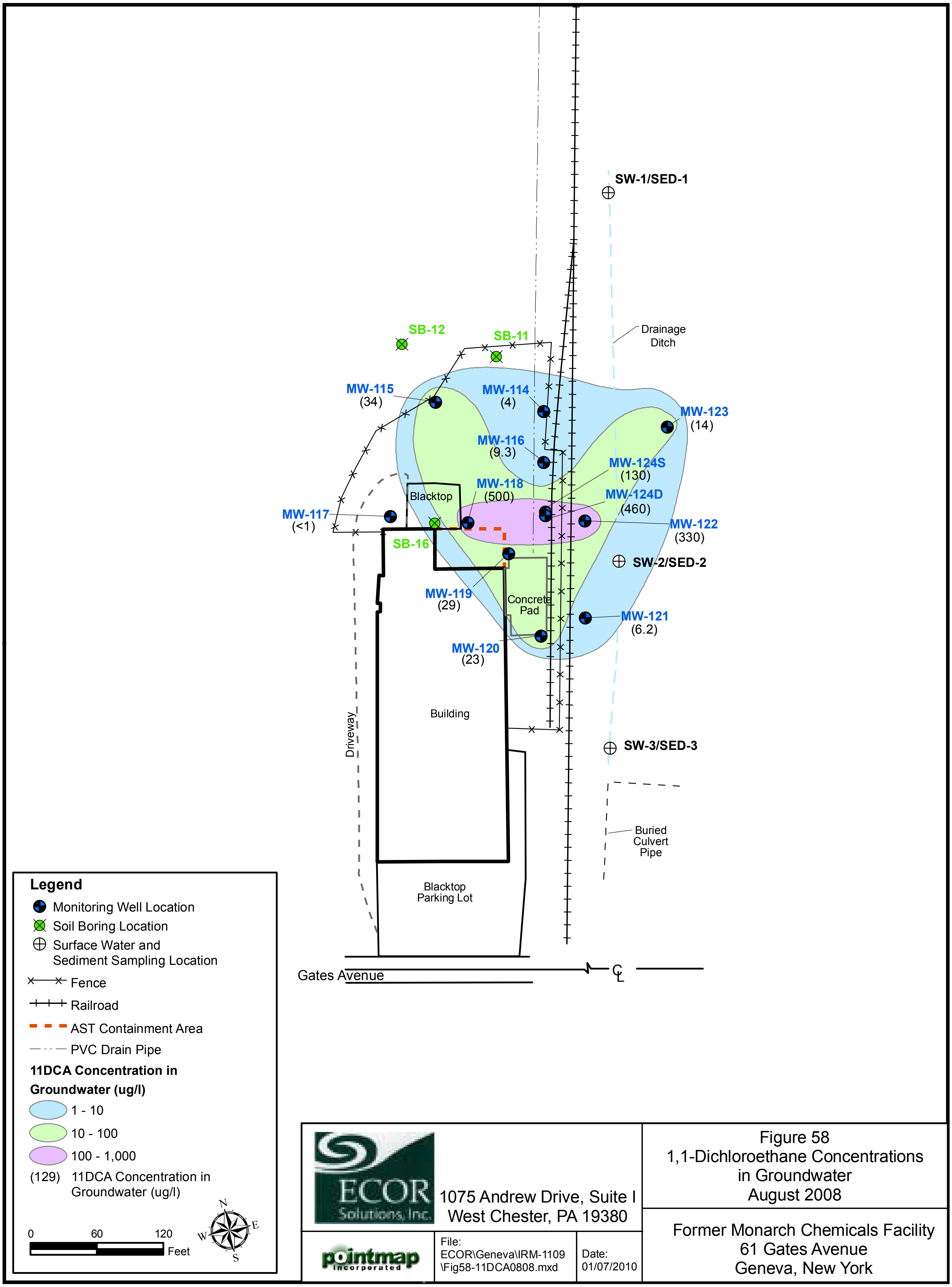
pointmap incorporated

File: ECOR\Geneva\
IRM-1109\drawings\
Fig57-cDCE-0808-A-A'.dwg

Date:
01/07/2010

Figure 57
cis-1,2-Dichloroethene Concentrations
in Groundwater
August 2008
Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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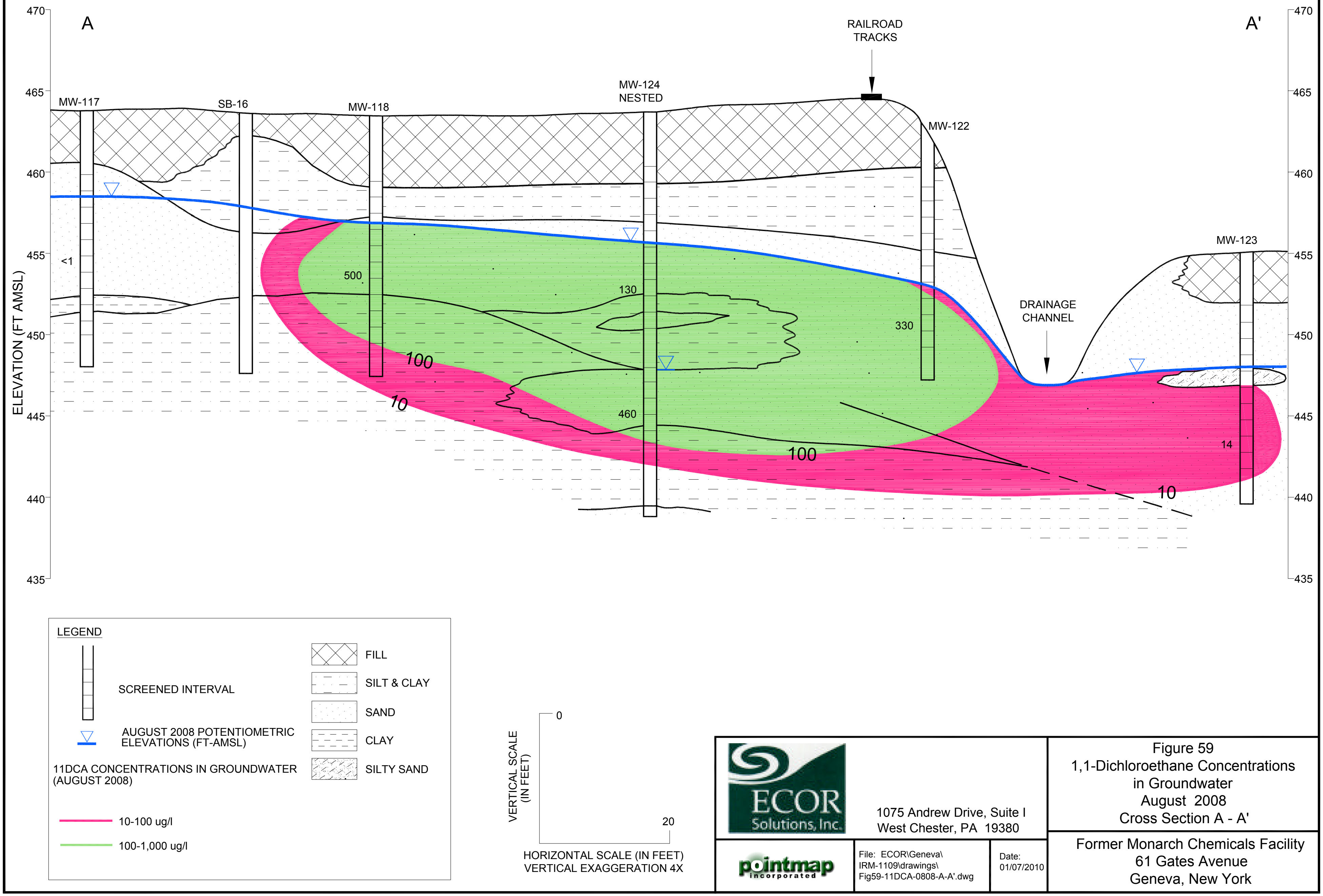
File:
ECOR\Geneva\IRM-1109
\Fig58-11DCA0808.mxd

Date:
01/07/2010

Figure 58
1,1-Dichloroethane Concentrations
in Groundwater
August 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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West Chester, PA 19380

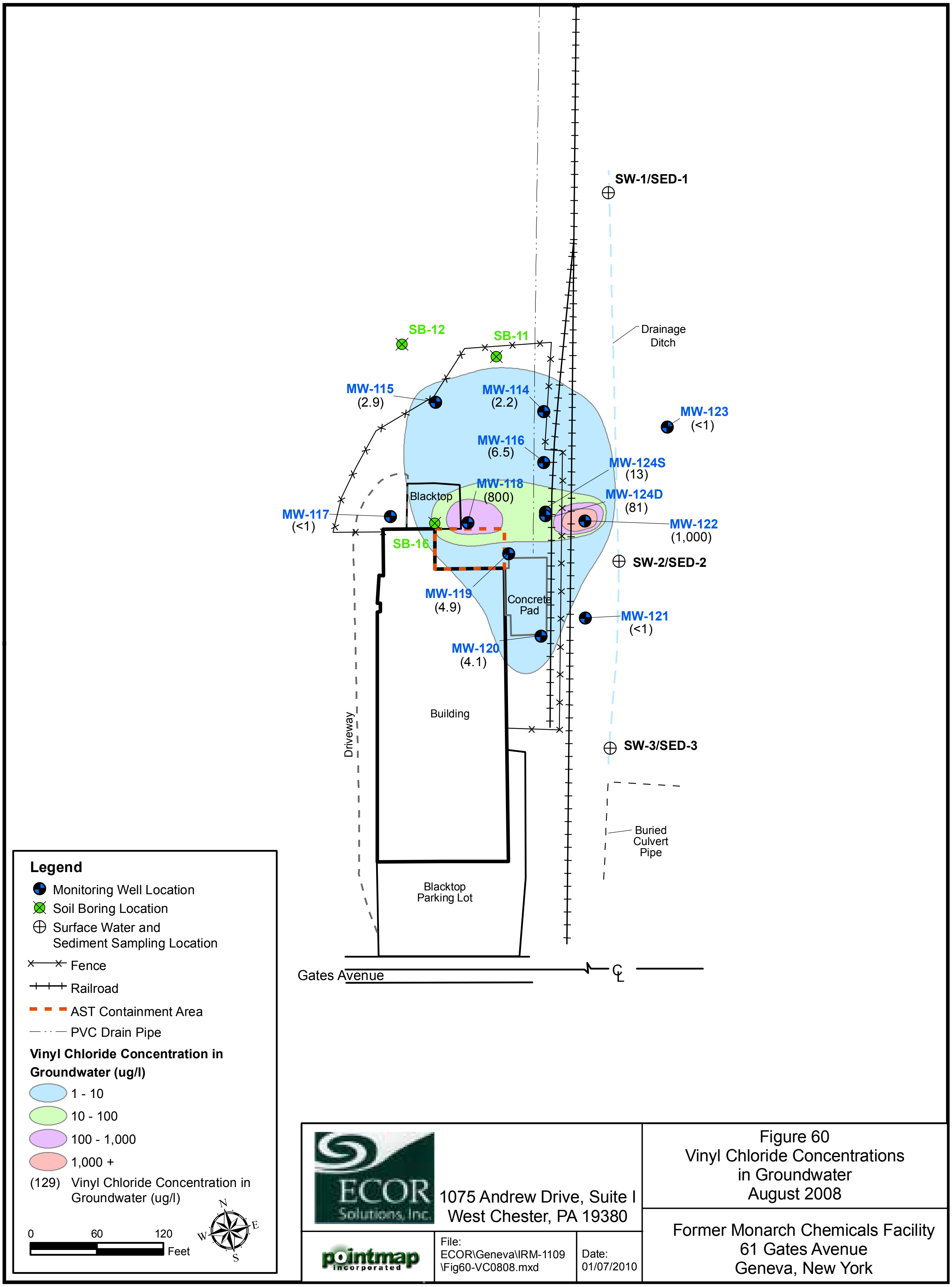
pointmap incorporated

File: ECOR\Geneva\
IRM-1109\drawings\
Fig59-11DCA-0808-A-A'.dwg

Date:
01/07/2010

Figure 59
1,1-Dichloroethane Concentrations
in Groundwater
August 2008
Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig60-VC0808.mxd

Date:
01/07/2010

Figure 60
Vinyl Chloride Concentrations
in Groundwater
August 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

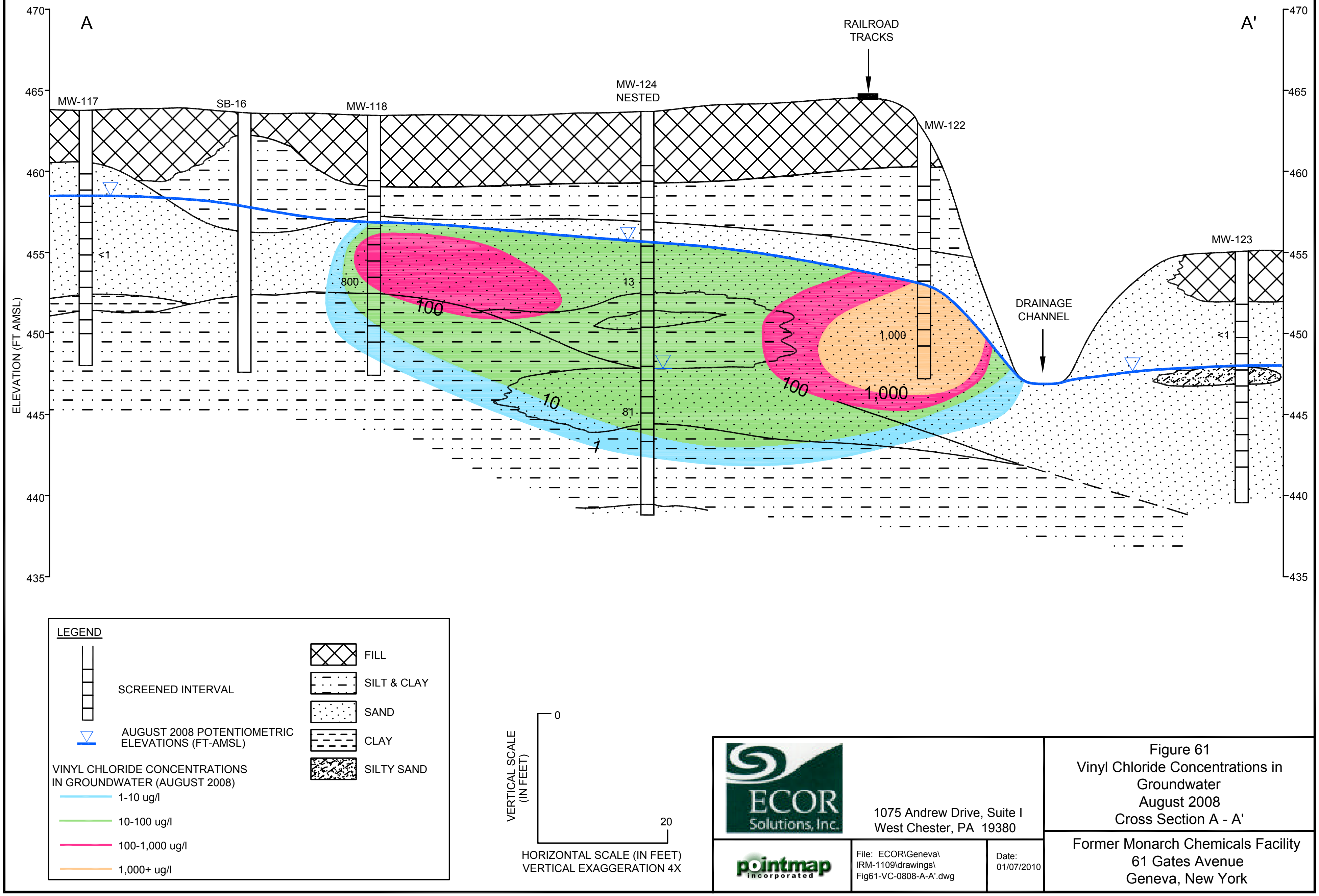

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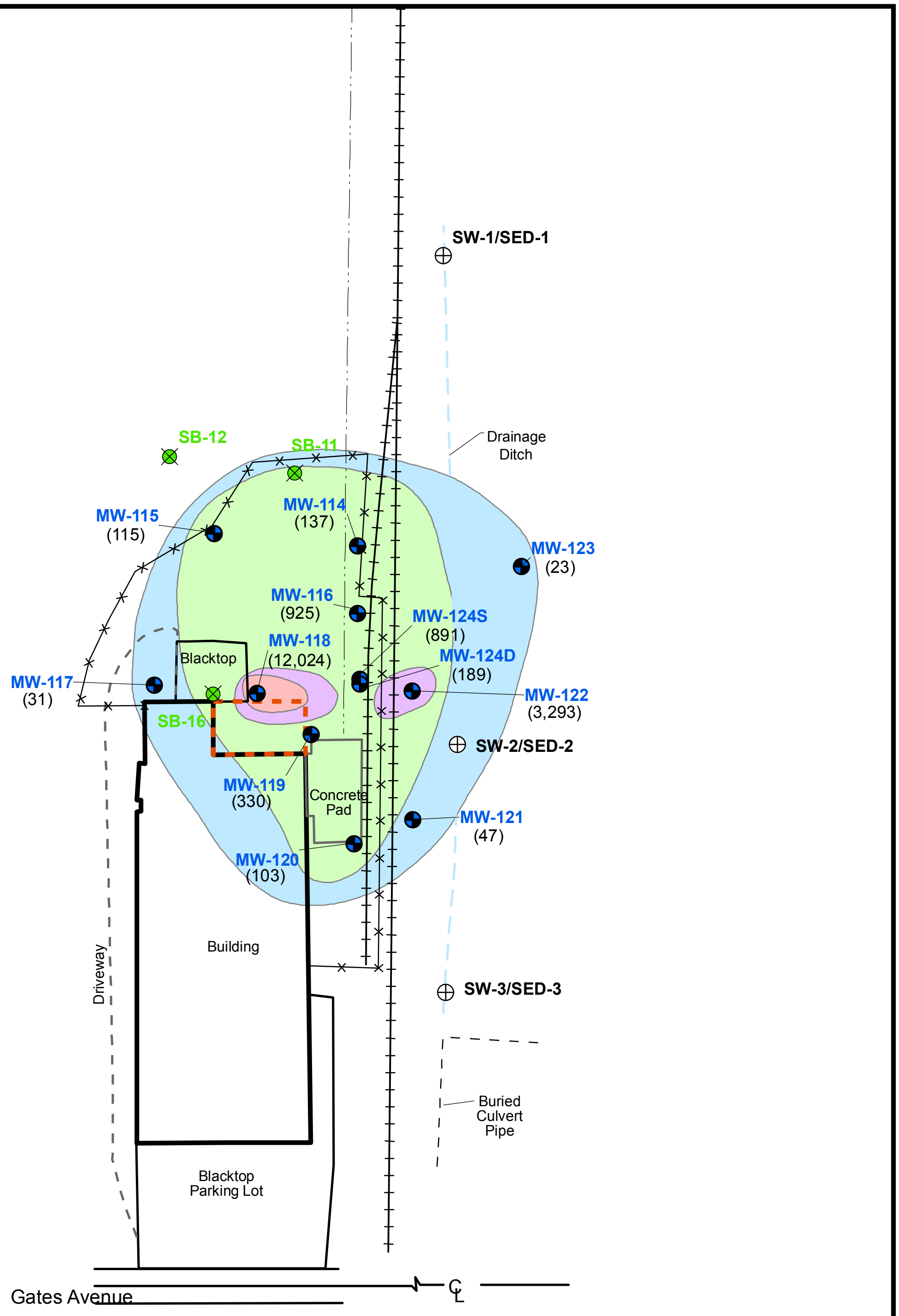
Figure 61
Vinyl Chloride Concentrations in Groundwater
August 2008
Cross Section A - A'

pointmap incorporated

File: ECOR\Geneva\IRM-1109\drawings\Fig61-VC-0808-A-A'.dwg

Date: 01/07/2010

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



Legend

● Monitoring Well Location

⊗ Soil Boring Location

⊕ Surface Water and Sediment Sampling Location

—×—×— Fence

—+—+— Railroad

- - - AST Containment Area

— · · — PVC Drain Pipe

TVOCs in Groundwater (ug/l)

🟦	10 - 100
🟩	100 - 1,000
🟪	1,000 - 10,000
🟥	10,000 +
(129)	TVOC Concentration in Groundwater (ug/l)

0 60 120 Feet

N E S W

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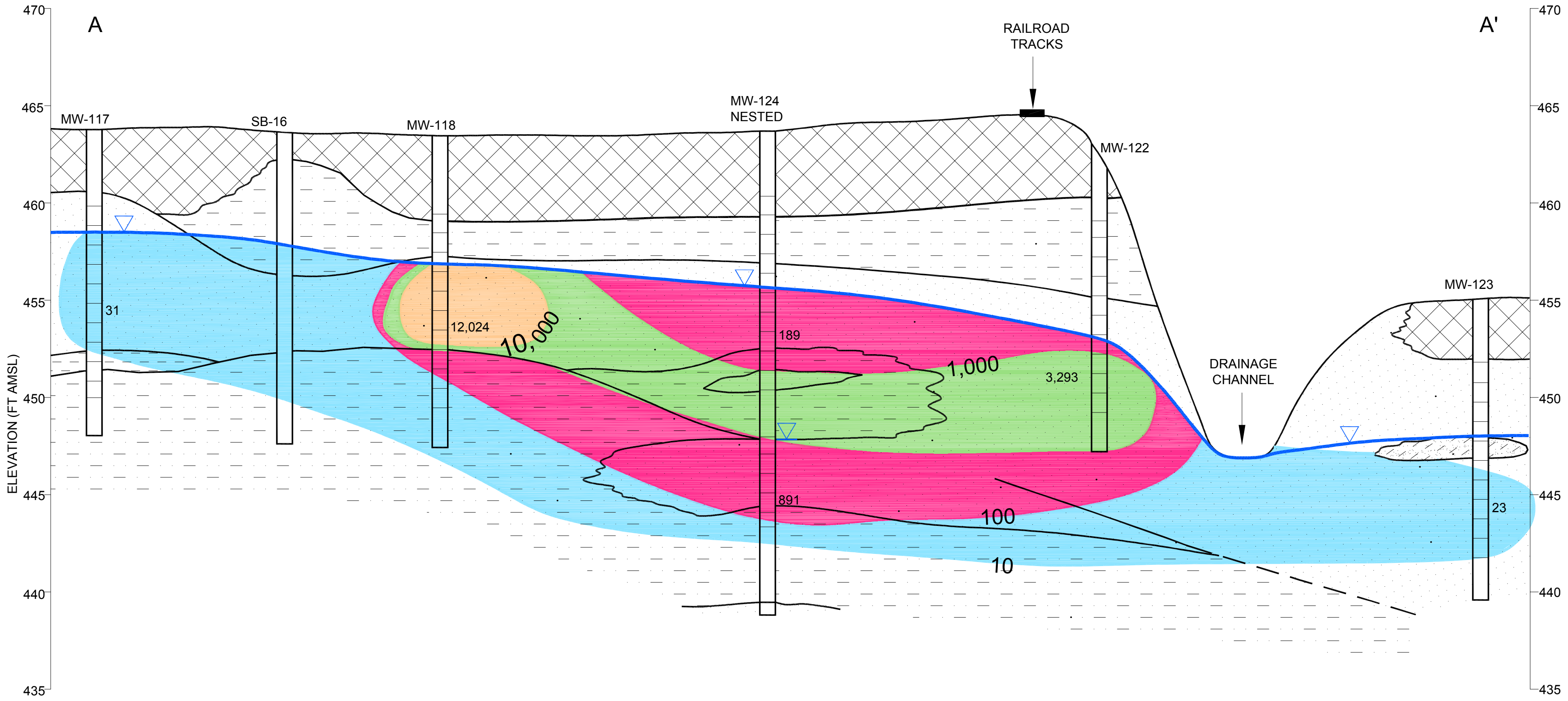
File:
ECOR\Geneva\IRM-1109
\Fig62-TVOC0808.mxd

Date:
01/07/2010

Figure 62
Total VOCs in Groundwater
August 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



LEGEND

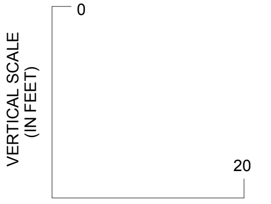
SCREENED INTERVAL

AUGUST 2008 POTENTIOMETRIC ELEVATIONS (FT-AMSL)

TOTAL VOC CONCENTRATIONS IN GROUNDWATER (AUGUST 2008)

- 10-100 ug/l
- 100-1,000 ug/l
- 1,000-10,000 ug/l
- 10,000+ ug/l

- ☒ FILL
- SILT & CLAY
- SAND
- CLAY
- SILTY SAND



HORIZONTAL SCALE (IN FEET)
VERTICAL EXAGGERATION 4X

ECOR Solutions, Inc.

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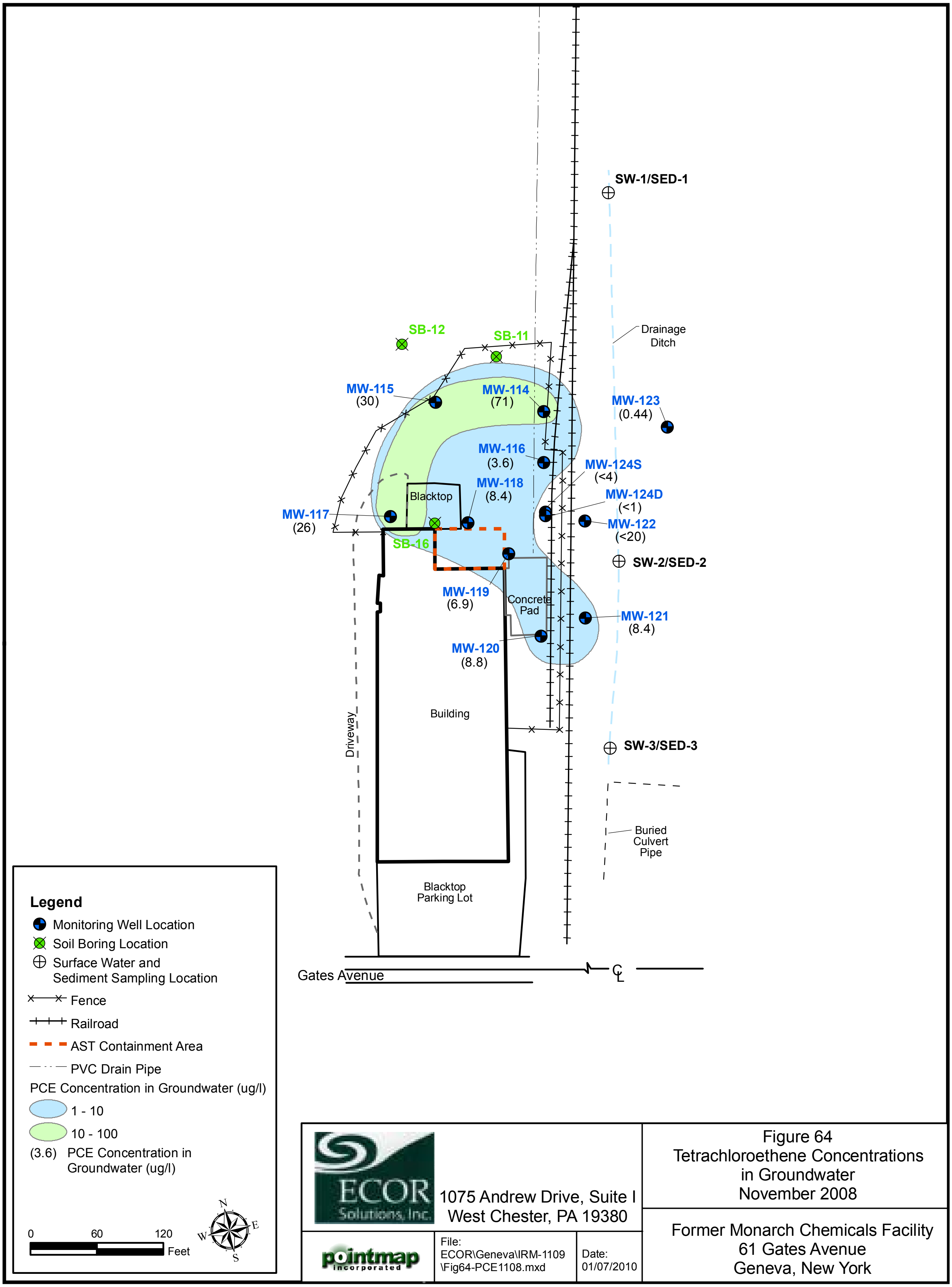
pointmap incorporated

File: ECOR\Geneva\IRM-1109\drawings\Fig63-TVOC-0808-A-A'.dwg

Date: 01/07/2010

Figure 63
Total VOCs Detected in Groundwater
August 2008
Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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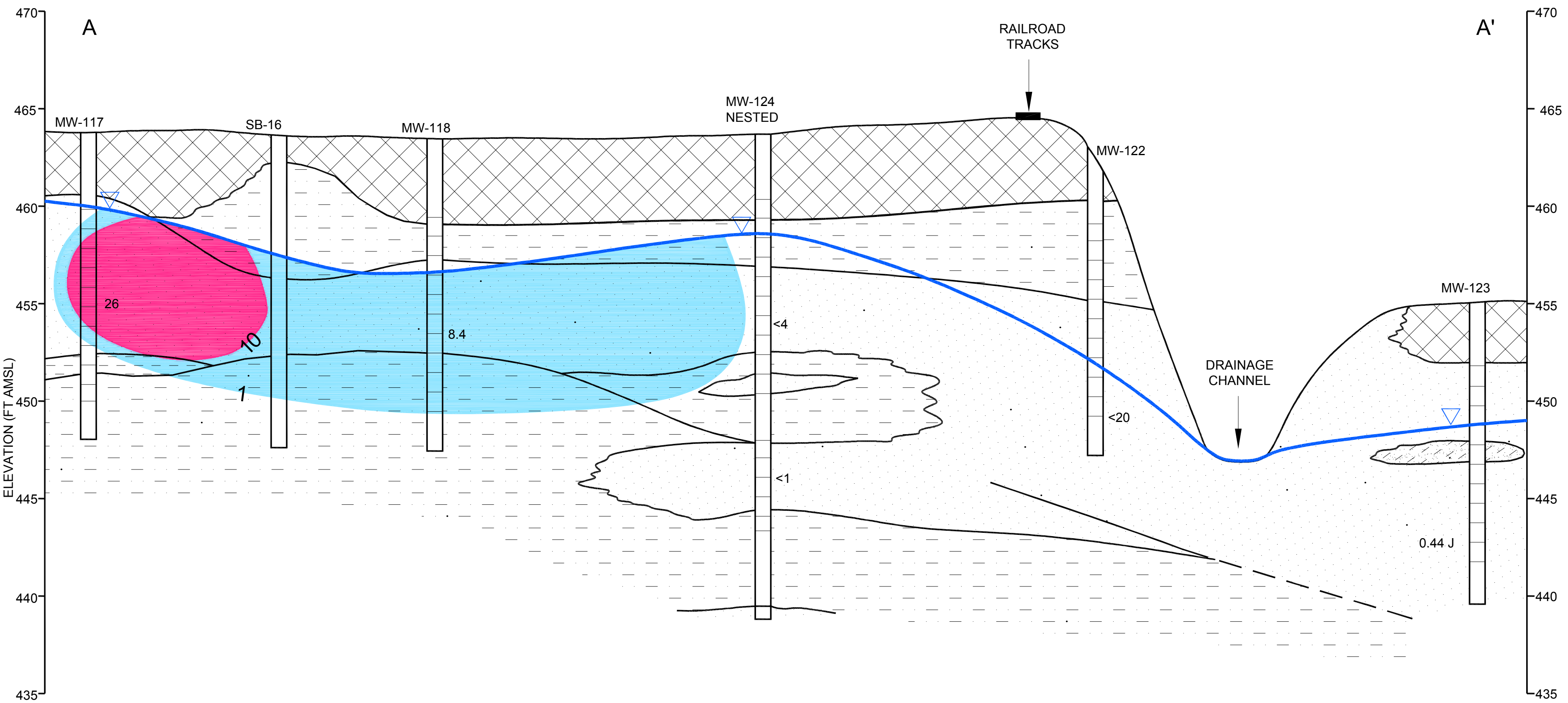
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig64-PCE1108.mxd

Date:
01/07/2010

Figure 64
Tetrachloroethene Concentrations in Groundwater
November 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



LEGEND

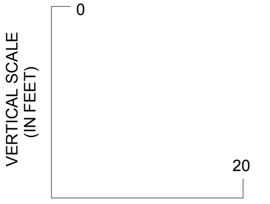
SCREENED INTERVAL

NOVEMBER 2008
POTENTIOMETRIC ELEVATIONS
(FT-AMSL)

PCE CONCENTRATIONS IN GROUNDWATER
(NOVEMBER 2008)

- 1-10 ug/l
- 10-100 ug/l

- ▨ FILL
- ▨ SILT & CLAY
- ▨ SAND
- ▨ CLAY
- ▨ SILTY SAND



HORIZONTAL SCALE (IN FEET)
VERTICAL EXAGGERATION 4X

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West Chester, PA 19380

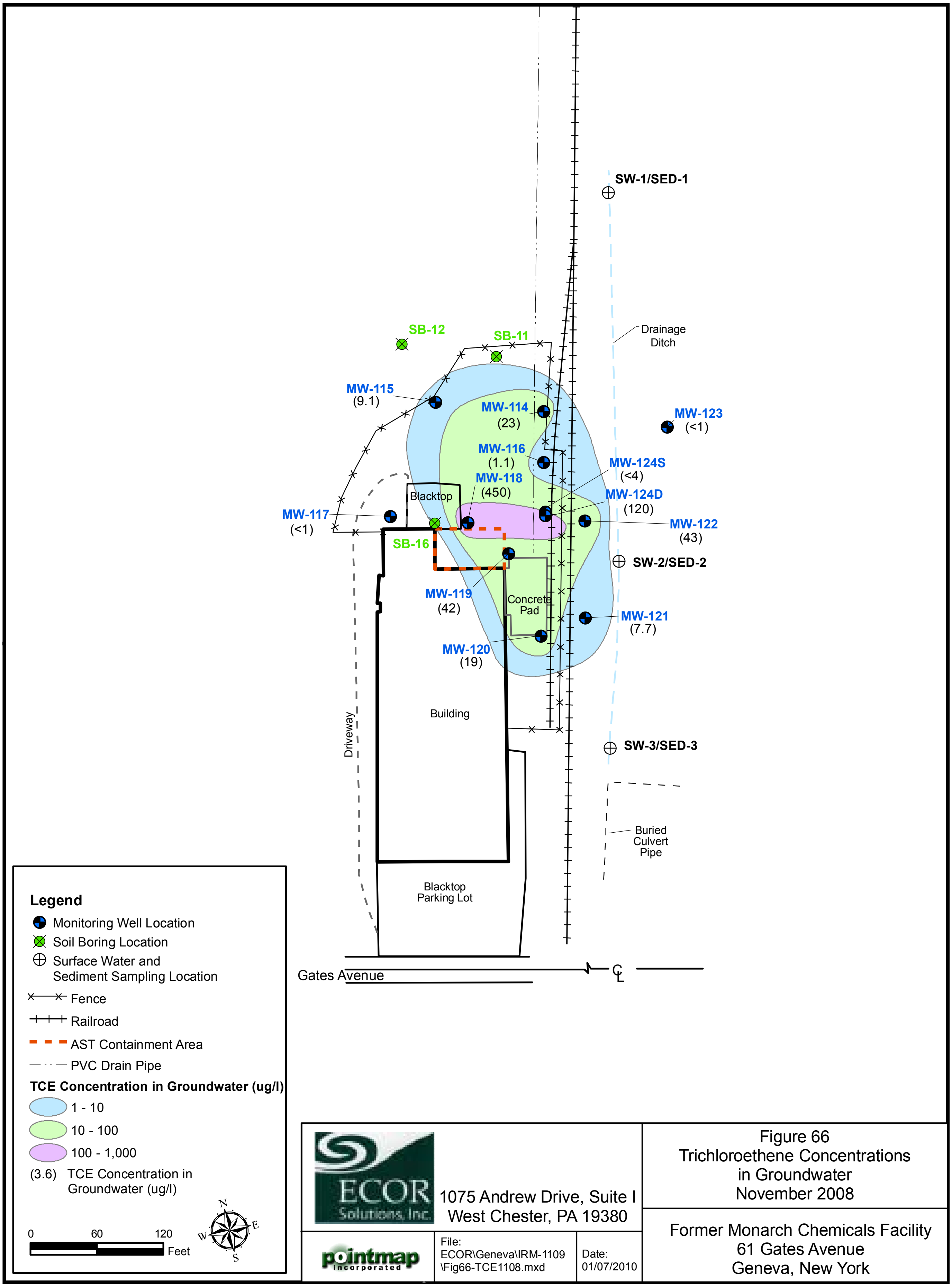
pointmap incorporated

File: ECOR\Geneva\
IRM-1109\drawings\
Fig65-PCE1108-AA.dwg

Date:
01/07/2010

Figure 65
Tetrachloroethene Concentrations Detected in Groundwater November 2008 Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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West Chester, PA 19380

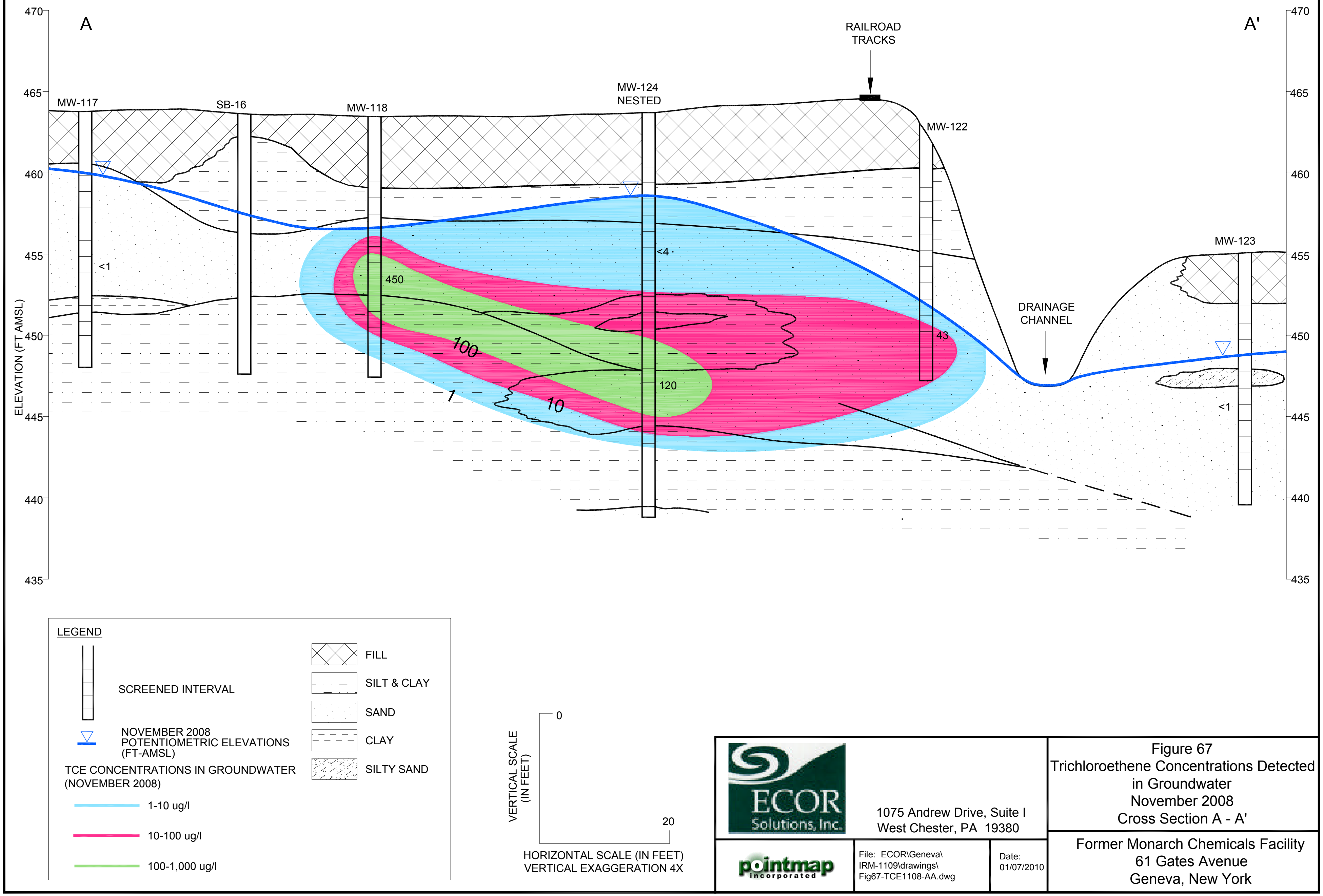
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig66-TCE1108.mxd

Date:
01/07/2010

Figure 66
Trichloroethene Concentrations
in Groundwater
November 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



ECOR Solutions, Inc.

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pointmap incorporated

File: ECOR\Geneva\
IRM-1109\drawings\
Fig67-TCE1108-AA.dwg

Date:
01/07/2010

Figure 67
Trichloroethene Concentrations Detected
in Groundwater
November 2008
Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

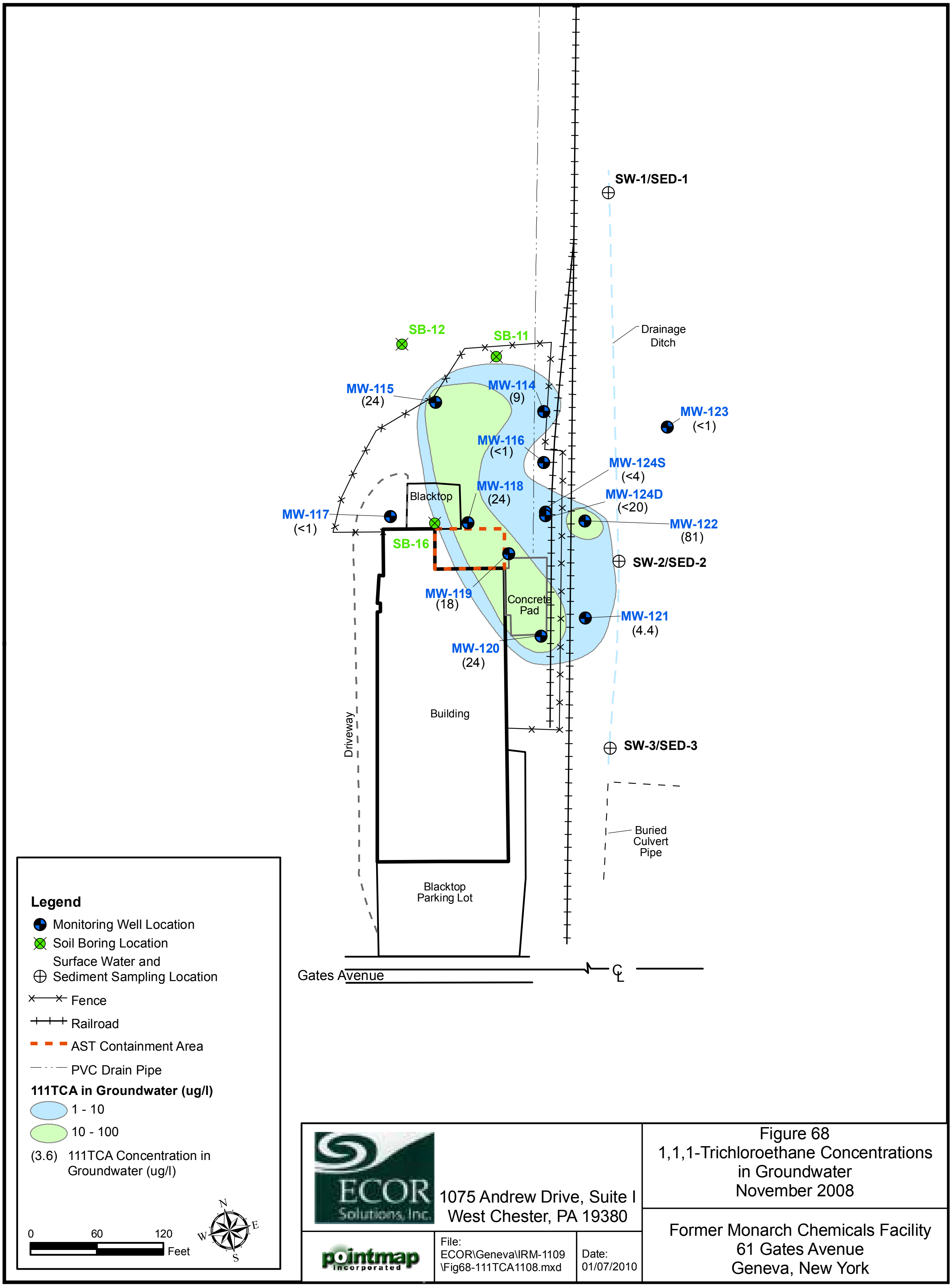

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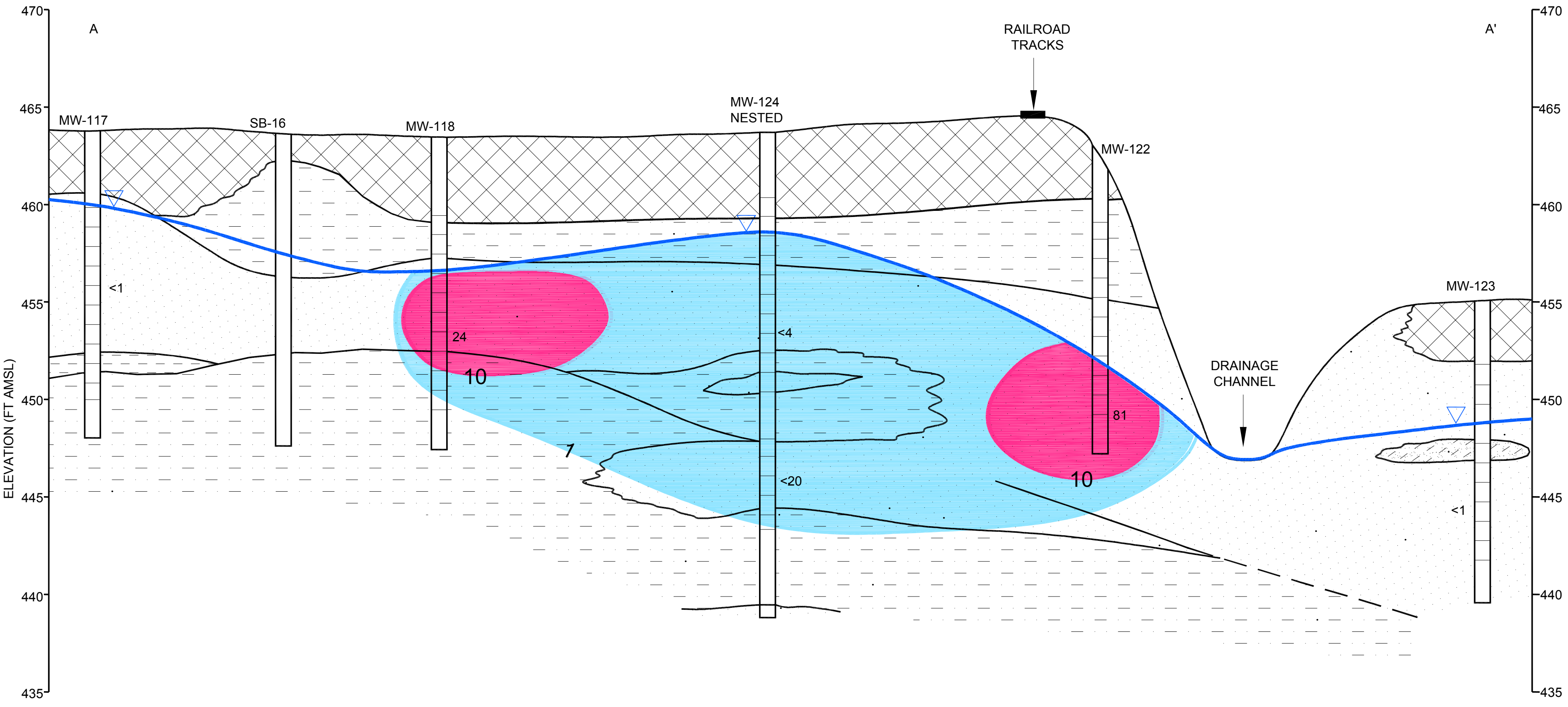
Figure 68
1,1,1-Trichloroethane Concentrations in Groundwater
November 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig68-111TCA1108.mxd

Date:
01/07/2010



LEGEND

SCREENED INTERVAL

▽ NOVEMBER 2008 POTENTIOMETRIC ELEVATIONS (FT-AMSL)

111TCA CONCENTRATIONS IN GROUNDWATER (NOVEMBER 2008)

1-10 ug/l

10-100 ug/l

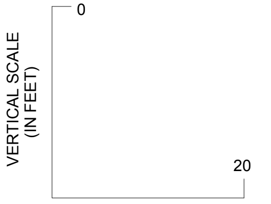
▨ FILL

▨ SILT & CLAY

▨ SAND

▨ CLAY

▨ SILTY SAND



HORIZONTAL SCALE (IN FEET)
VERTICAL EXAGGERATION 4X

ECOR Solutions, Inc.
1075 Andrew Drive, Suite I
West Chester, PA 19380

pointmap incorporated

File: ECOR\Geneva\IRM-1109\drawings\Fig69-111TCA1108-AA.dwg

Date: 01/07/2010

Figure 69
1,1,1-Trichloroethane Concentrations Detected in Groundwater November 2008 Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

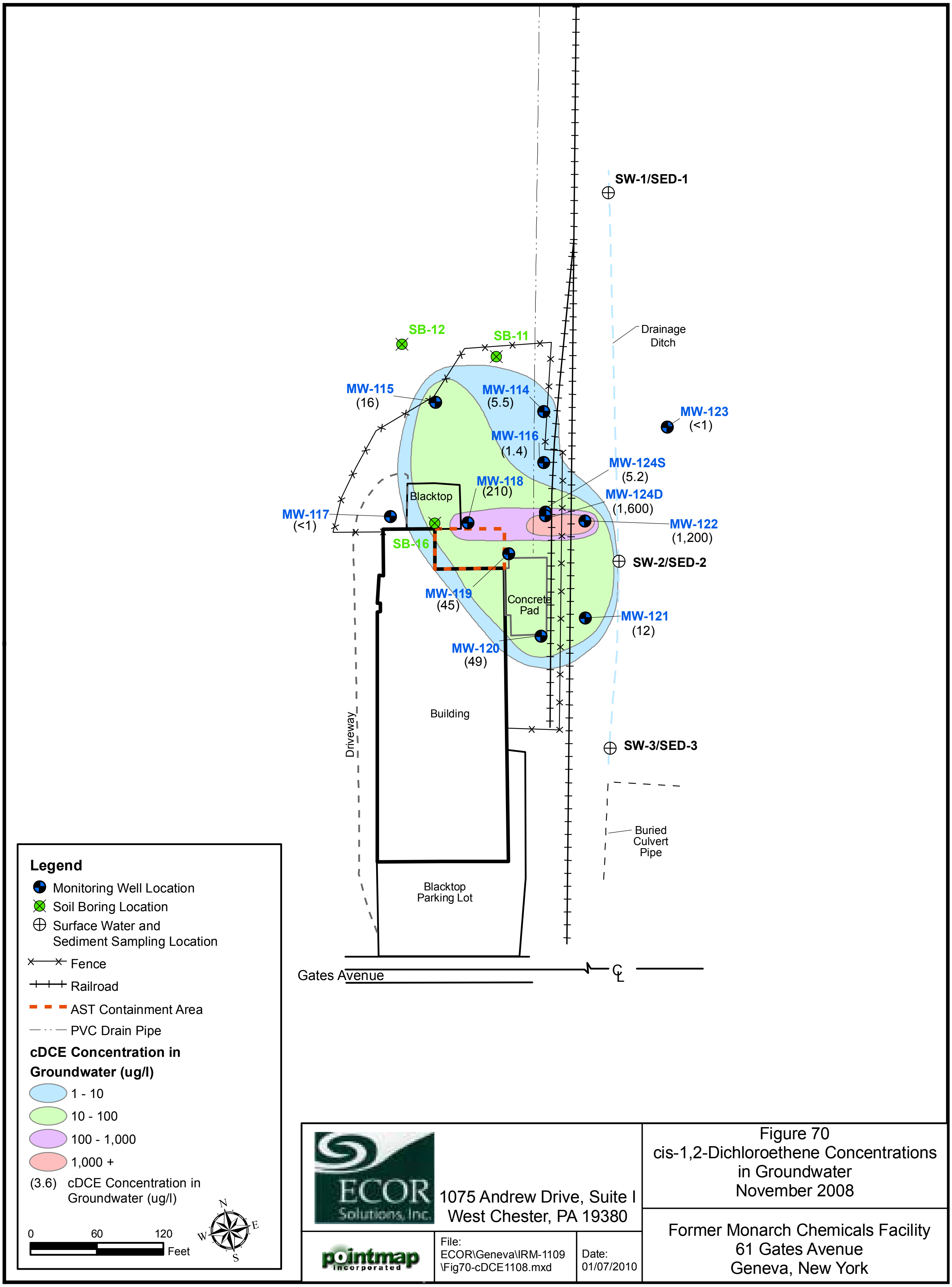


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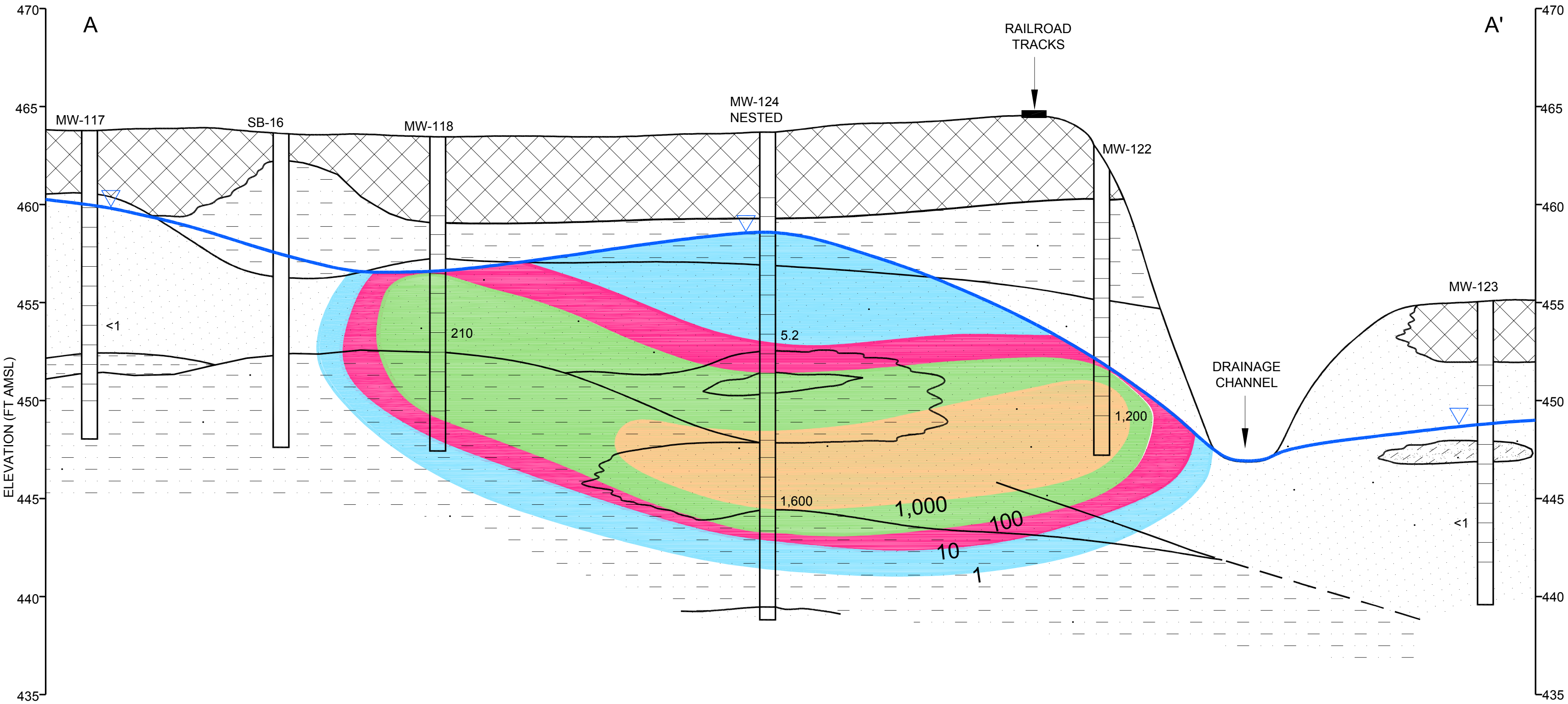
Figure 70
cis-1,2-Dichloroethene Concentrations in Groundwater
November 2008

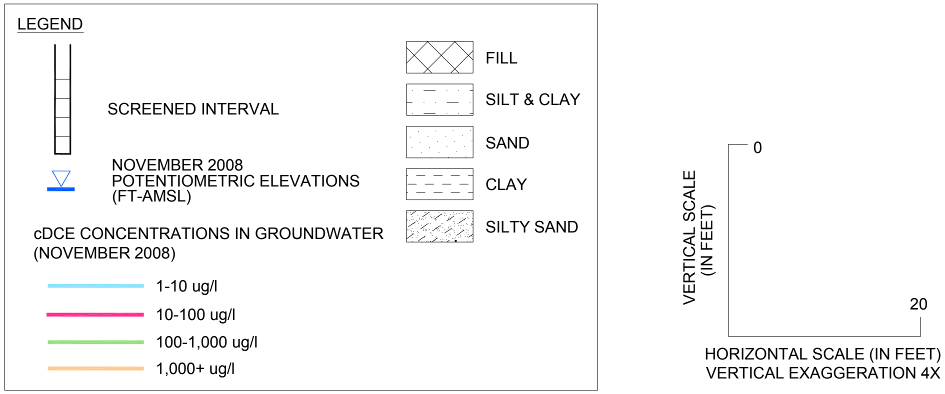
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig70-cDCE1108.mxd

Date:
01/07/2010

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York





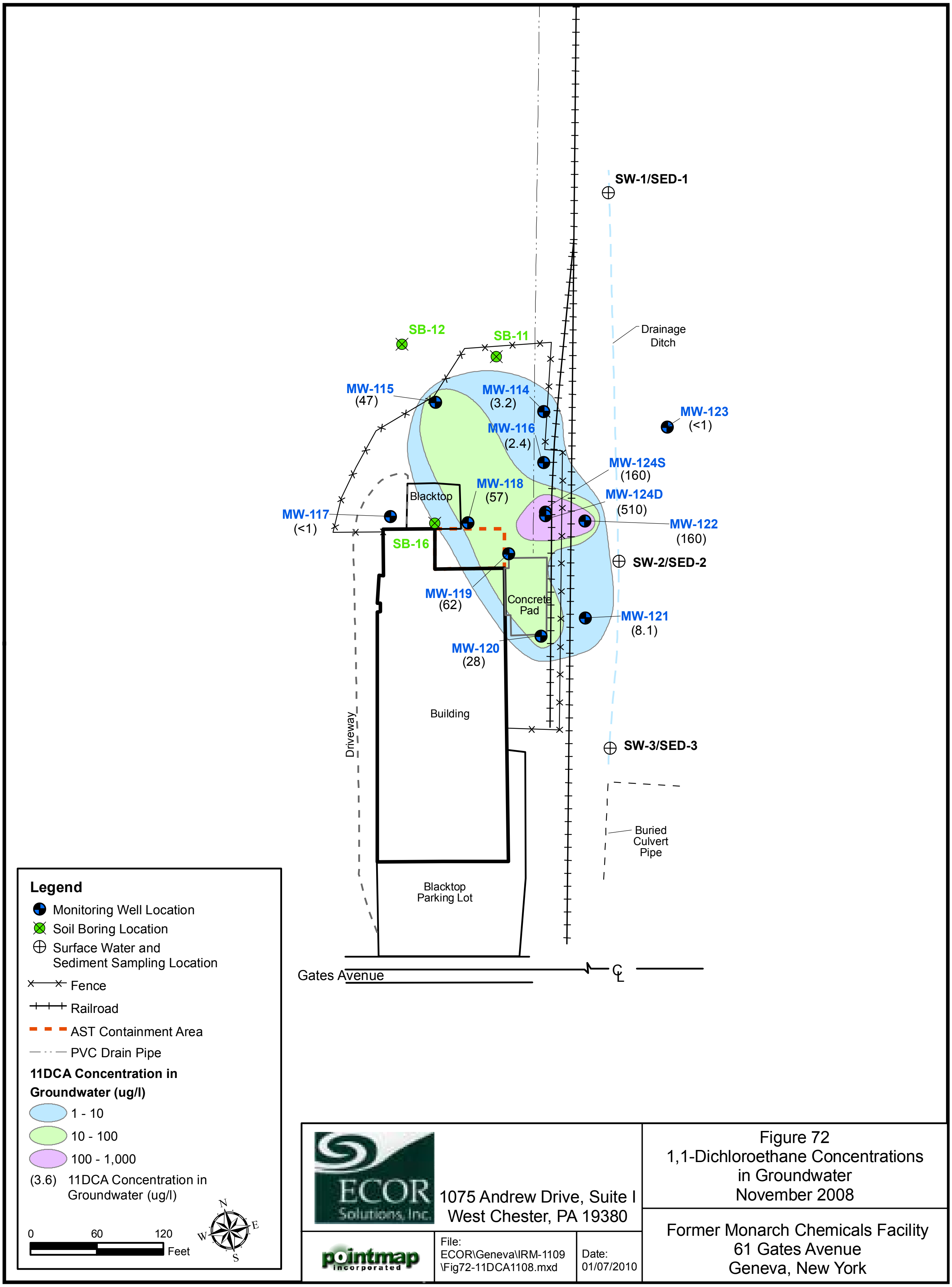
1075 Andrew Drive, Suite I
West Chester, PA 19380

File: ECOR\Geneva\
IRM-1109\drawings\
Fig71-cDCE1108-AA.dwg

Date:
01/07/2010

Figure 71
cis-1,2-Dichloroethene Concentrations
Detected in Groundwater
November 2008
Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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1075 Andrew Drive, Suite I
West Chester, PA 19380

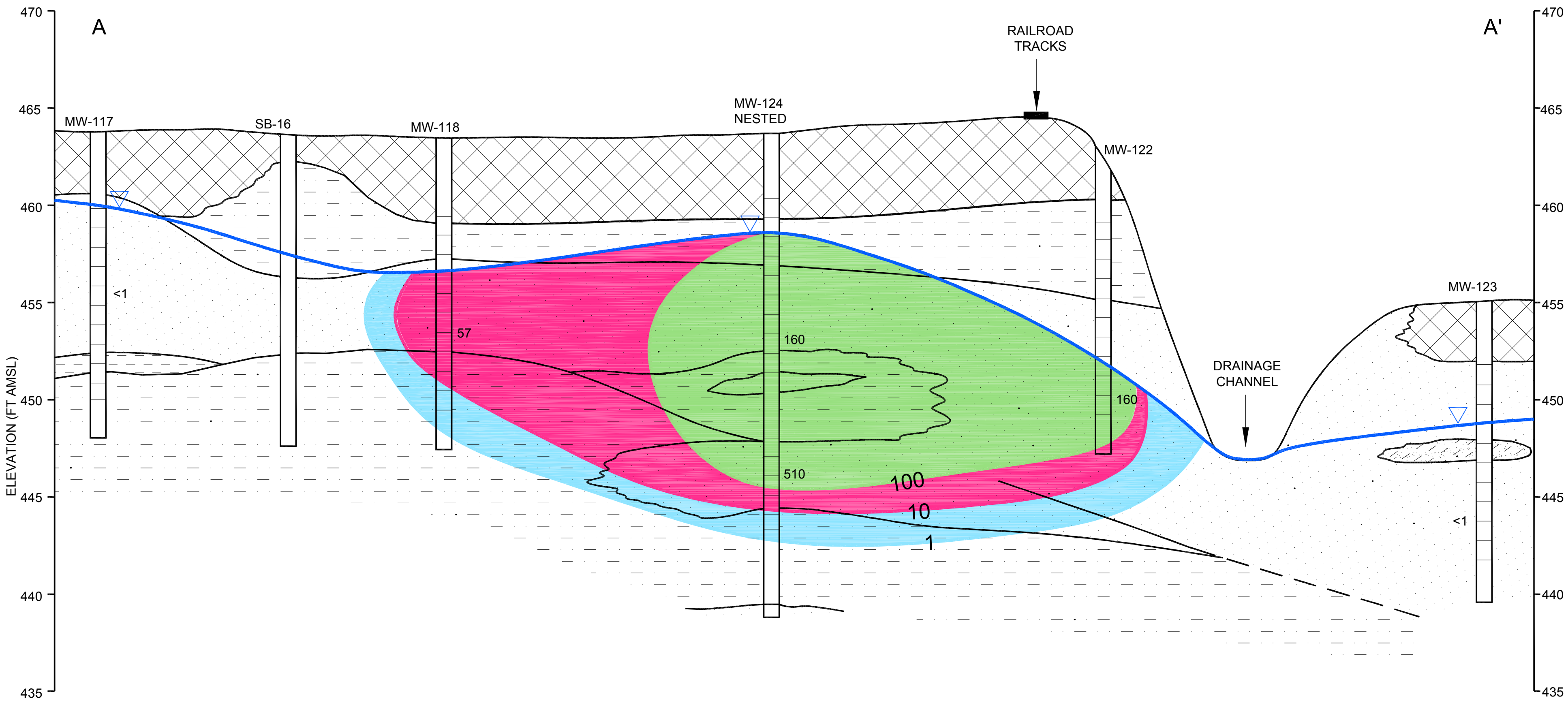
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig72-11DCA1108.mxd

Date:
01/07/2010

Figure 72
1,1-Dichloroethane Concentrations
in Groundwater
November 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



LEGEND

SCREENED INTERVAL

NOVEMBER 2008 POTENTIOMETRIC ELEVATIONS (FT-AMSL)

11DCA CONCENTRATIONS IN GROUNDWATER (NOVEMBER 2008)

- 1-10 ug/l
- 10-100 ug/l
- 100-1,000 ug/l

- ▨ FILL
- ▨ SILT & CLAY
- ▨ SAND
- ▨ CLAY
- ▨ SILTY SAND

VERTICAL SCALE (IN FEET)

0

20

HORIZONTAL SCALE (IN FEET)
VERTICAL EXAGGERATION 4X

ECOR Solutions, Inc.

1075 Andrew Drive, Suite I
West Chester, PA 19380

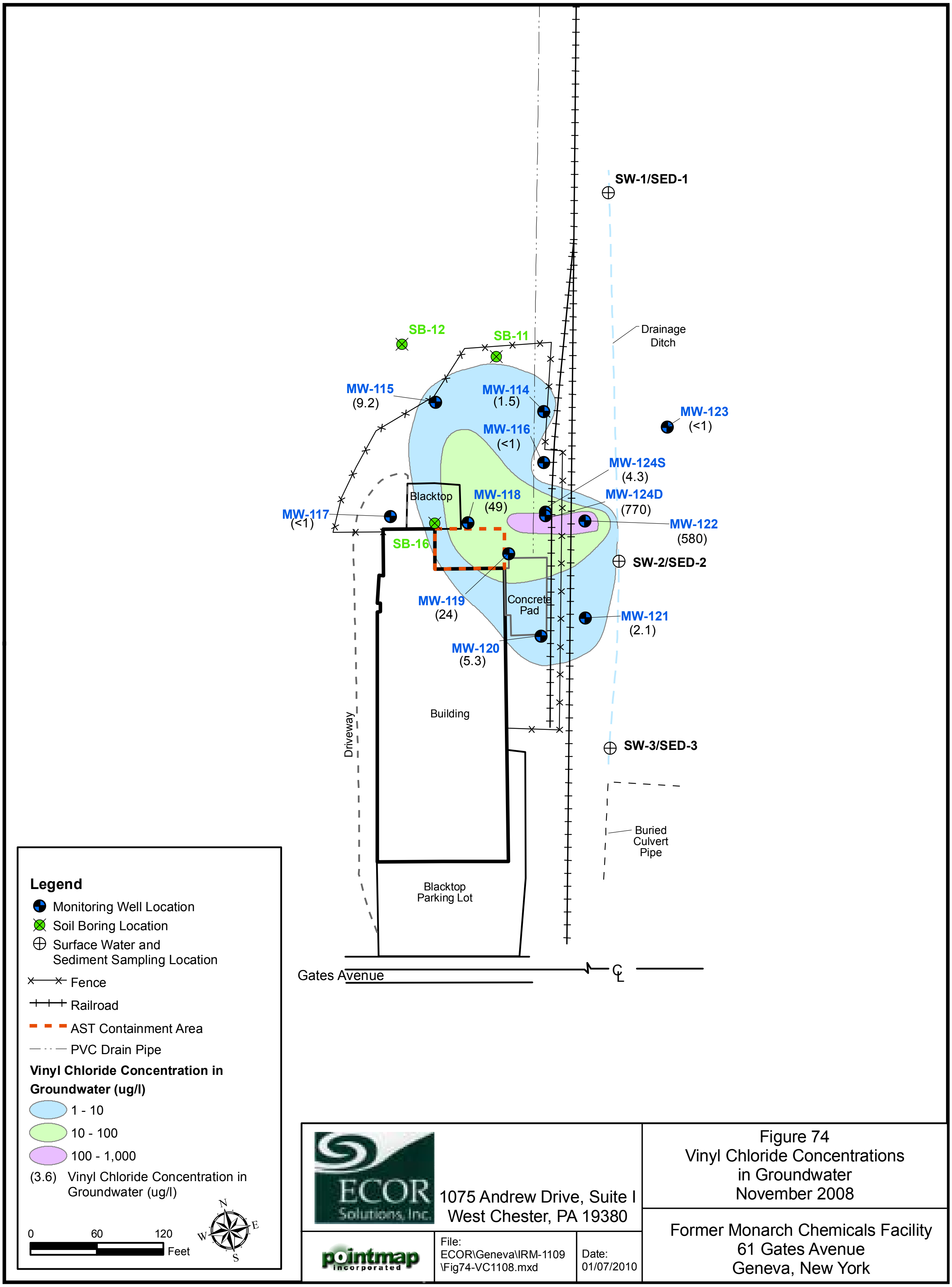
pointmap incorporated

File: ECOR\Geneva\IRM-1109\drawings\Fig73-11DCA1108-AA.dwg

Date: 01/07/2010

Figure 73
1,1-Dichloroethane Concentrations
Detected in Groundwater
November 2008
Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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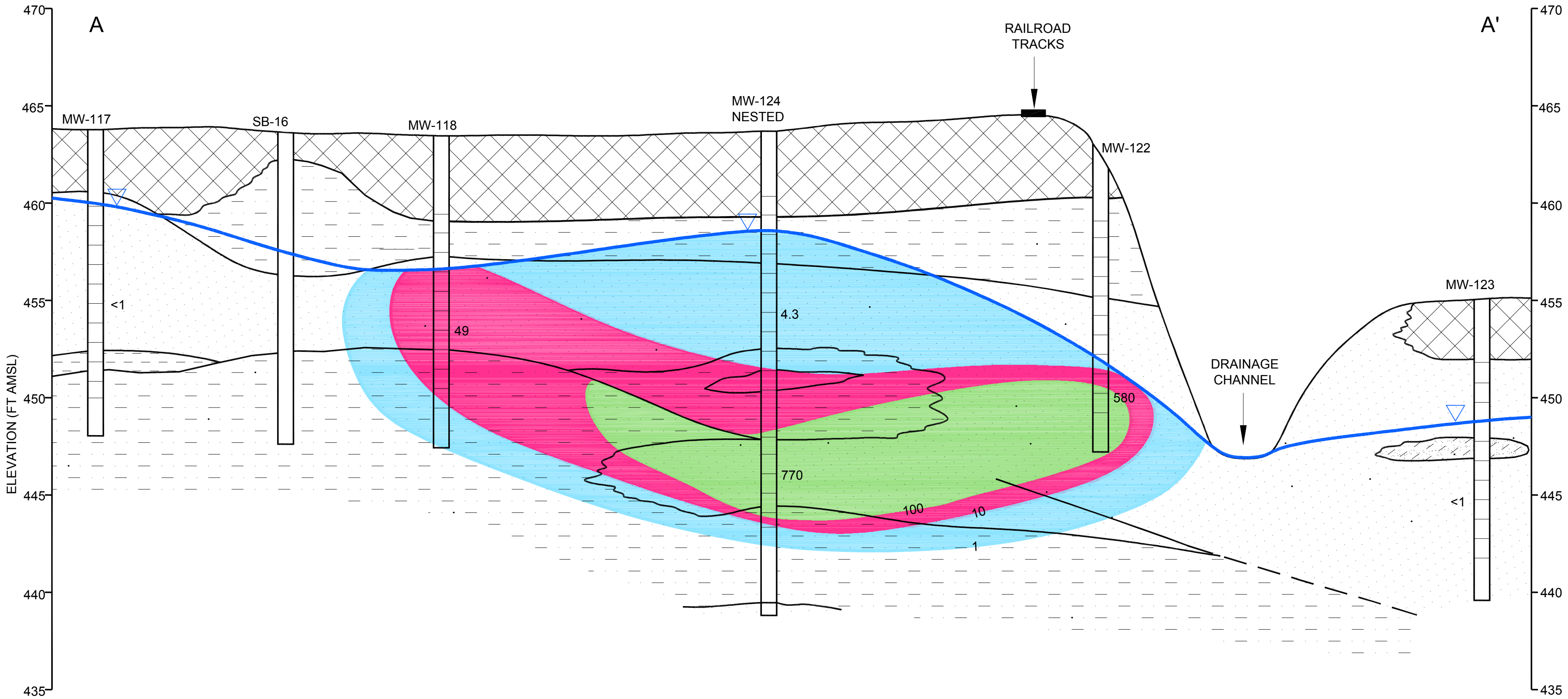
File:
ECOR\Geneva\IRM-1109
\Fig74-VC1108.mxd

Date:
01/07/2010

Figure 74
Vinyl Chloride Concentrations
in Groundwater
November 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



LEGEND

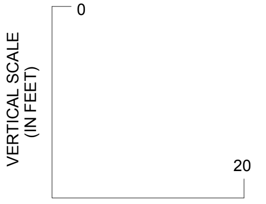
SCREENED INTERVAL

▽ NOVEMBER 2008 POTENTIOMETRIC ELEVATIONS (FT-AMSL)

VINYL CHLORIDE CONCENTRATIONS IN GROUNDWATER (NOVEMBER 2008)

- ━ 1-10 ug/l
- ━ 10-100 ug/l
- ━ 100-1,000 ug/l

- ▨ FILL
- ▭ SILT & CLAY
- ▭ SAND
- ▭ CLAY
- ▨ SILTY SAND



HORIZONTAL SCALE (IN FEET)
VERTICAL EXAGGERATION 4X

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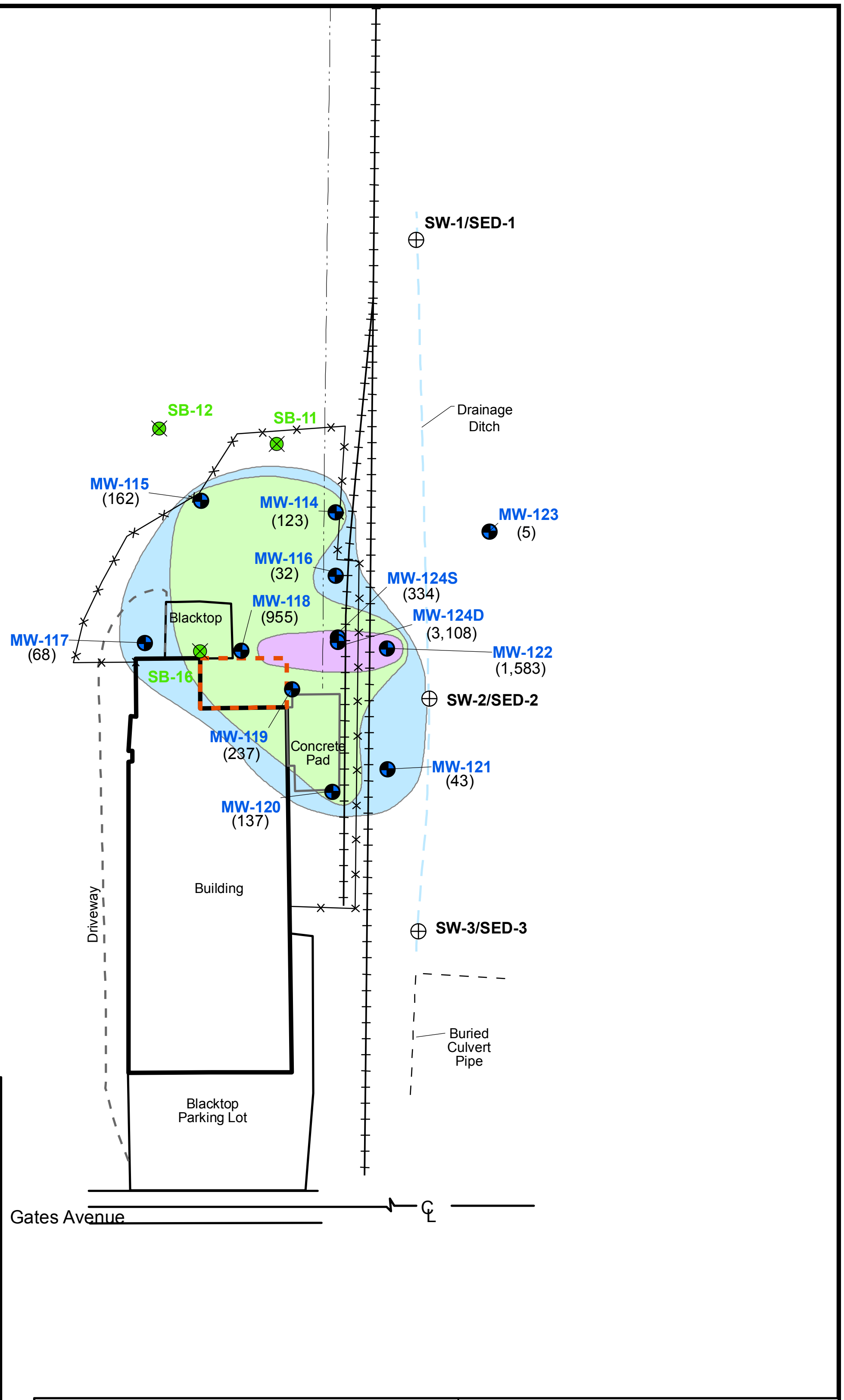
File: ECOR\Geneva\
IRM-1109\drawings\
Fig75-VC1108-AA.dwg

Date:
01/07/2010

Figure 75
Vinyl Chloride Concentrations
Detected in Groundwater
November 2008
Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



Legend

- Monitoring Well Location
- Soil Boring Location
- ⊕ Surface Water and Sediment Sampling Location
- Fence
- Railroad
- AST Containment Area
- PVC Drain Pipe

TVOCs in Groundwater (ug/l)

- 10 - 100
- 100 - 1,000
- 1,000 +

(3.6) TVOC Concentration in Groundwater (ug/l)

0 60 120 Feet

N E S W

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File:
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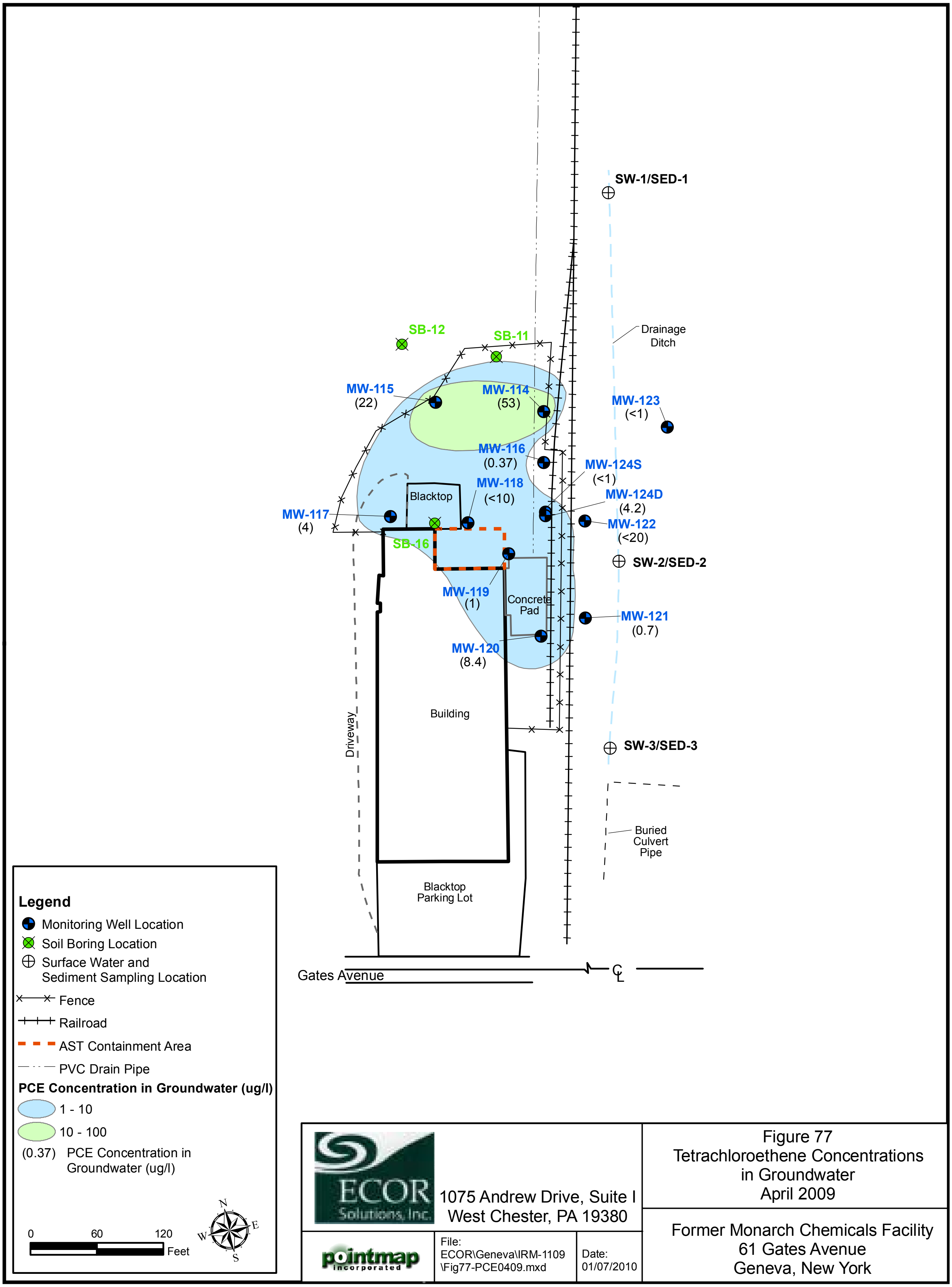
\Fig76-TVOC1108.mxd

Date:
01/07/2010

Figure 76
Total VOCs in Groundwater
November 2008

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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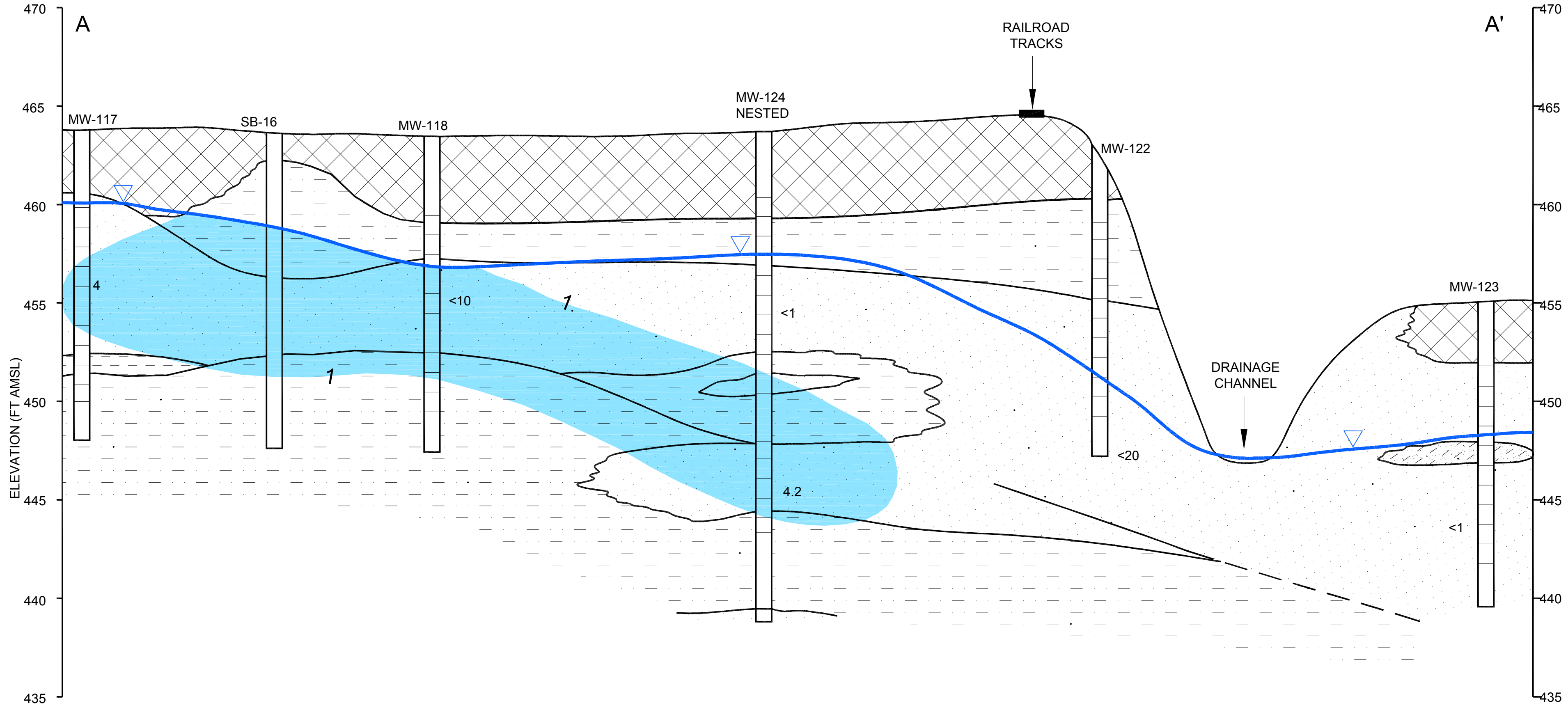
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig77-PCE0409.mxd

Date:
01/07/2010

Figure 77
Tetrachloroethene Concentrations
in Groundwater
April 2009

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



LEGEND

SCREENED INTERVAL

▽ APRIL 2009 POTENTIOMETRIC ELEVATIONS (FT-AMSL)

PCE CONCENTRATIONS IN GROUNDWATER APRIL 2009

10-100 ug/l

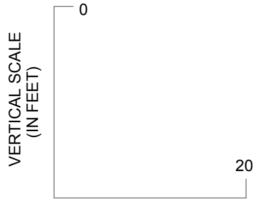
▨ FILL

▨ SILT & CLAY

▨ SAND

▨ CLAY

▨ SILTY SAND



HORIZONTAL SCALE (IN FEET)
VERTICAL EXAGGERATION 4X

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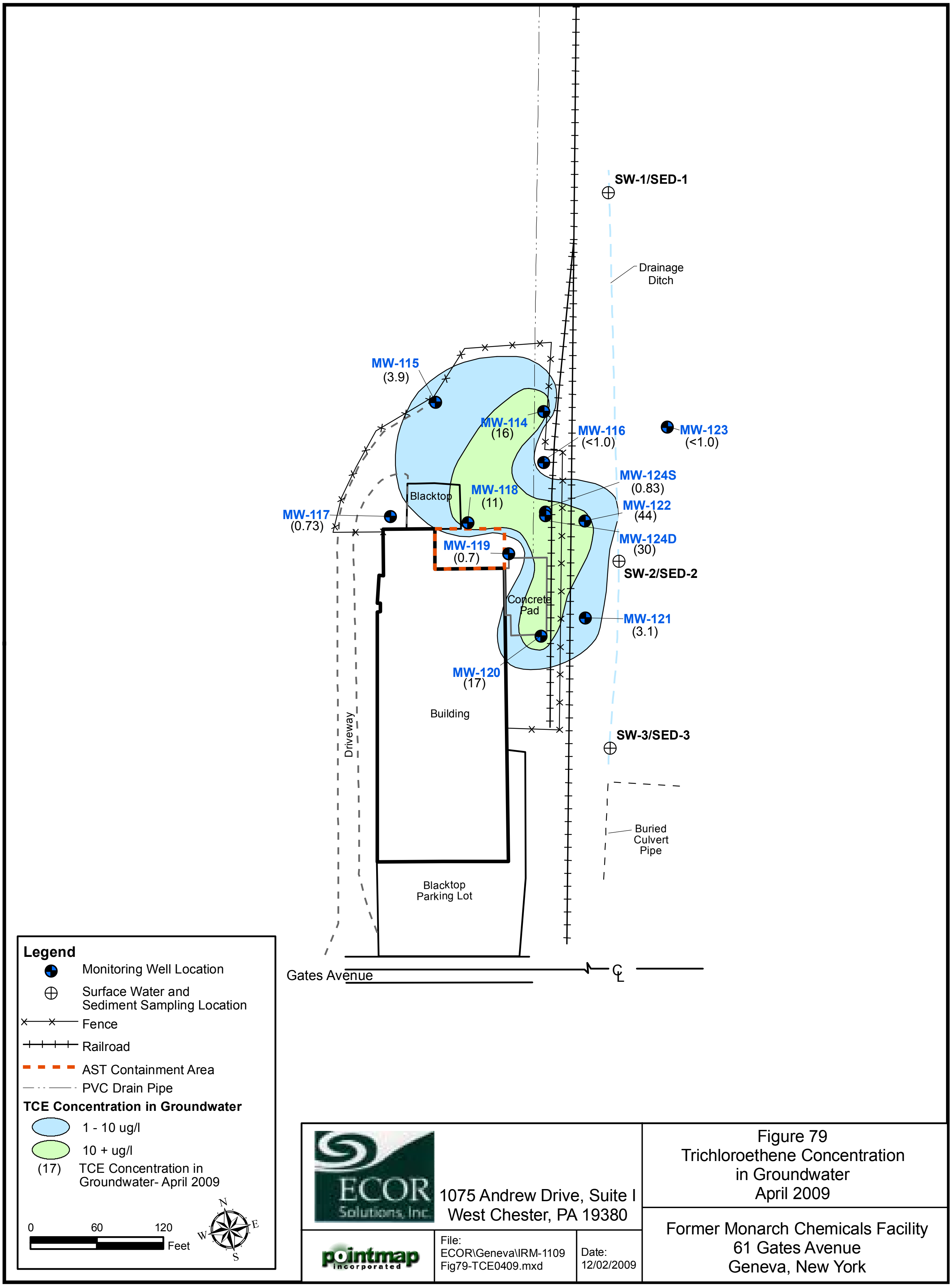
Figure 78
PCE Detected in Groundwater
April 2009
Cross Section A - A'

pointmap incorporated

File: ECOR\Geneva\IRM-1109\drawings\Fig78-TCE0409-AA.dwg

Date: 01/07/2010

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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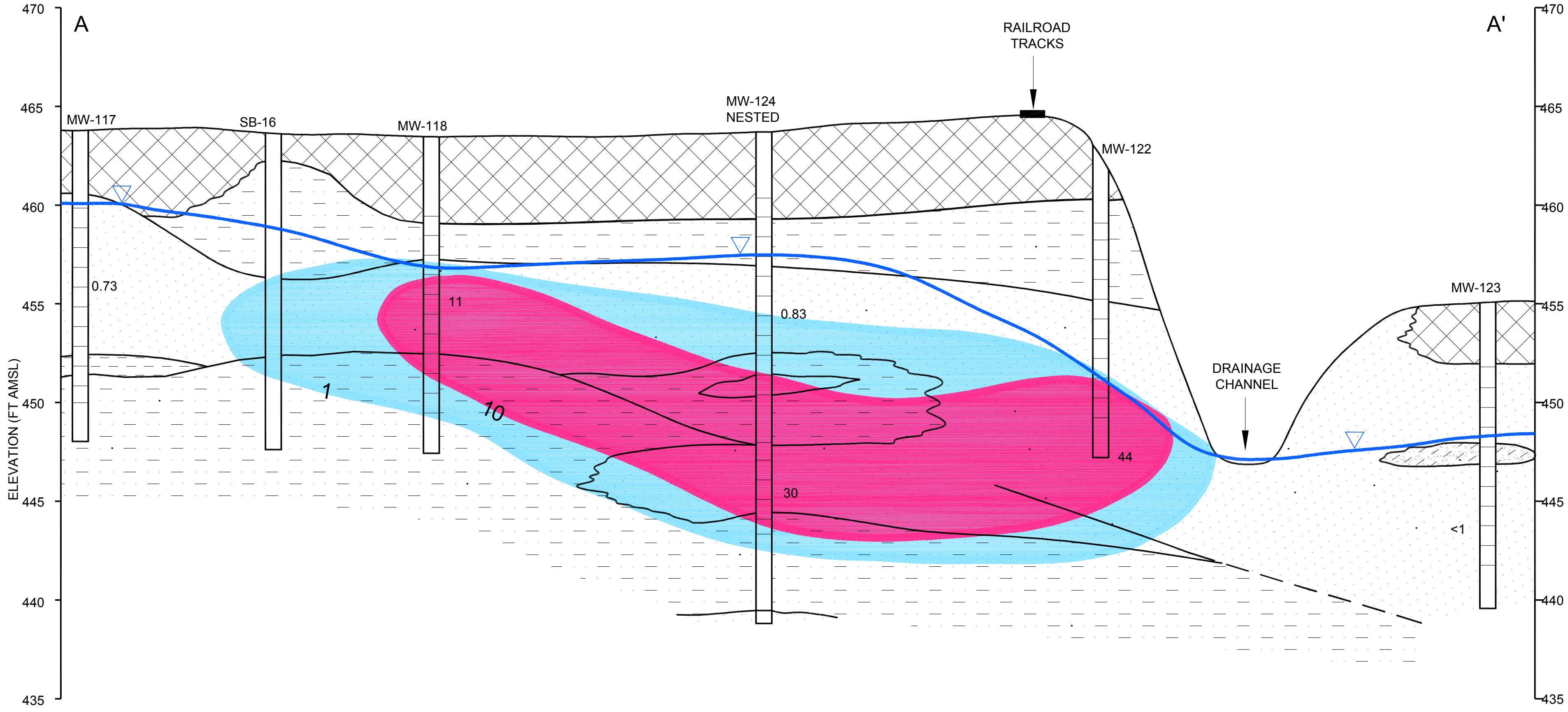
pointmap incorporated

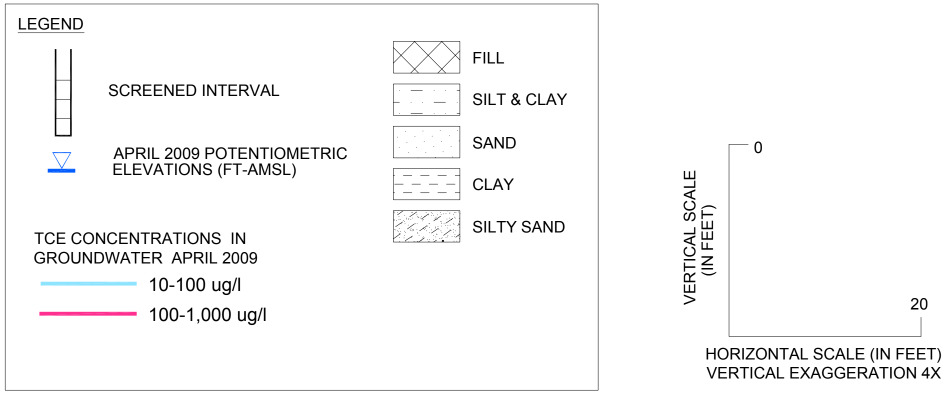
File:
ECOR\Geneva\IRM-1109
Fig79-TCE0409.mxd

Date:
12/02/2009

Figure 79
Trichloroethene Concentration
in Groundwater
April 2009

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York





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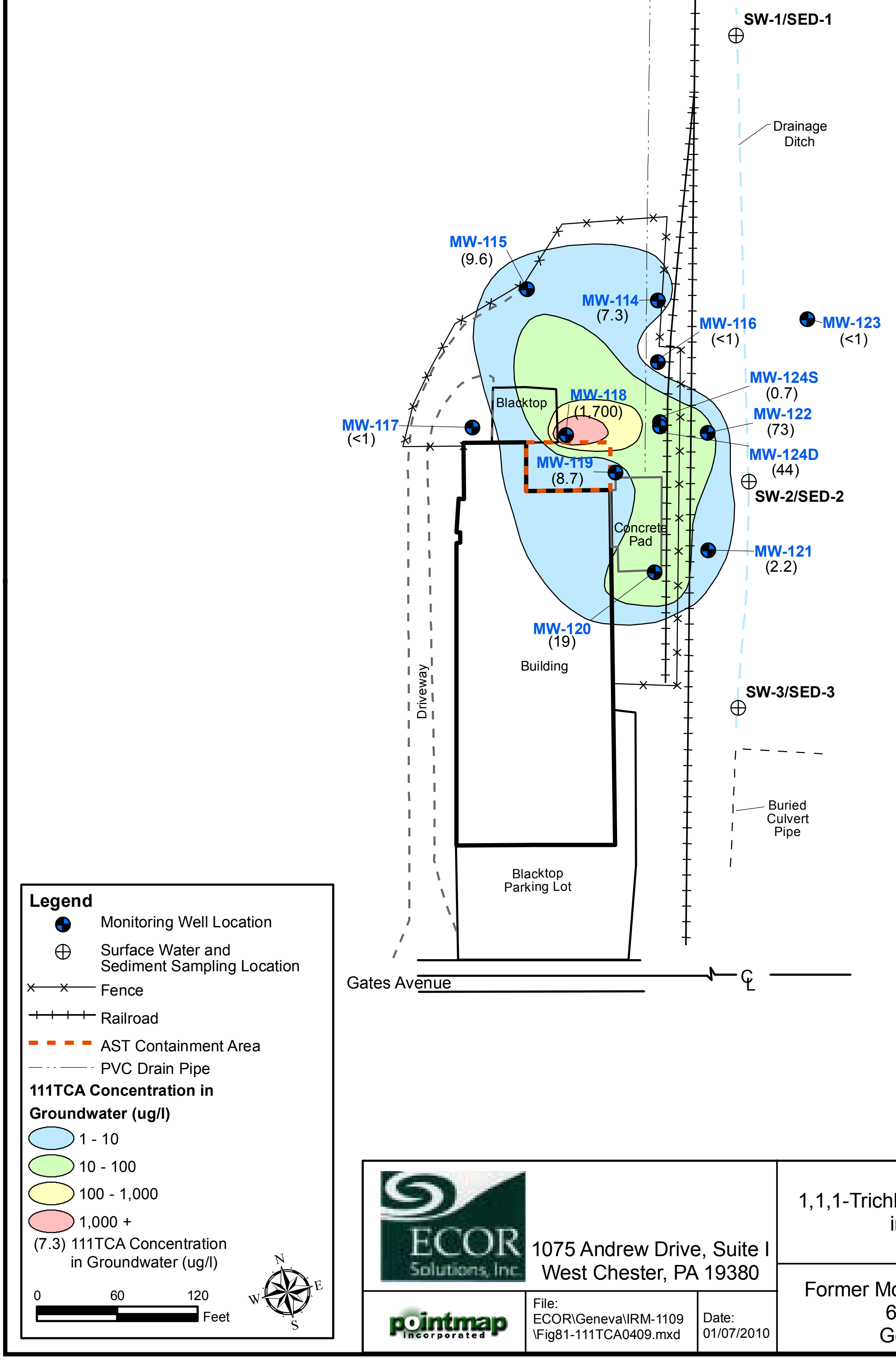
pointmap incorporated

File: ECOR\Geneva\
IRM-1109\drawings\
Fig80-TCE0409-AA.dwg

Date:
12/07/2009

Figure 80
TCE Detected in Groundwater
April 2009
Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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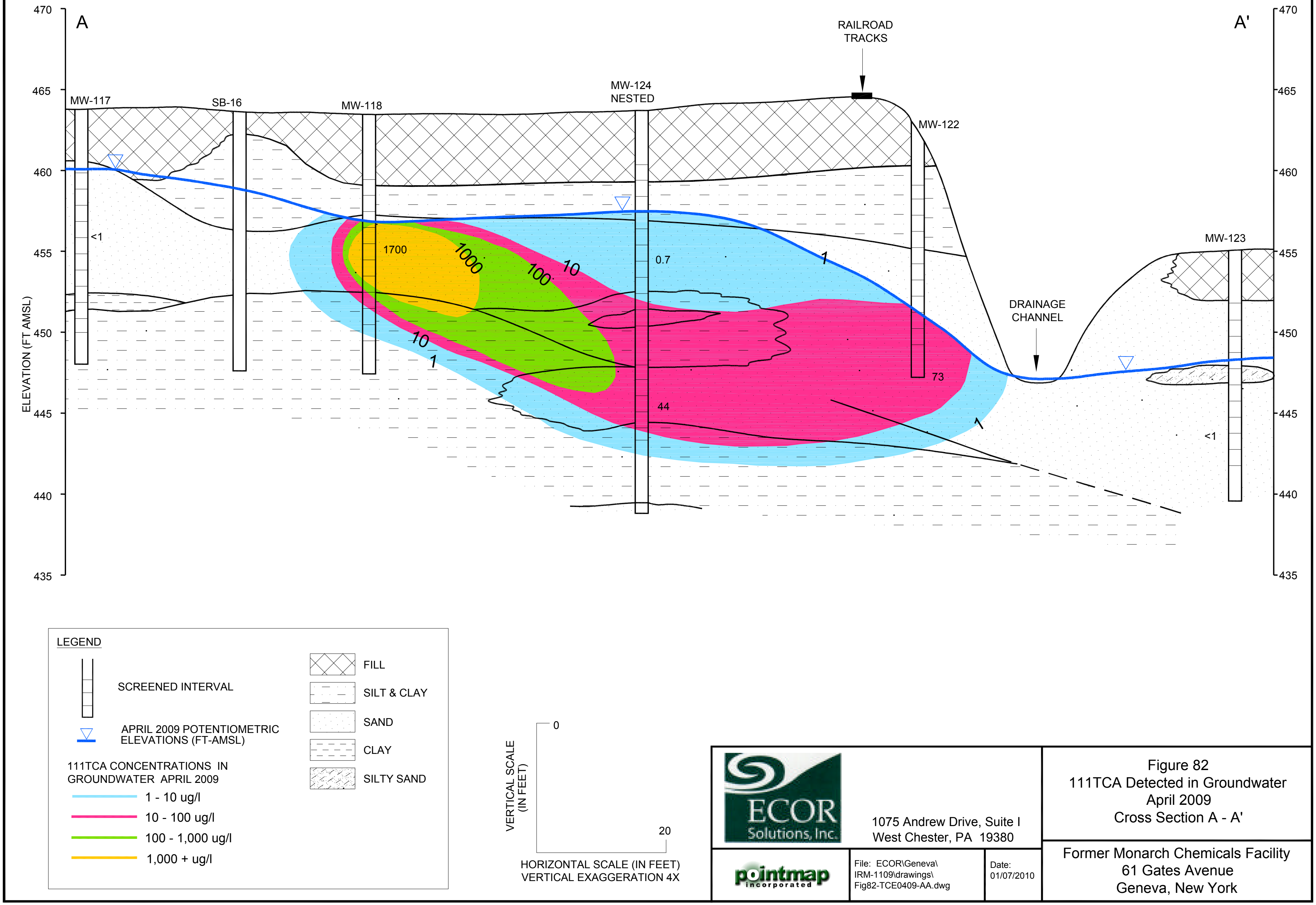
File:
ECOR\Geneva\IRM-1109
\Fig81-111TCA0409.mxd

Date:
01/07/2010

Figure 81
1,1,1-Trichloroethane Concentration
in Groundwater
April 2009

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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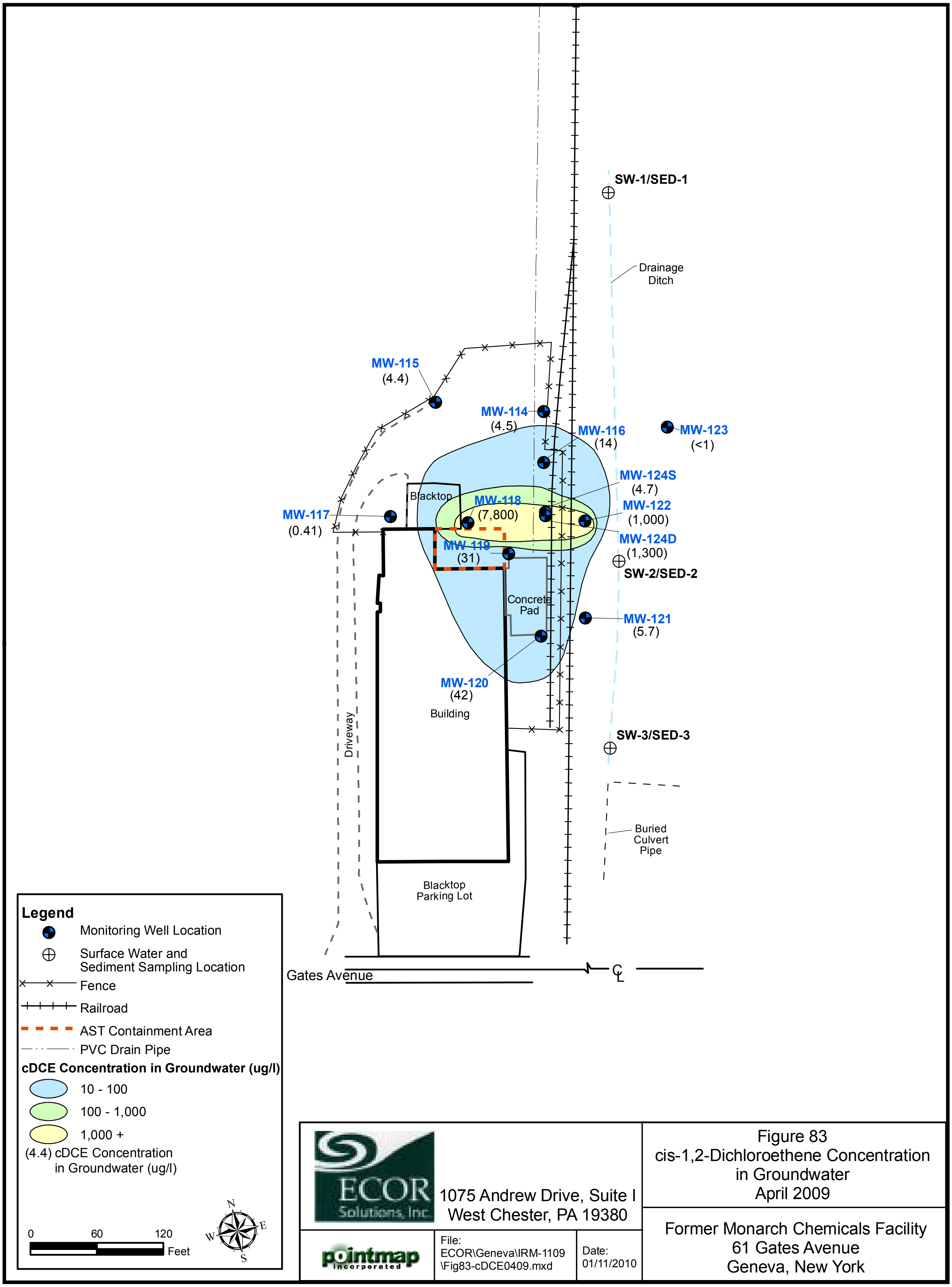
pointmap
incorporated

File: ECOR\Geneva\
IRM-1109\drawings\
Fig82-TCE0409-AA.dwg

Date:
01/07/2010

Figure 82
111TCA Detected in Groundwater
April 2009
Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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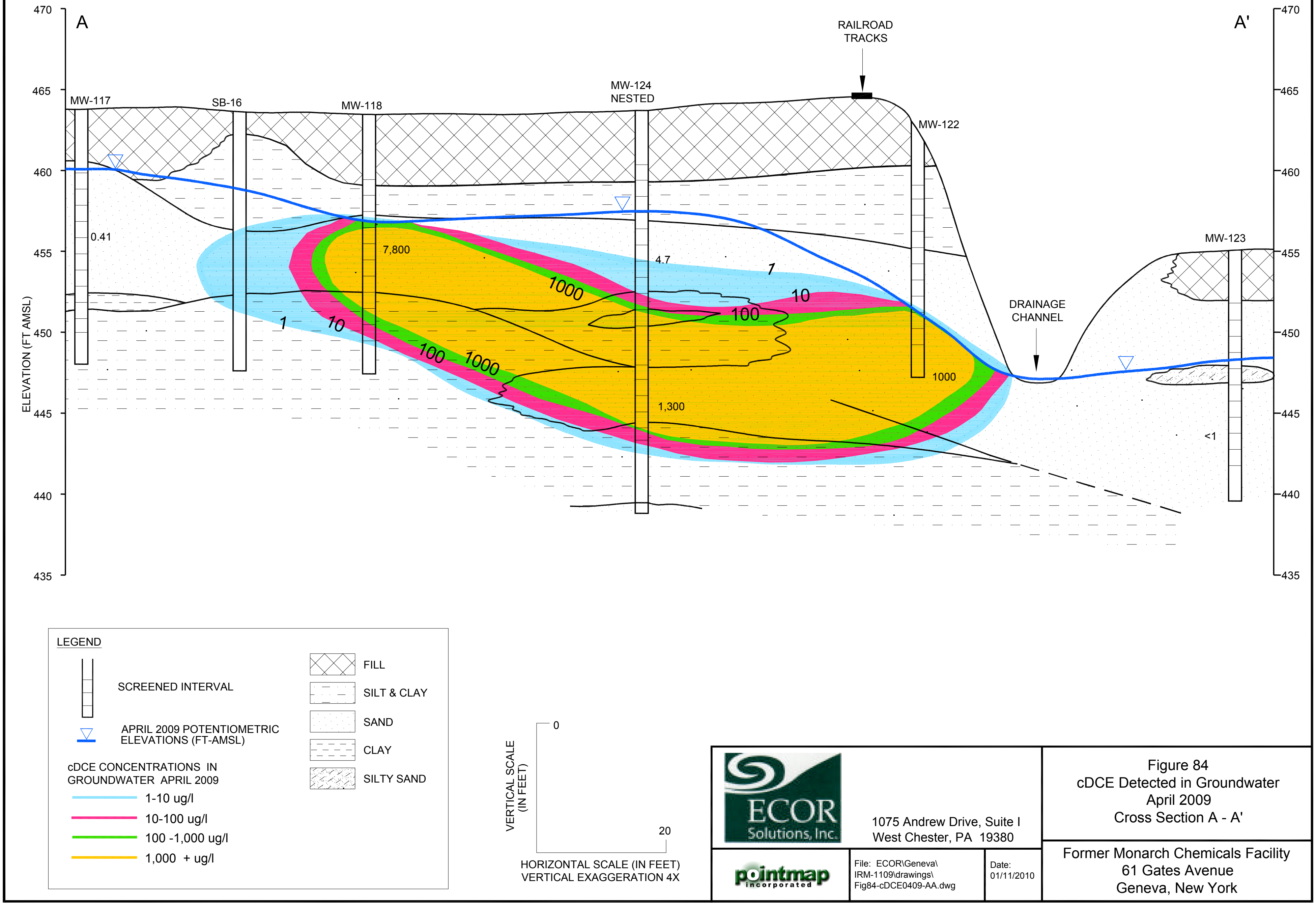
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig83-cDCE0409.mxd

Date:
01/11/2010

Figure 83
cis-1,2-Dichloroethene Concentration in Groundwater
April 2009

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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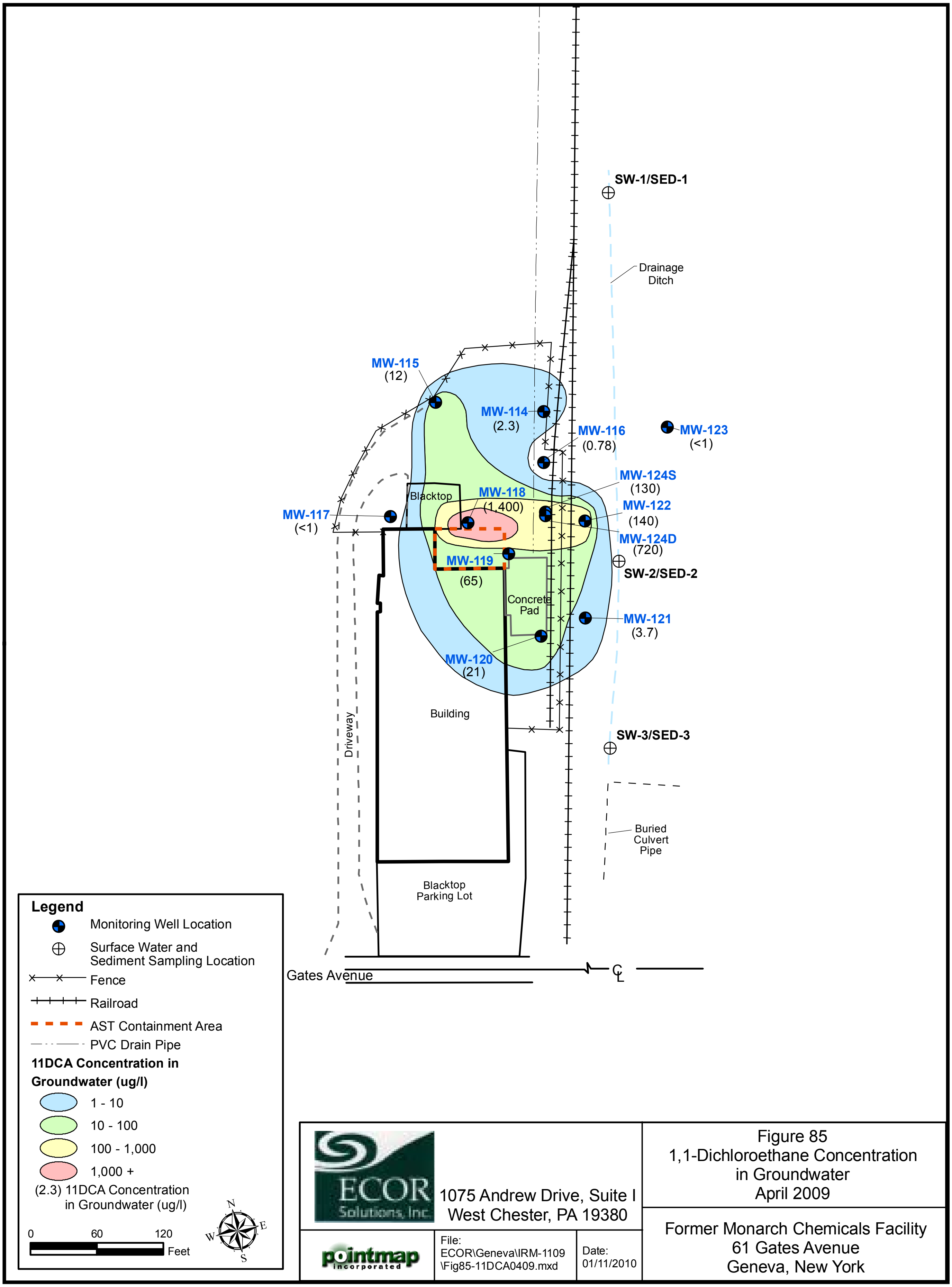
pointmap incorporated

File: ECOR\Geneva\IRM-1109\drawings\Fig84-cDCE0409-AA.dwg

Date: 01/11/2010

Figure 84
cDCE Detected in Groundwater
April 2009
Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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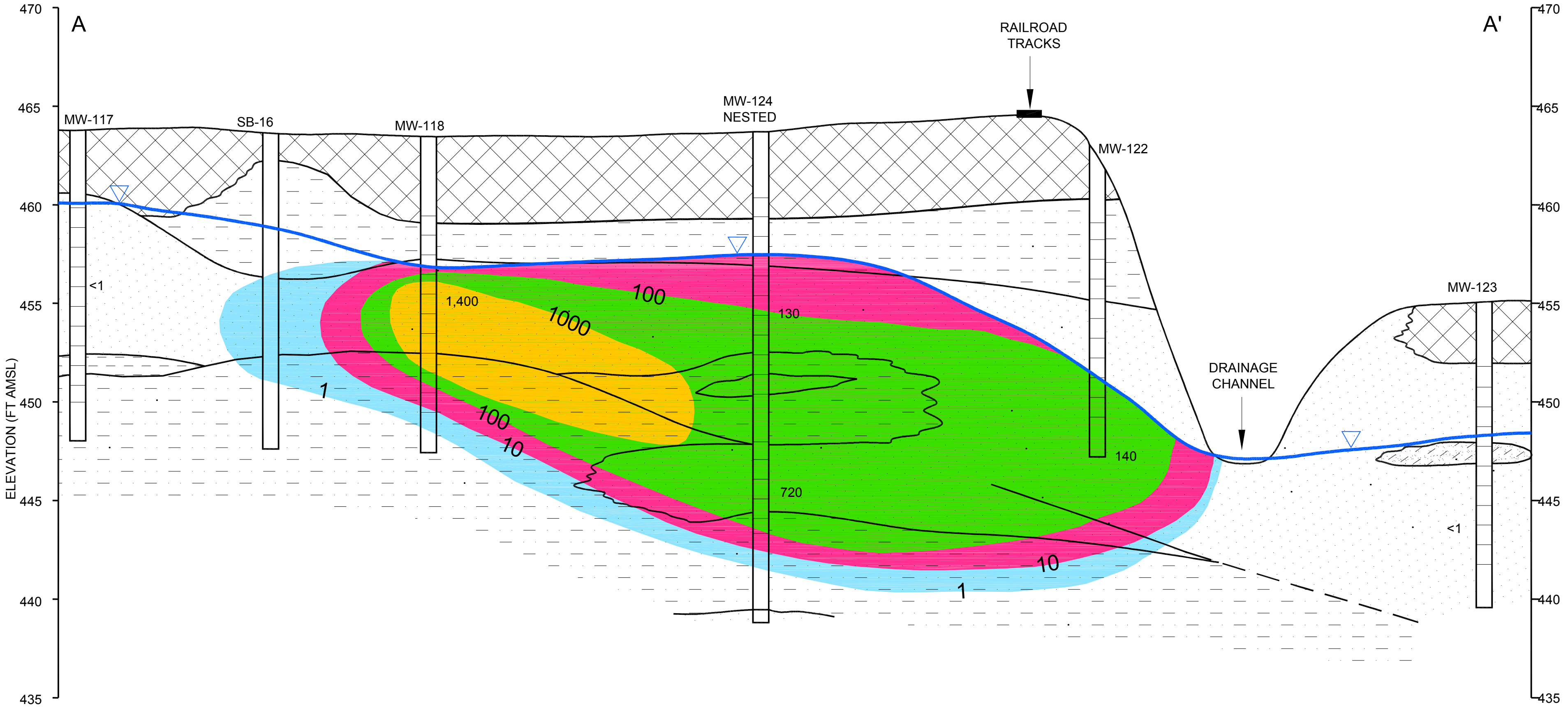
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig85-11DCA0409.mxd

Date:
01/11/2010

Figure 85
1,1-Dichloroethane Concentration
in Groundwater
April 2009

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



LEGEND

‖	SCREENED INTERVAL
▽	APRIL 2009 POTENTIOMETRIC ELEVATIONS (FT-AMSL)
⊠	FILL
┄	SILT & CLAY
⠂	SAND
┄	CLAY
▨	SILTY SAND

11DCA CONCENTRATIONS IN GROUNDWATER APRIL 2009

🟦	1-10 ug/l
🟥	10-100 ug/l
🟩	100 - 1,000 ug/l
🟨	1,000 + ug/l

VERTICAL SCALE (IN FEET)

0

20

HORIZONTAL SCALE (IN FEET)
VERTICAL EXAGGERATION 4X

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pointmap incorporated

File: ECOR\Geneva\IRM-1109\drawings\Fig86-11DCA0409-AA.dwg

Date: 12/07/2009

Figure 86
11DCA Detected in Groundwater
April 2009
Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

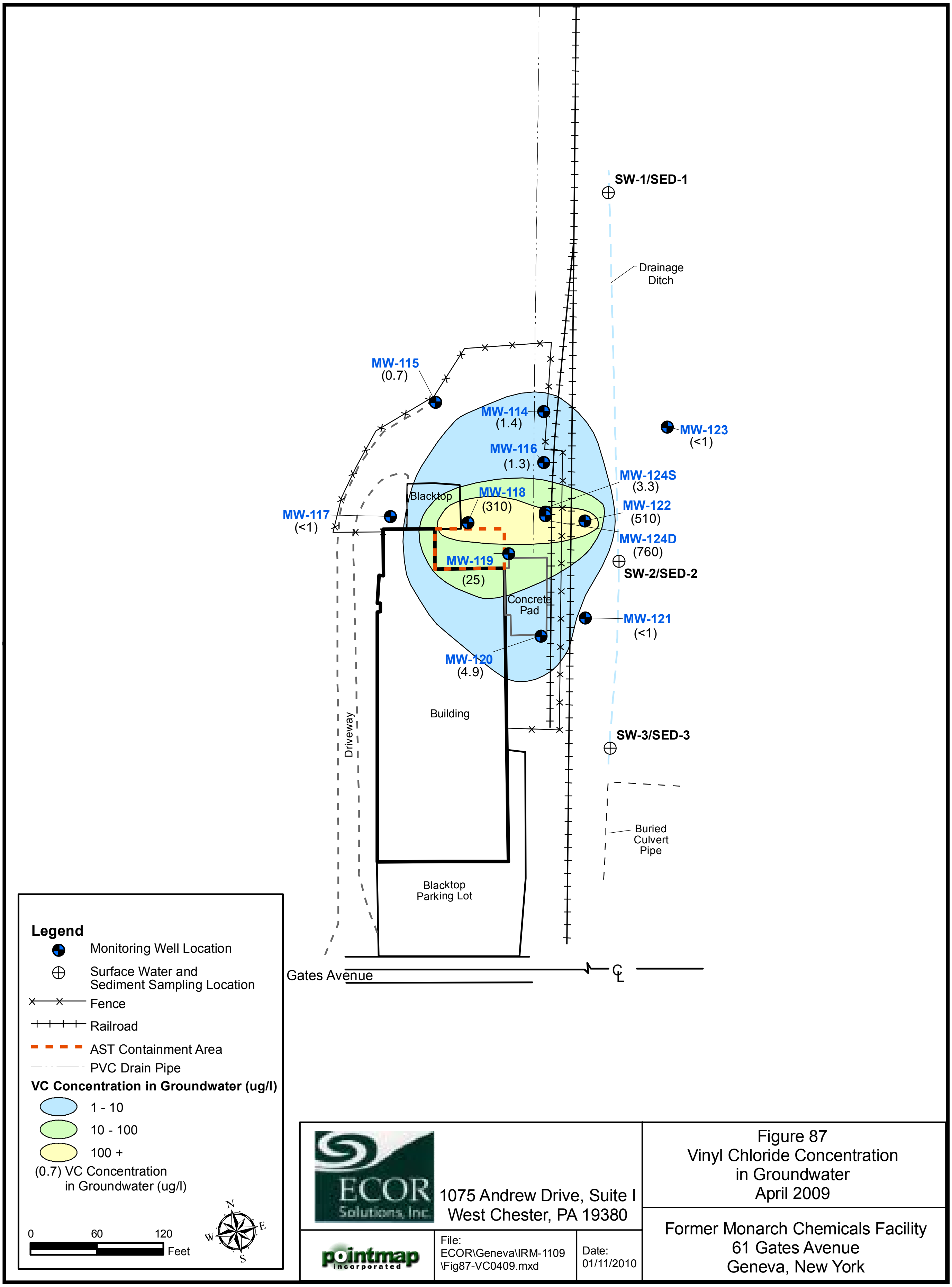

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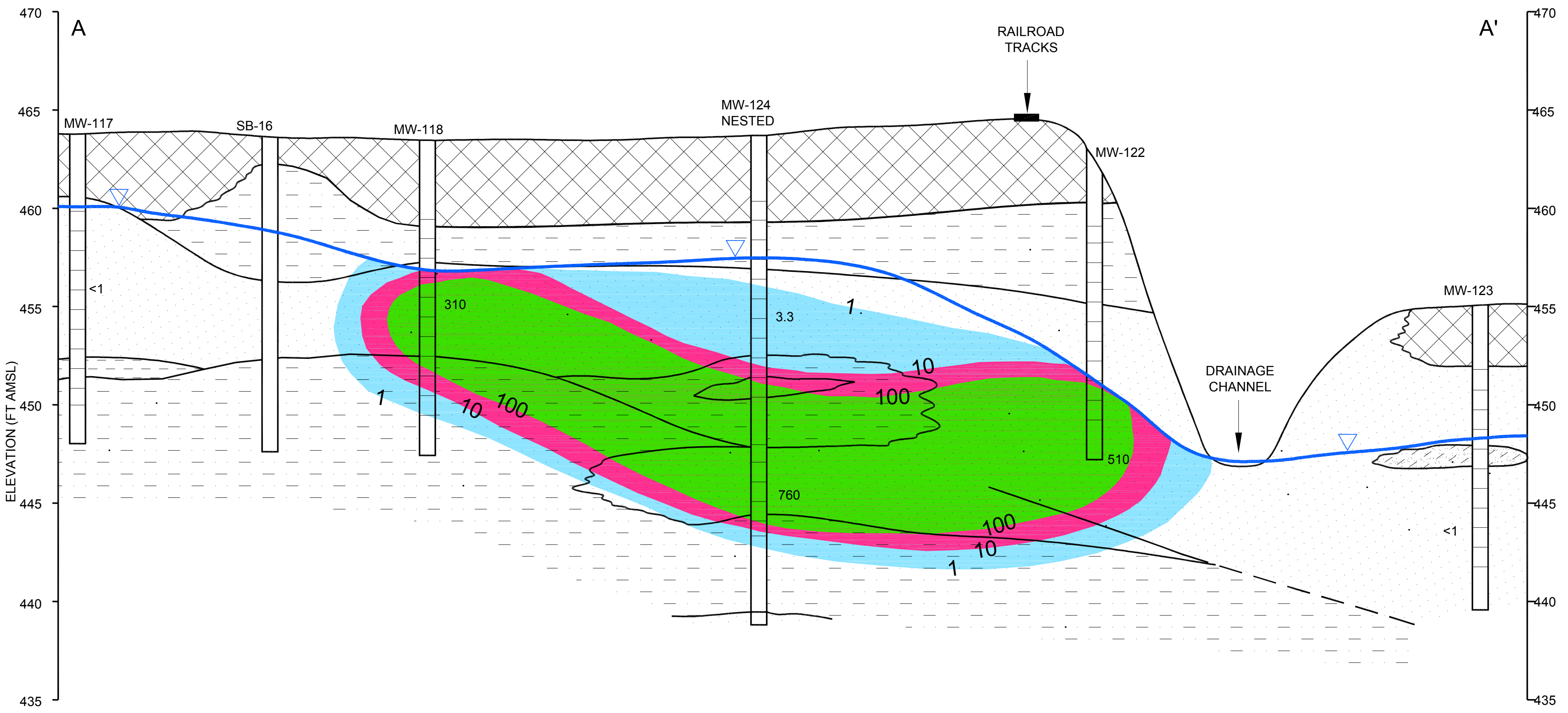
Figure 87
Vinyl Chloride Concentration
in Groundwater
April 2009

pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig87-VC0409.mxd

Date:
01/11/2010

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



LEGEND

SCREENED INTERVAL

▽ APRIL 2009 POTENTIOMETRIC ELEVATIONS (FT-AMSL)

VC CONCENTRATIONS IN GROUNDWATER APRIL 2009

- 1-10 ug/l
- 10-100 ug/l
- 100 - 1,000 ug/l

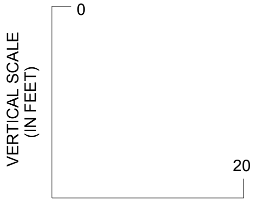
☒ FILL

▭ SILT & CLAY

▭ SAND

▭ CLAY

▨ SILTY SAND



HORIZONTAL SCALE (IN FEET)
VERTICAL EXAGGERATION 4X

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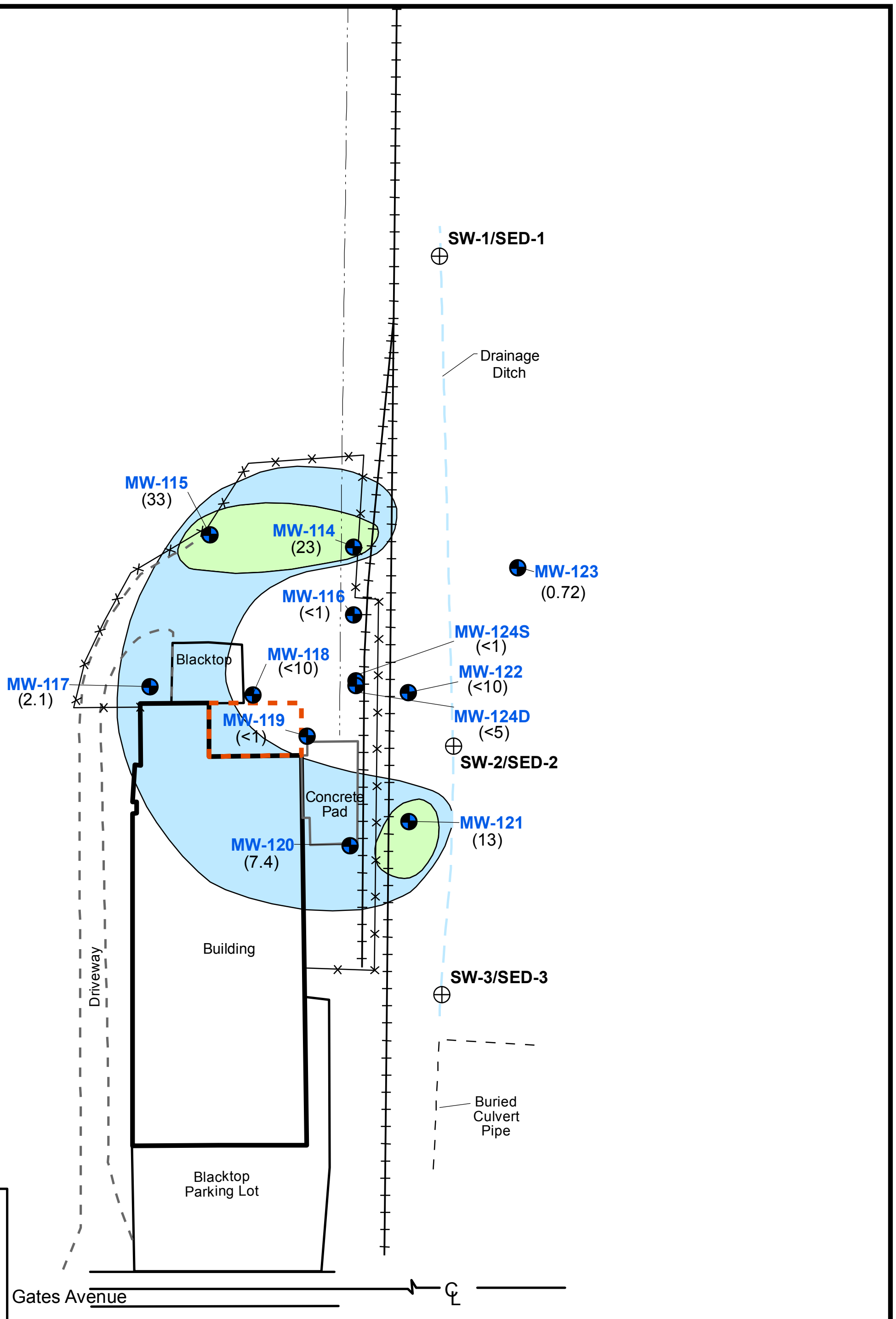
pointmap
incorporated

File: ECOR\Geneva\
IRM-1109\drawings\
Fig88-VC0409-AA.dwg

Date:
01/11/2010

Figure 88
Vinyl Chloride Detected in Groundwater
April 2009
Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



Legend

● Monitoring Well Location

⊕ Surface Water and Sediment Sampling Location

×—× Fence

┼┼┼┼ Railroad

▬ ▬ ▬ AST Containment Area

— · — PVC Drain Pipe

PCE Concentration in Groundwater (ug/l)

🟦 1 - 10

🟩 10 +

(33) PCE Concentration in Groundwater (ug/l)

0 60 120 Feet

N E S W

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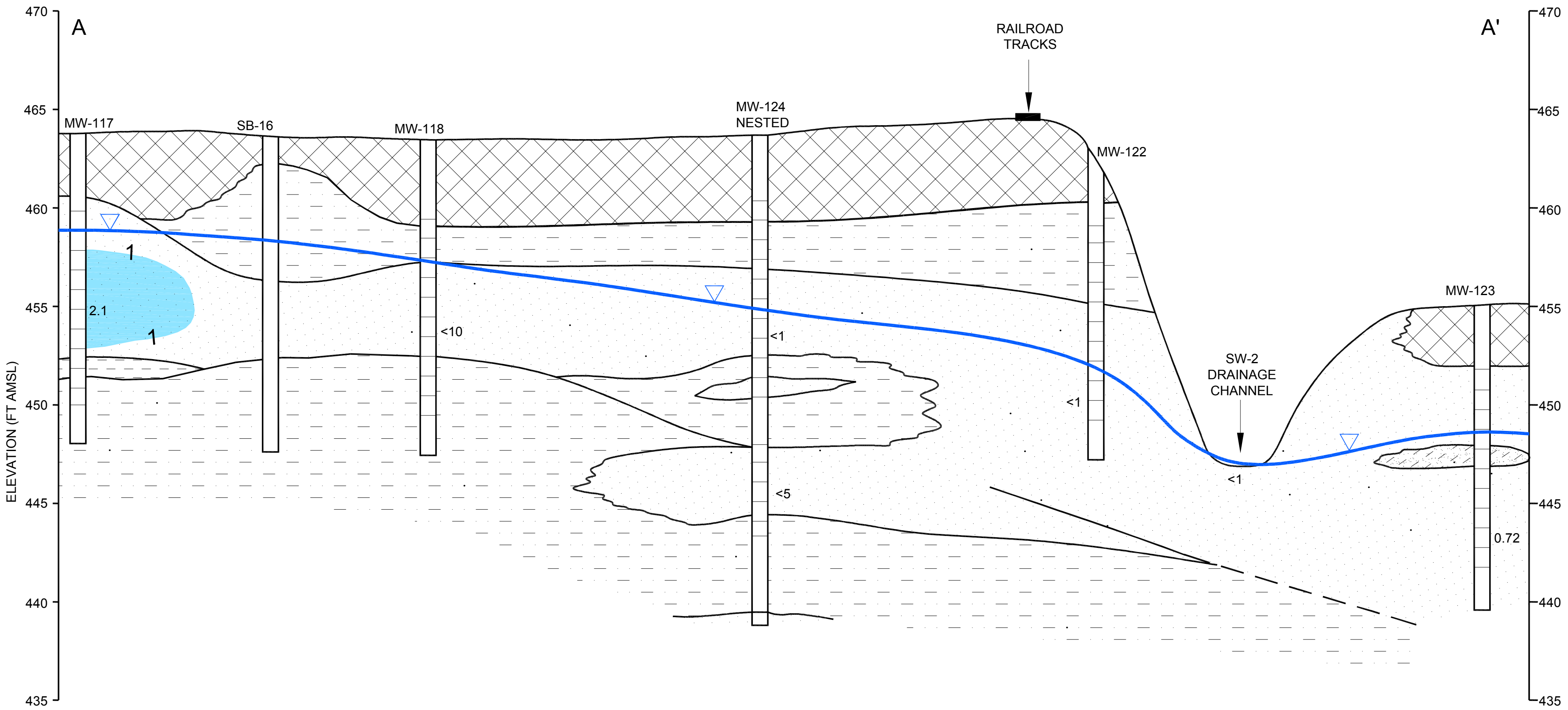
Figure 89
Tetrachloroethene Concentrations in Groundwater
August 2009

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

pointmap incorporated

File: ECOR\Geneva\IRM-1109\Fig89-PCE0809.mxd

Date: 01/11/2010



LEGEND

SCREENED INTERVAL

▽ AUGUST 2009 POTENTIOMETRIC ELEVATIONS (FT-AMSL)

PCE CONCENTRATIONS
IN GROUNDWATER
AUGUST 2009

— 1-10 ug/l

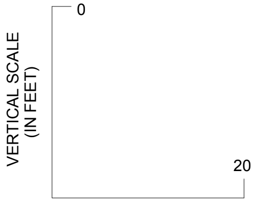
▨ FILL

▨ SILT & CLAY

▨ SAND

▨ CLAY

▨ SILTY SAND



HORIZONTAL SCALE (IN FEET)
VERTICAL EXAGGERATION 4X

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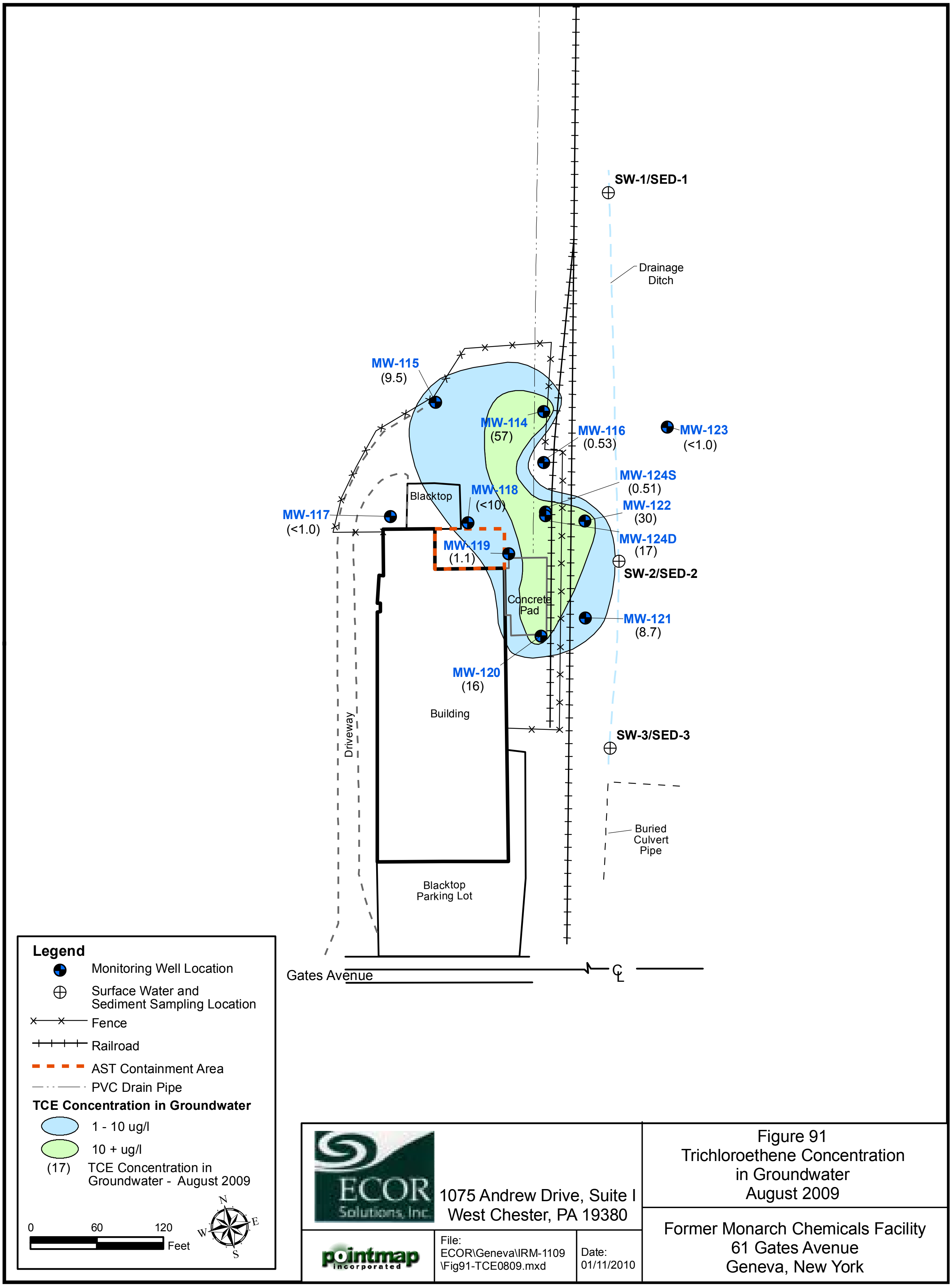
File: ECOR\Geneva\
IRM-1109\drawings\
Fig90-PCE0809-AA.dwg

Date:
01/13/2010

Figure 90
Tetrachloroethane Detected in Groundwater August 2009 Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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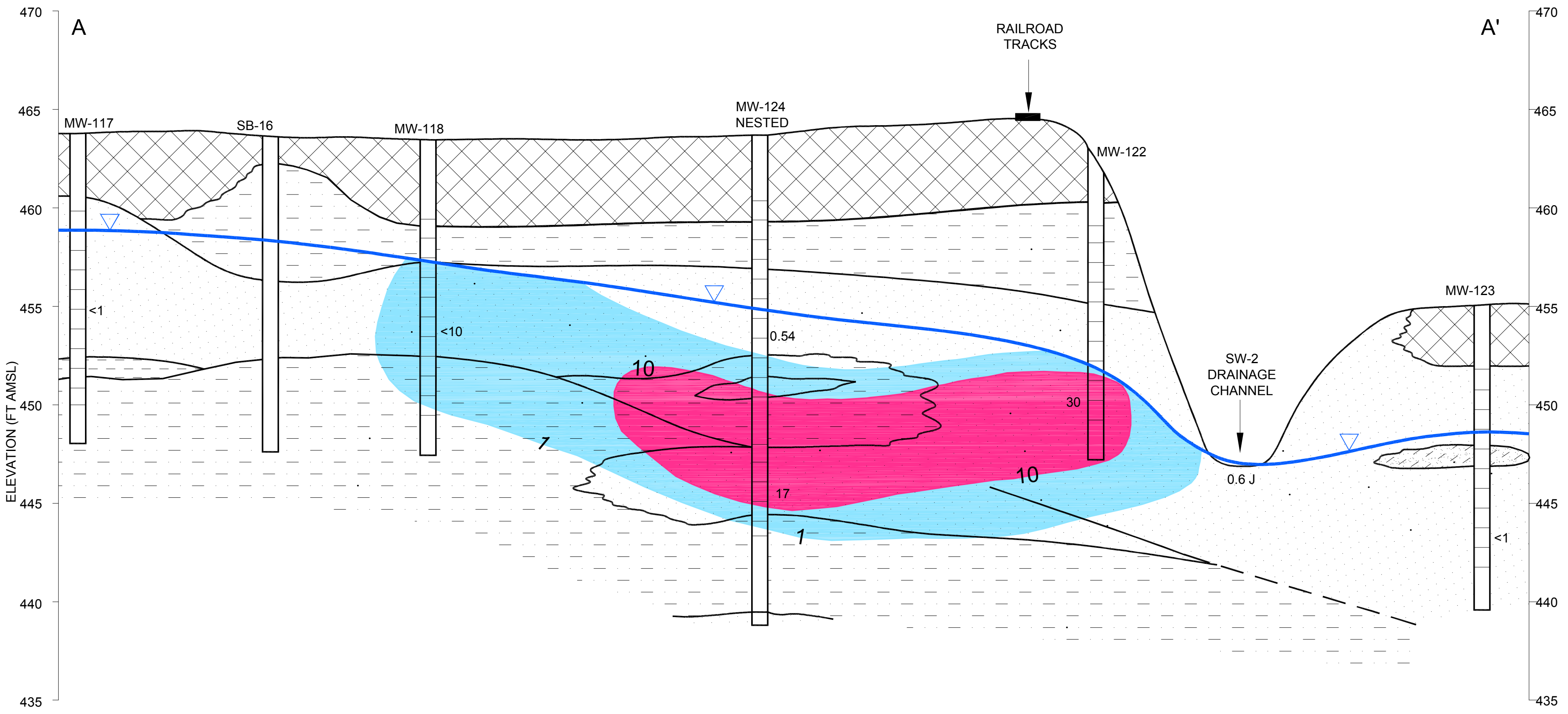
File:
ECOR\Geneva\IRM-1109
\Fig91-TCE0809.mxd

Date:
01/11/2010

Figure 91
Trichloroethene Concentration
in Groundwater
August 2009

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



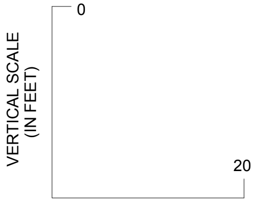
LEGEND

- SCREENED INTERVAL
- ▽ AUGUST 2009 POTENTIOMETRIC ELEVATIONS (FT-AMSL)

TCE CONCENTRATIONS
IN GROUNDWATER
AUGUST 2009

- 1-10 ug/l
- 10-100 ug/l

- ▨ FILL
- SILT & CLAY
- SAND
- CLAY
- SILTY SAND



HORIZONTAL SCALE (IN FEET)
VERTICAL EXAGGERATION 4X

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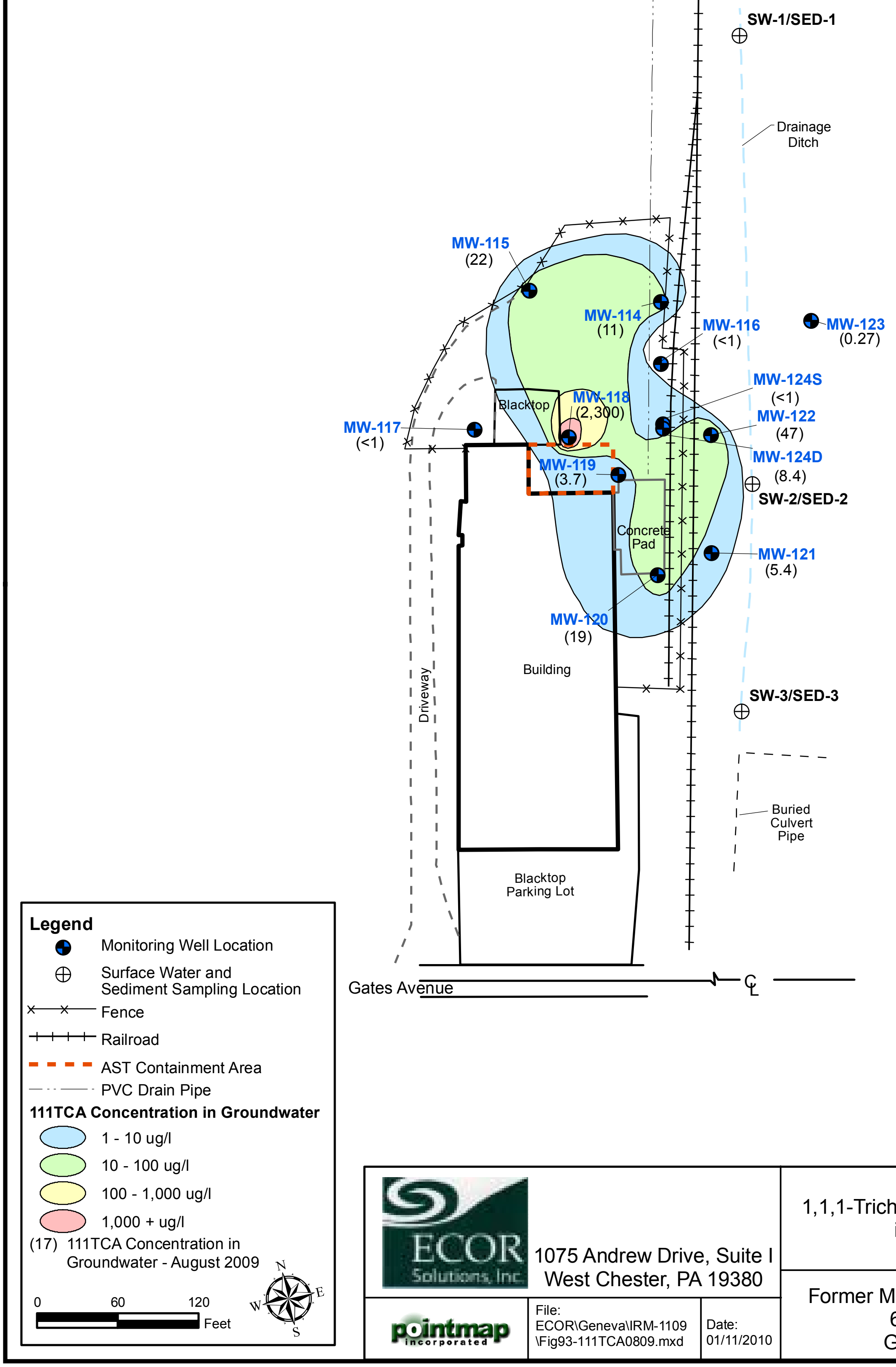
pointmap incorporated

File: ECOR\Geneva\
IRM-1109\drawings\
Fig92-TCE0809-AA.dwg

Date:
01/11/2010

Figure 92
Trichloroethane Detected in Groundwater
August 2009
Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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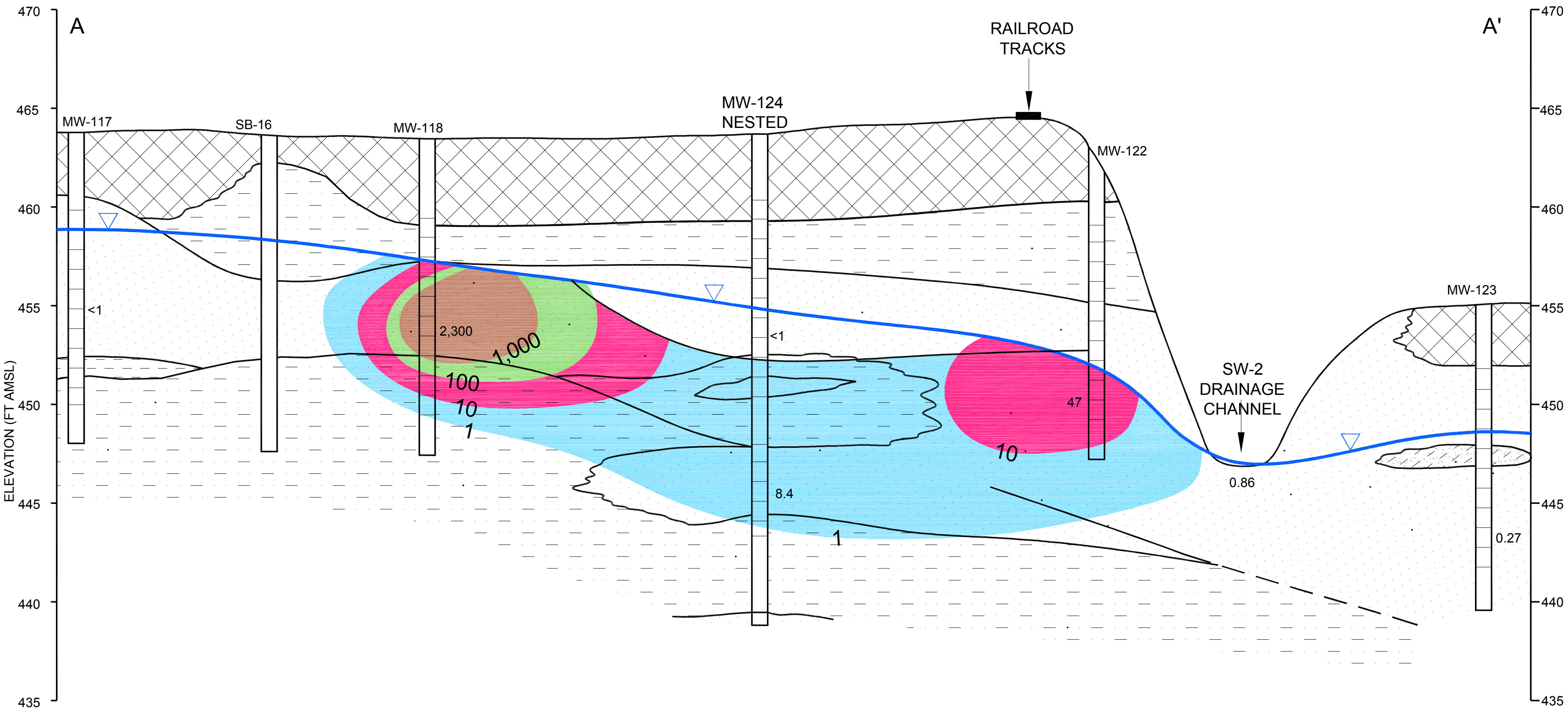
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig93-111TCA0809.mxd

Date:
01/11/2010

Figure 93
1,1,1-Trichloroethane Concentration
in Groundwater
August 2009

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



LEGEND

SCREENED INTERVAL

AUGUST 2009 POTENTIOMETRIC ELEVATIONS (FT-AMSL)

111TCA CONCENTRATIONS IN GROUNDWATER AUGUST 2009

- 1-10 ug/l
- 10-100 ug/l
- 100-1,000 ug/l
- 1,000+ ug/l

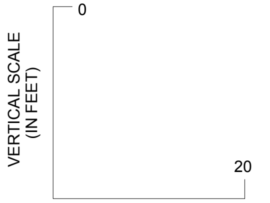
▨ FILL

SILT & CLAY

SAND

CLAY

SILTY SAND



HORIZONTAL SCALE (IN FEET)
VERTICAL EXAGGERATION 4X

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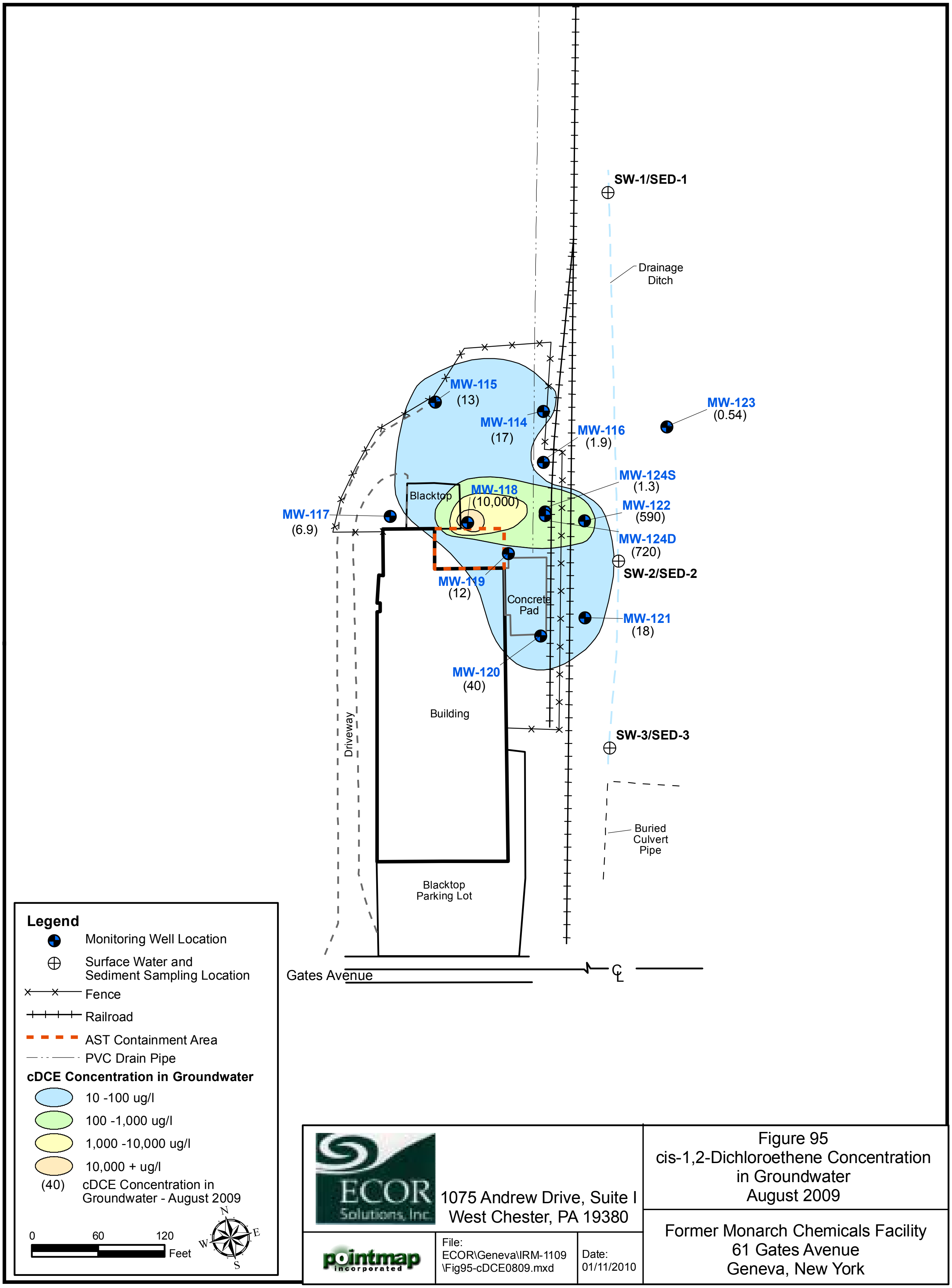
File: ECOR\Geneva\IRM-1109\drawings\Fig94-111TCA0809-AA.dwg

Date: 01/11/2010

Figure 94
111TCA Detected in Groundwater
August 2009
Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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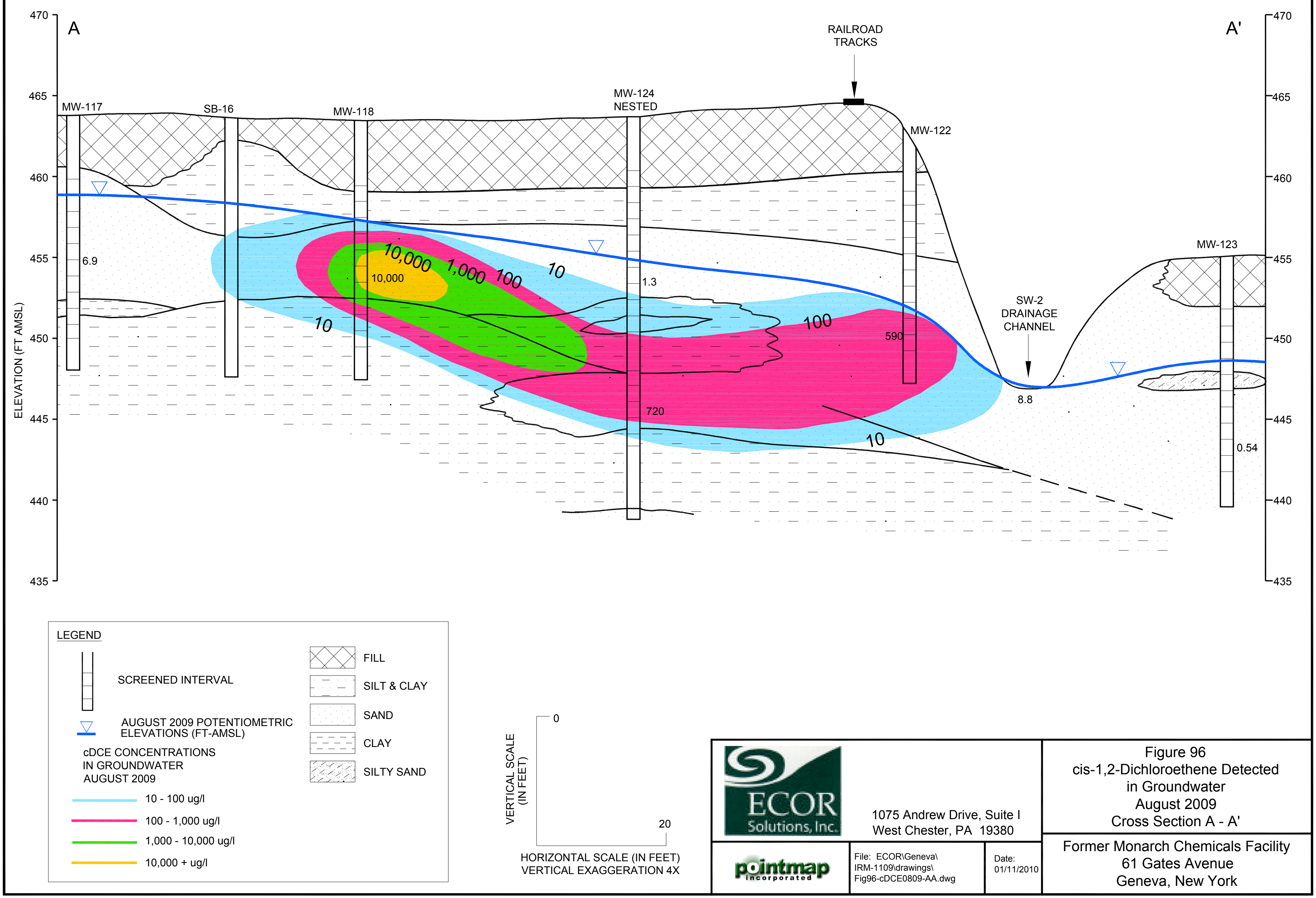
pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig95-cDCE0809.mxd

Date:
01/11/2010

Figure 95
cis-1,2-Dichloroethene Concentration
in Groundwater
August 2009

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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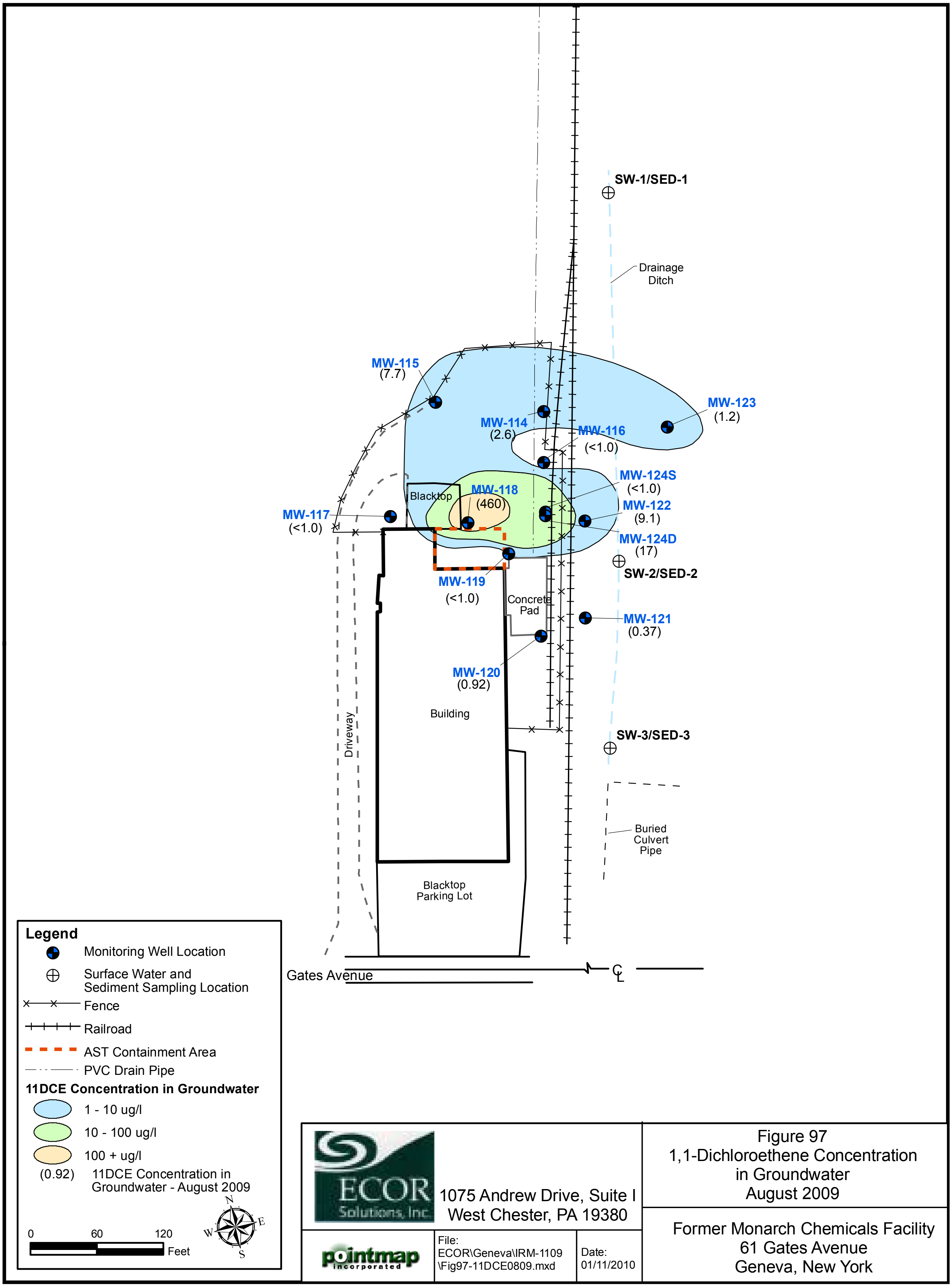
pointmap incorporated

File: ECOR\Geneva\
IRM-1109\drawings\
Fig96-cDCE0809-AA.dwg

Date:
01/11/2010

Figure 96
cis-1,2-Dichloroethene Detected
in Groundwater
August 2009
Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York



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West Chester, PA 19380

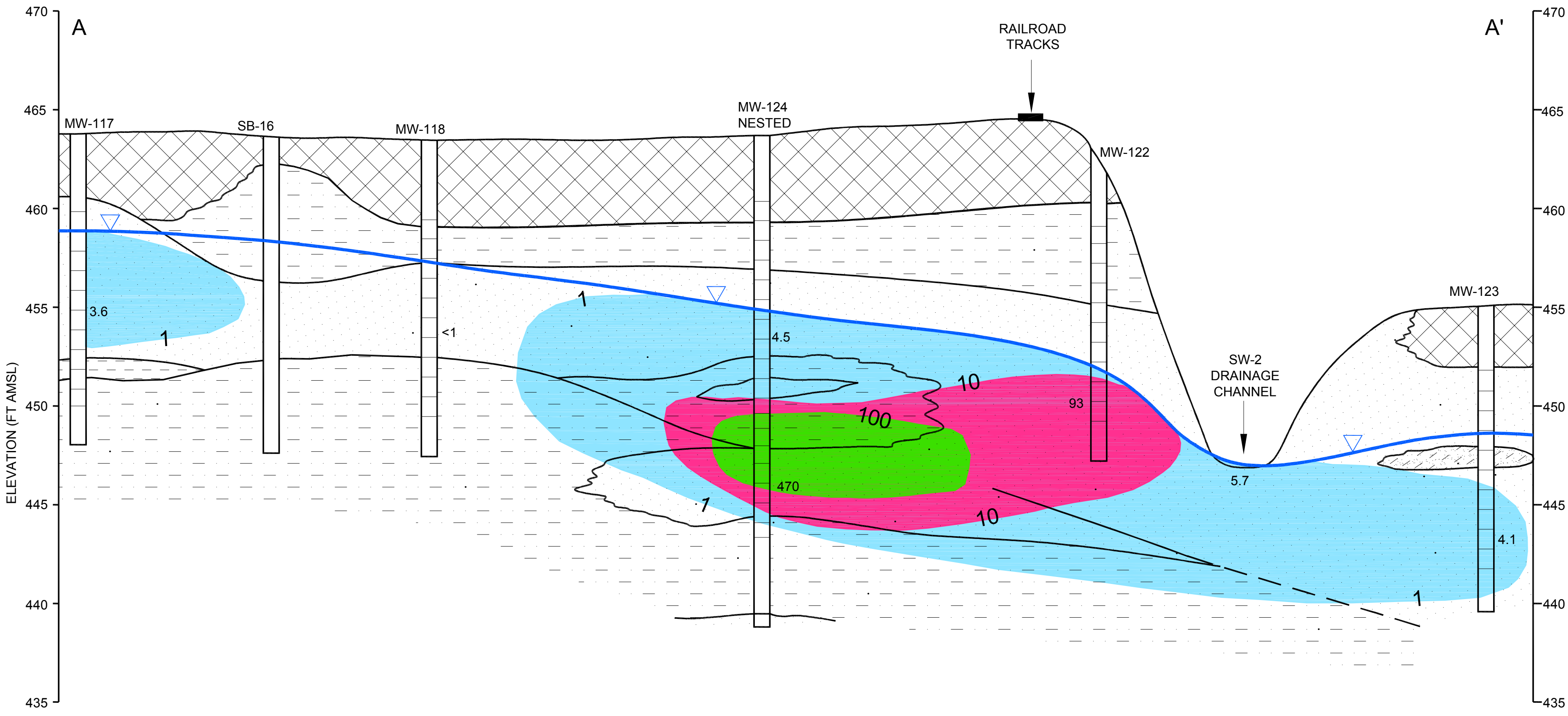
pointmap incorporated

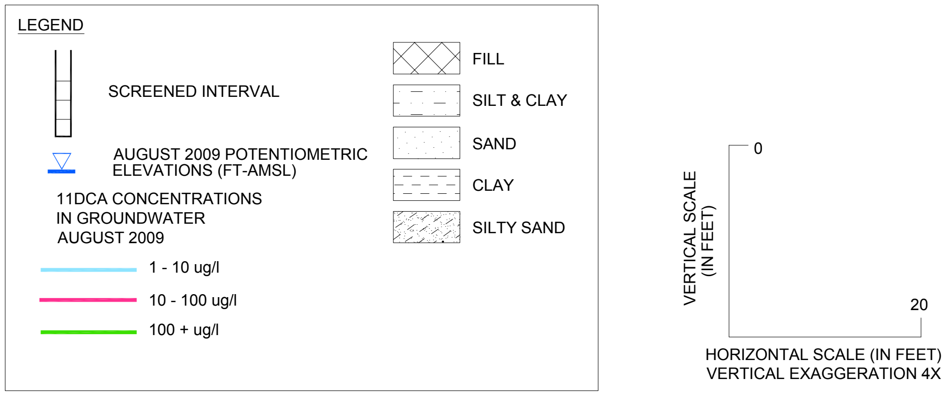
File:
ECOR\Geneva\IRM-1109
\Fig97-11DCE0809.mxd

Date:
01/11/2010

Figure 97
1,1-Dichloroethene Concentration
in Groundwater
August 2009

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York





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West Chester, PA 19380

pointmap incorporated

File: ECOR\Geneva\
IRM-1109\drawings\
Fig98-11DCA0809-AA.dwg

Date:
01/11/2010

Figure 98
1,1-Dichloroethane Detected
in Groundwater
August 2009
Cross Section A - A'

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

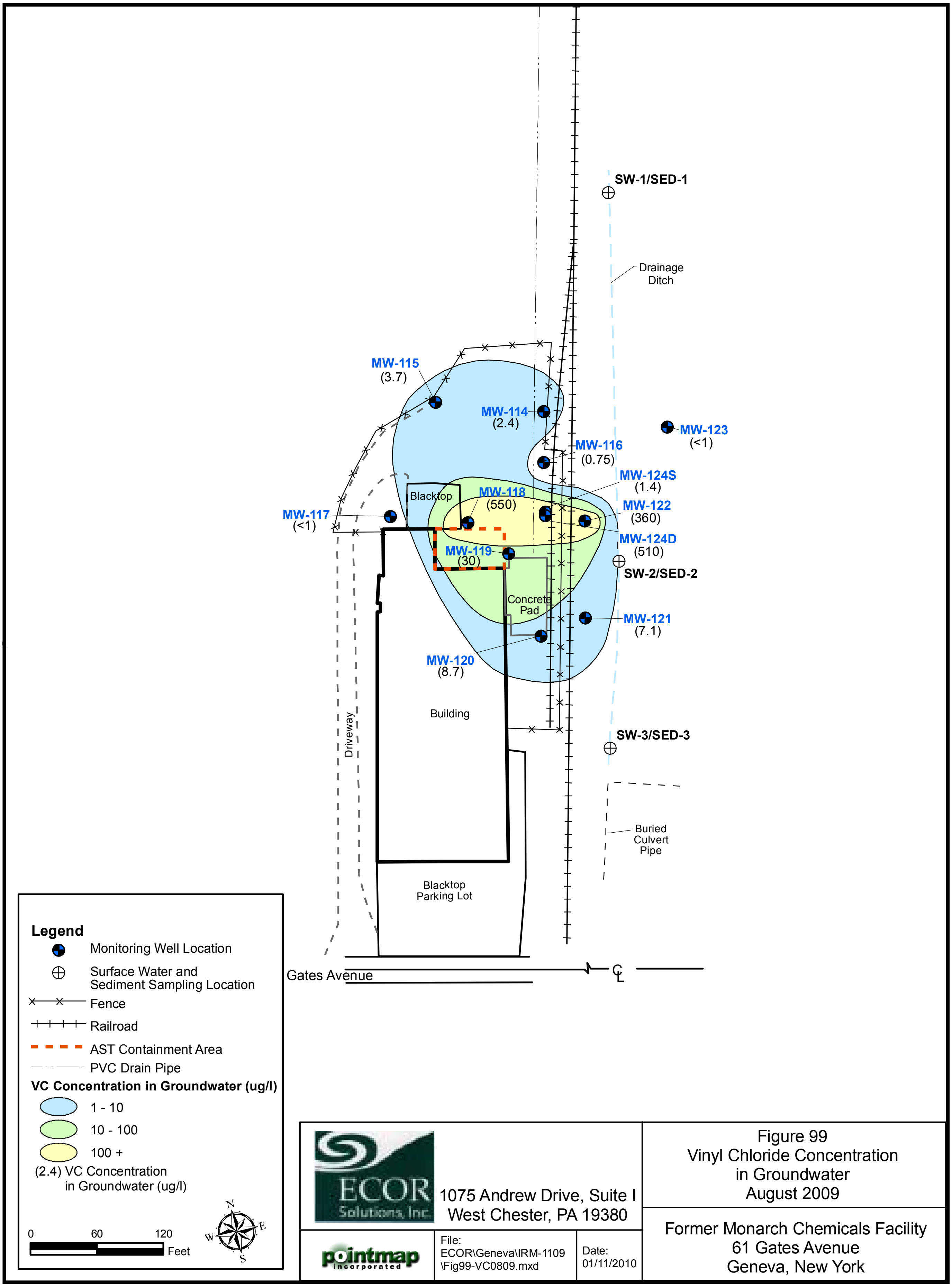

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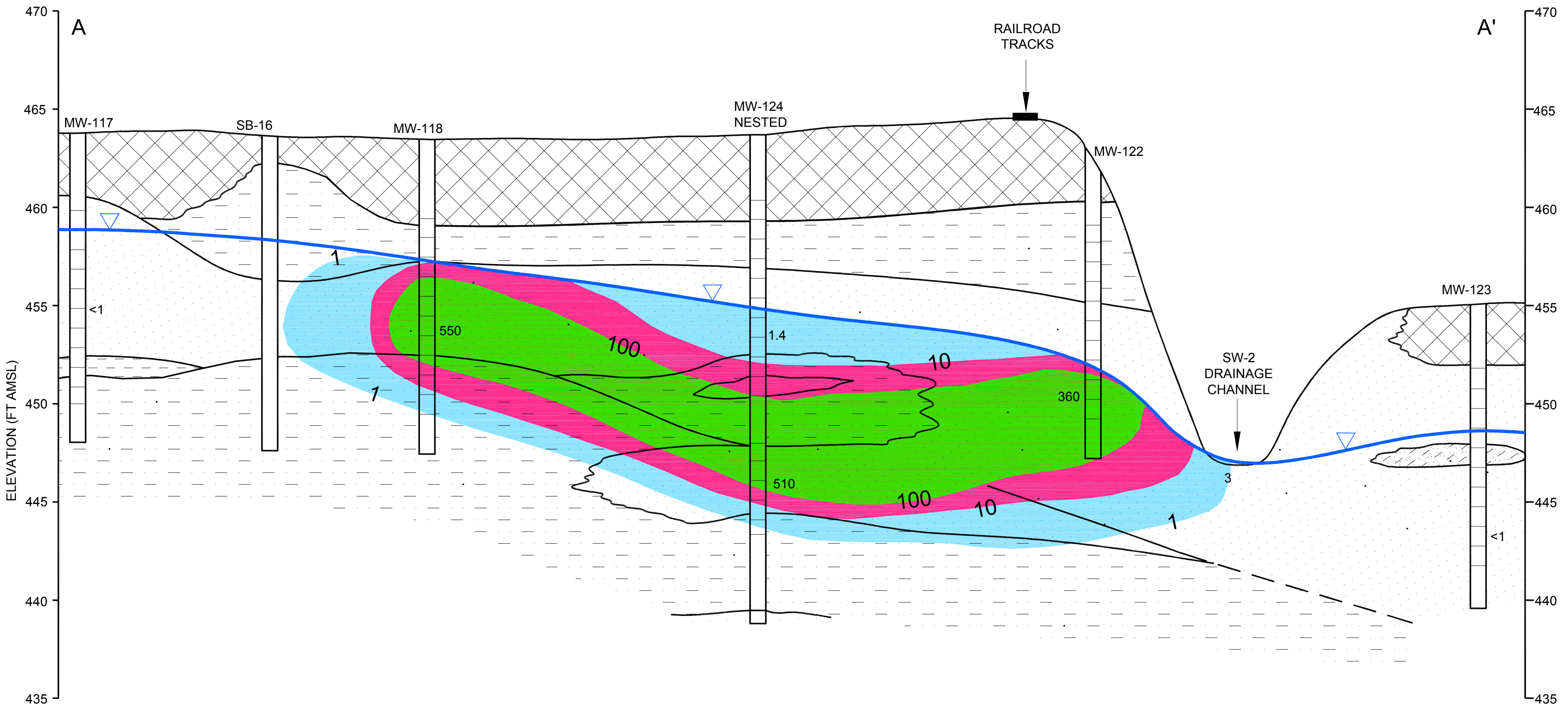
Figure 99
Vinyl Chloride Concentration in Groundwater
August 2009

Former Monarch Chemicals Facility
61 Gates Avenue
Geneva, New York

pointmap incorporated

File:
ECOR\Geneva\IRM-1109
\Fig99-VC0809.mxd

Date:
01/11/2010



LEGEND

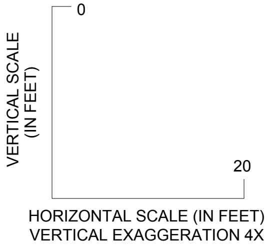
SCREENED INTERVAL

AUGUST 2009 POTENTIOMETRIC ELEVATIONS (FT-AMSL)

VC CONCENTRATIONS
IN GROUNDWATER
AUGUST 2009

- 1 - 10 ug/l
- 10 - 100 ug/l
- 100 + ug/l

- ▨ FILL
- SILT & CLAY
- SAND
- CLAY
- SILTY SAND



HORIZONTAL SCALE (IN FEET)
VERTICAL EXAGGERATION 4X

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Fig100-VC0809-AA.dwg

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Figure 100
Vinyl Chloride Detected
in Groundwater
August 2009
Cross Section A - A'

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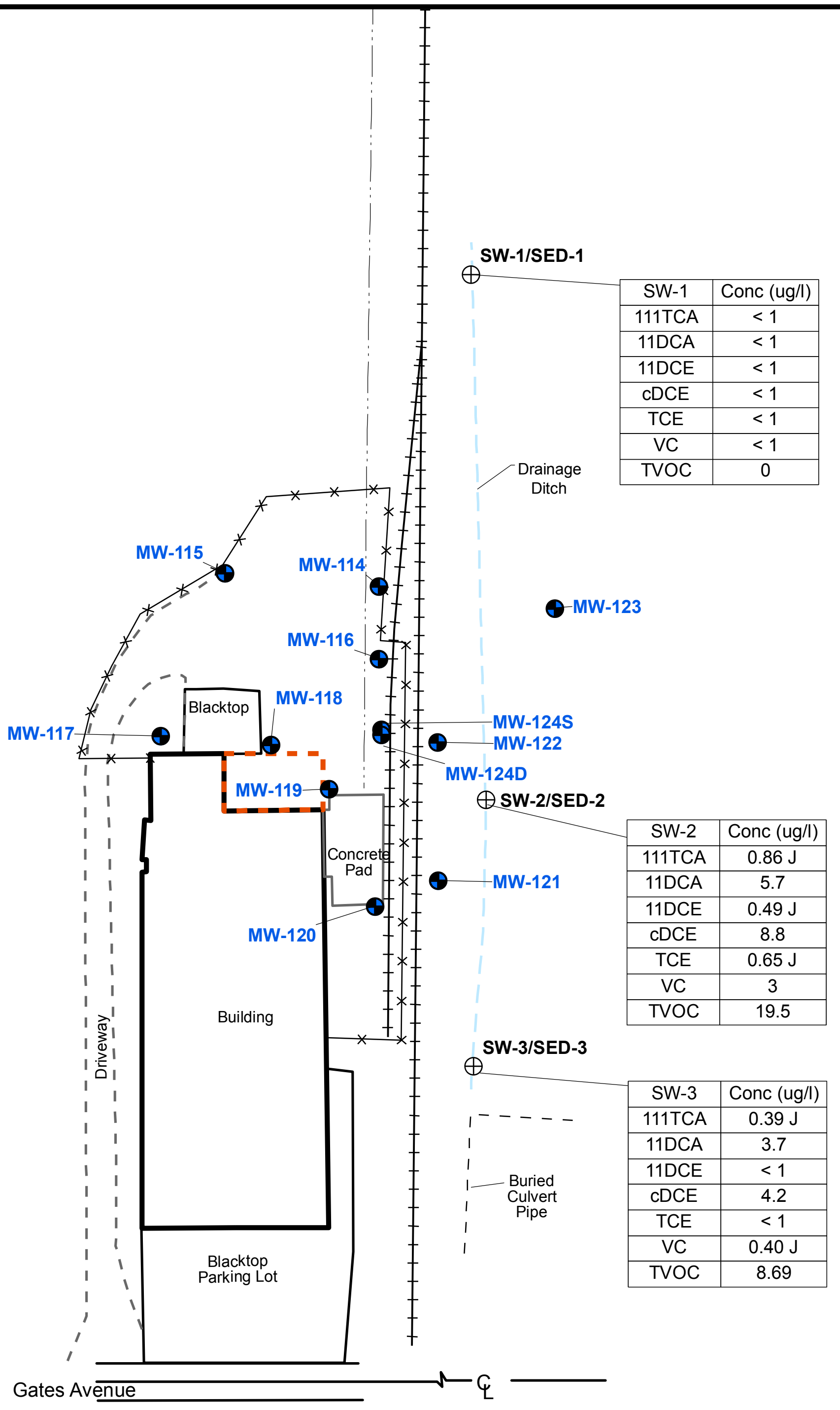
61 Gates Avenue
Geneva, New York



SW-1	Conc (ug/l)
111TCA	< 1
11DCA	< 1
11DCE	< 1
cDCE	< 1
TCE	< 1
VC	< 1
TVOC	0

SW-2	Conc (ug/l)
111TCA	0.86 J
11DCA	5.7
11DCE	0.49 J
cDCE	8.8
TCE	0.65 J
VC	3
TVOC	19.5

SW-3	Conc (ug/l)
111TCA	0.39 J
11DCA	3.7
11DCE	< 1
cDCE	4.2
TCE	< 1
VC	0.40 J
TVOC	8.69

Legend

● Monitoring Well Location
⊕ Surface Water and Sediment Sampling Location
×—× Fence
+++ Railroad
- - - AST Containment Area
—·— PVC Drain Pipe

111TCA = 1,1,1-Trichloroethane
11DCA = 1,1-Dichloroethane
11DCE = 1,1-Dichloroethene
cDCE = cis-1,2-Dichloroethene
TCE = Trichloroethene
VC = Vinyl Chloride
J = Estimated Concentration

0 60 120 Feet

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\Fig101-SWQ-VOCs.mxd

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Figure 101
Surface Water Quality Sampling Results - VOCs
August 2009

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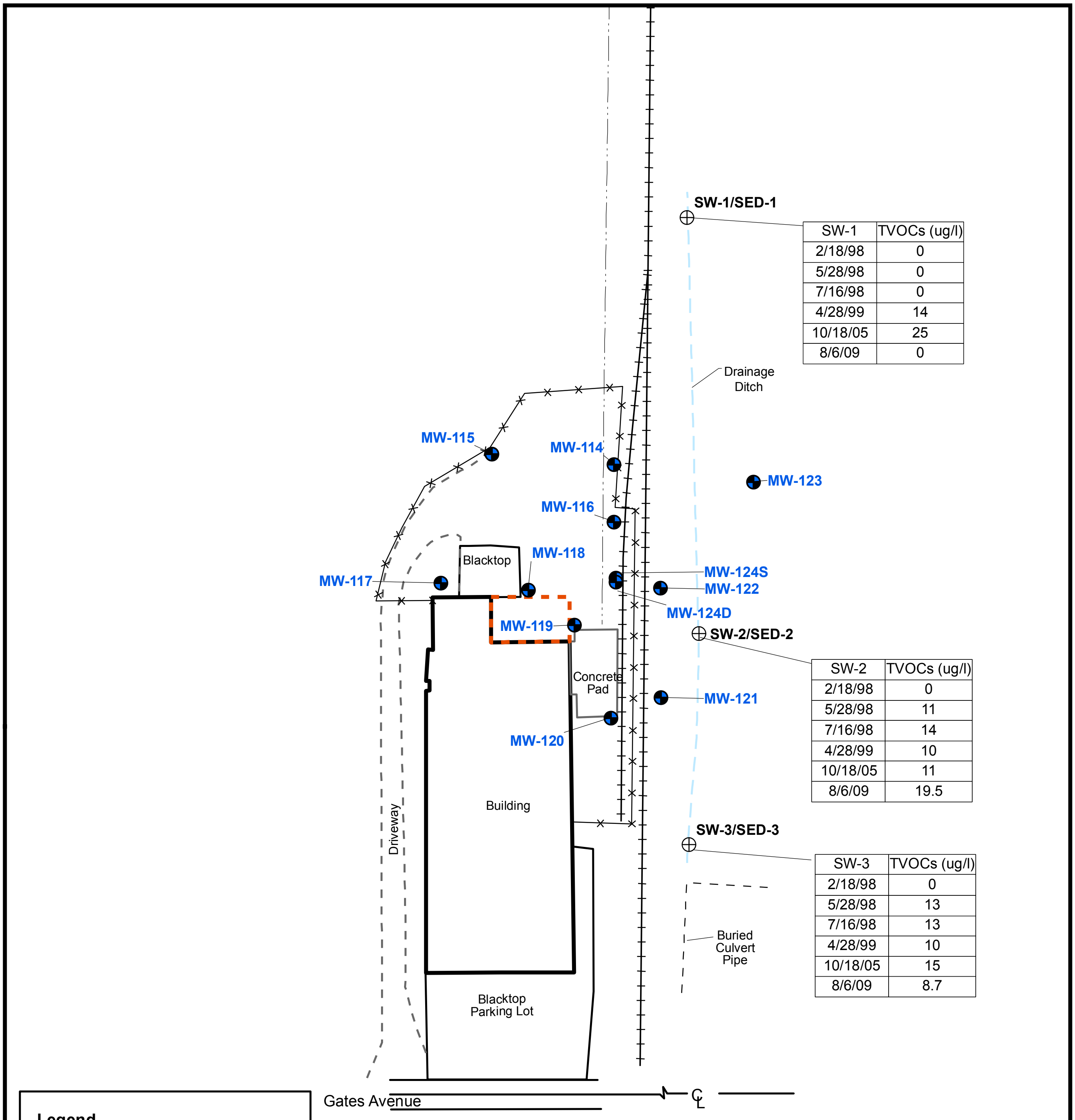

SW-1	TVOCs (ug/l)
2/18/98	0
5/28/98	0
7/16/98	0
4/28/99	14
10/18/05	25
8/6/09	0

SW-2	TVOCs (ug/l)
2/18/98	0
5/28/98	11
7/16/98	14
4/28/99	10
10/18/05	11
8/6/09	19.5

SW-3	TVOCs (ug/l)
2/18/98	0
5/28/98	13
7/16/98	13
4/28/99	10
10/18/05	15
8/6/09	8.7

Legend

● Monitoring Well Location
⊕ Surface Water and Sediment Sampling Location
×—×— Fence
┼┼┼┼ Railroad
▬ ▬ ▬ AST Containment Area
—·—·— PVC Drain Pipe

TVOC = Total Volatile Organic Compound

0 60 120
Feet

N E S W

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\Fig102-Hist-SWQ-TVOC.mxd

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Figure 102
Historical Surface Water Quality
Sampling Results - TVOCs

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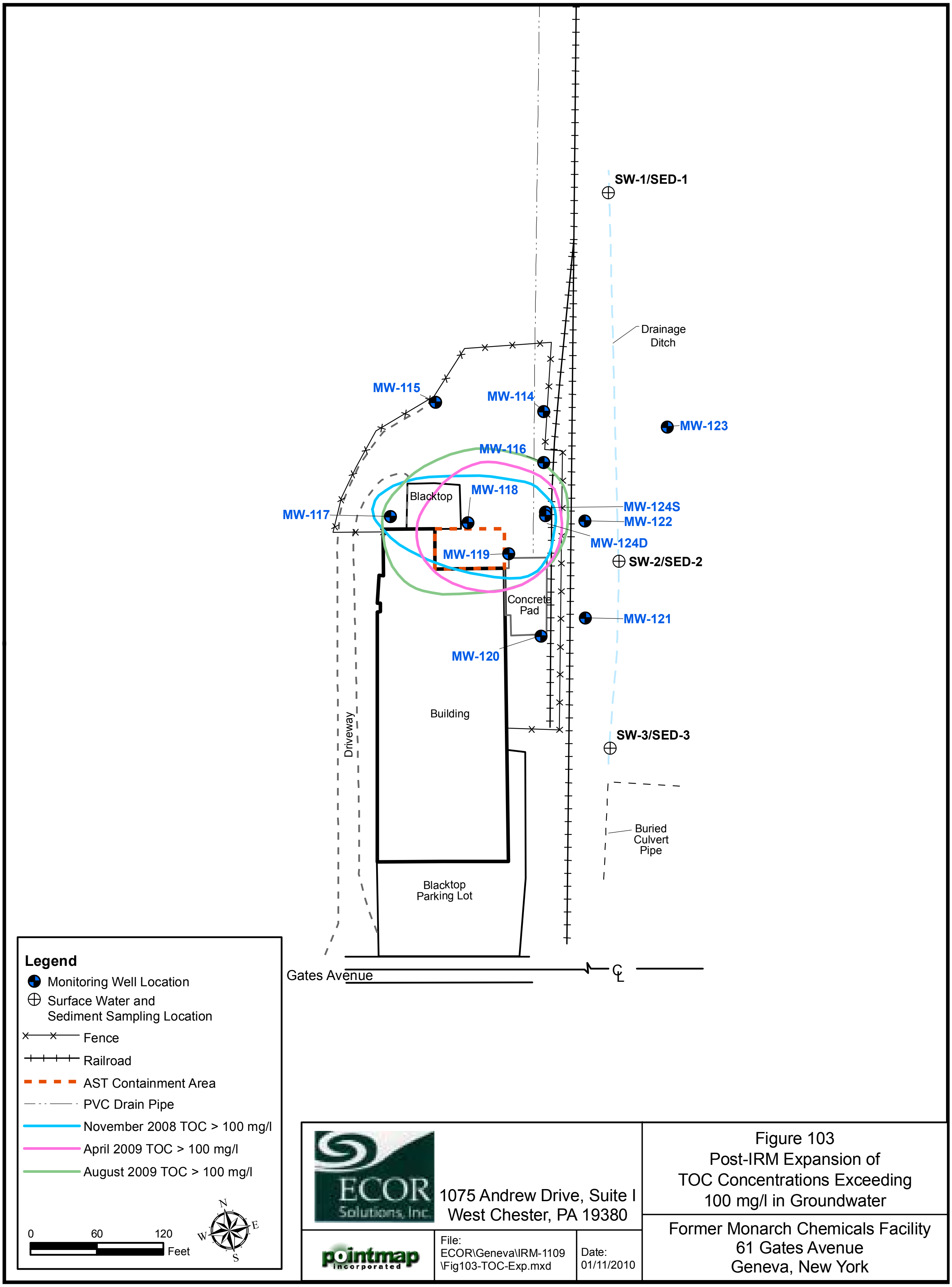

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Figure 103
Post-IRM Expansion of TOC Concentrations Exceeding 100 mg/l in Groundwater

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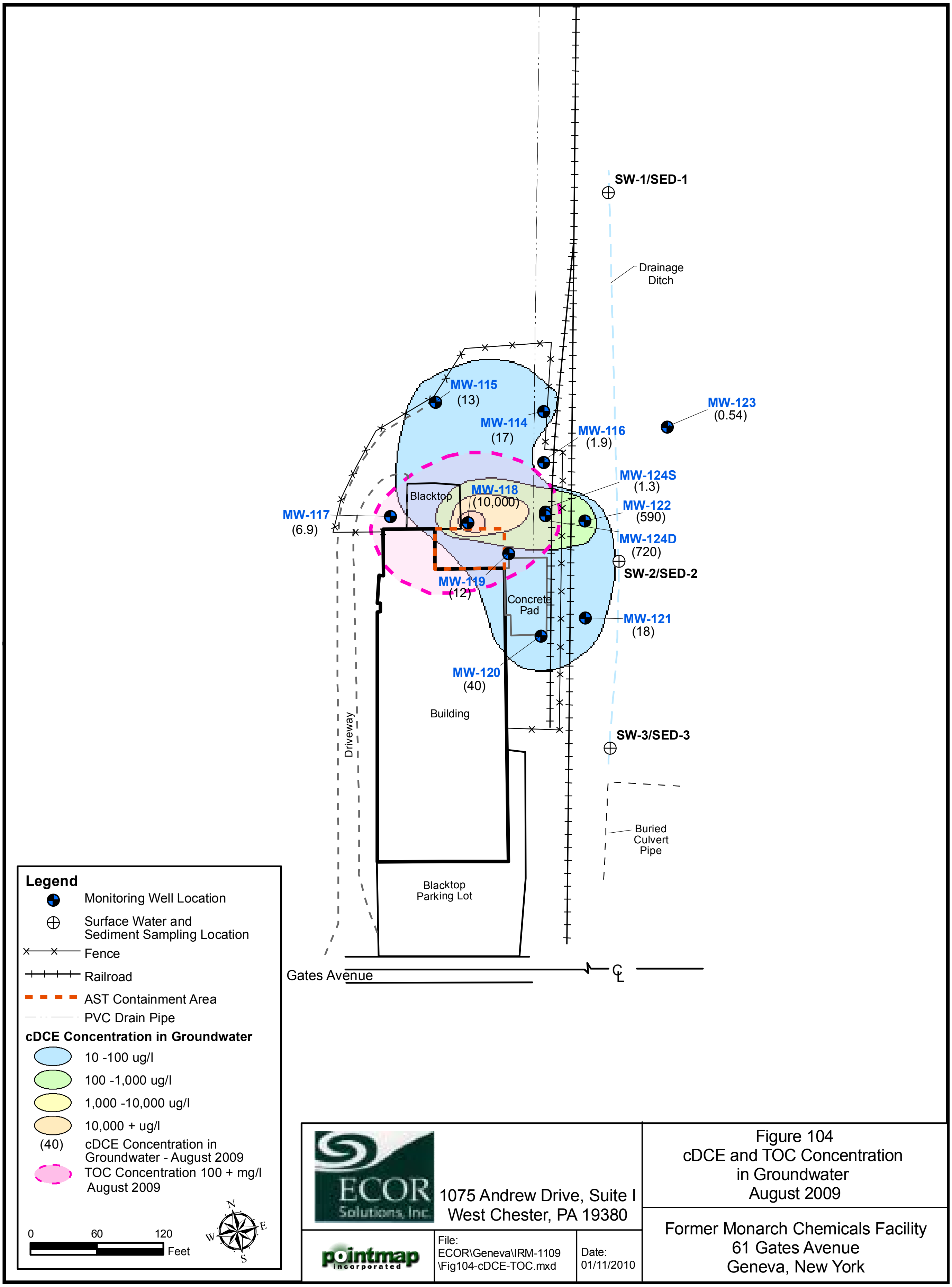

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\Fig104-cDCE-TOC.mxd

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Figure 104
cDCE and TOC Concentration
in Groundwater
August 2009

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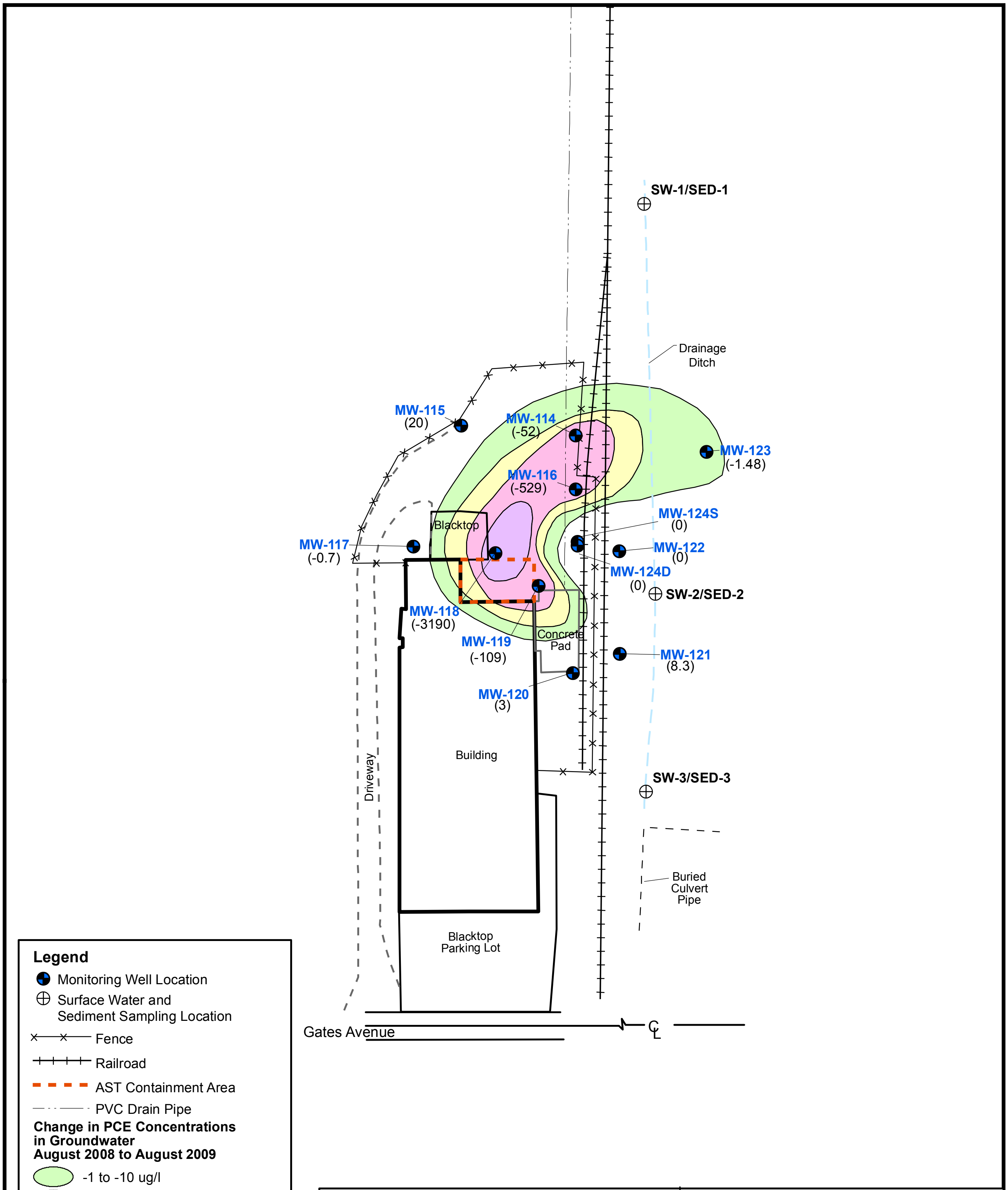

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Figure 105
Change in PCE Concentrations in Groundwater August 2008 to August 2009

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\Fig105-PCE-Change.mxd

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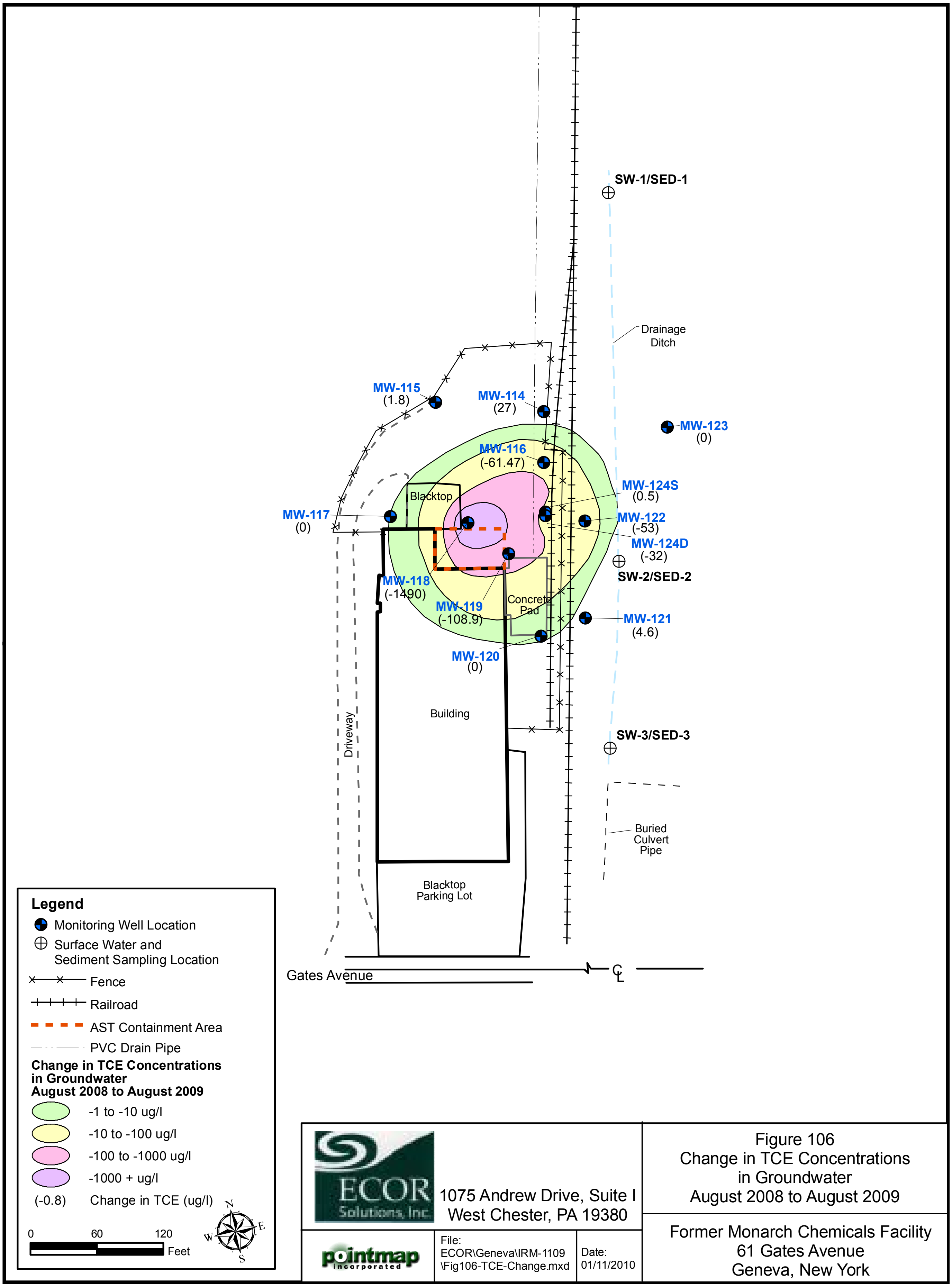

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Figure 106
Change in TCE Concentrations
in Groundwater
August 2008 to August 2009

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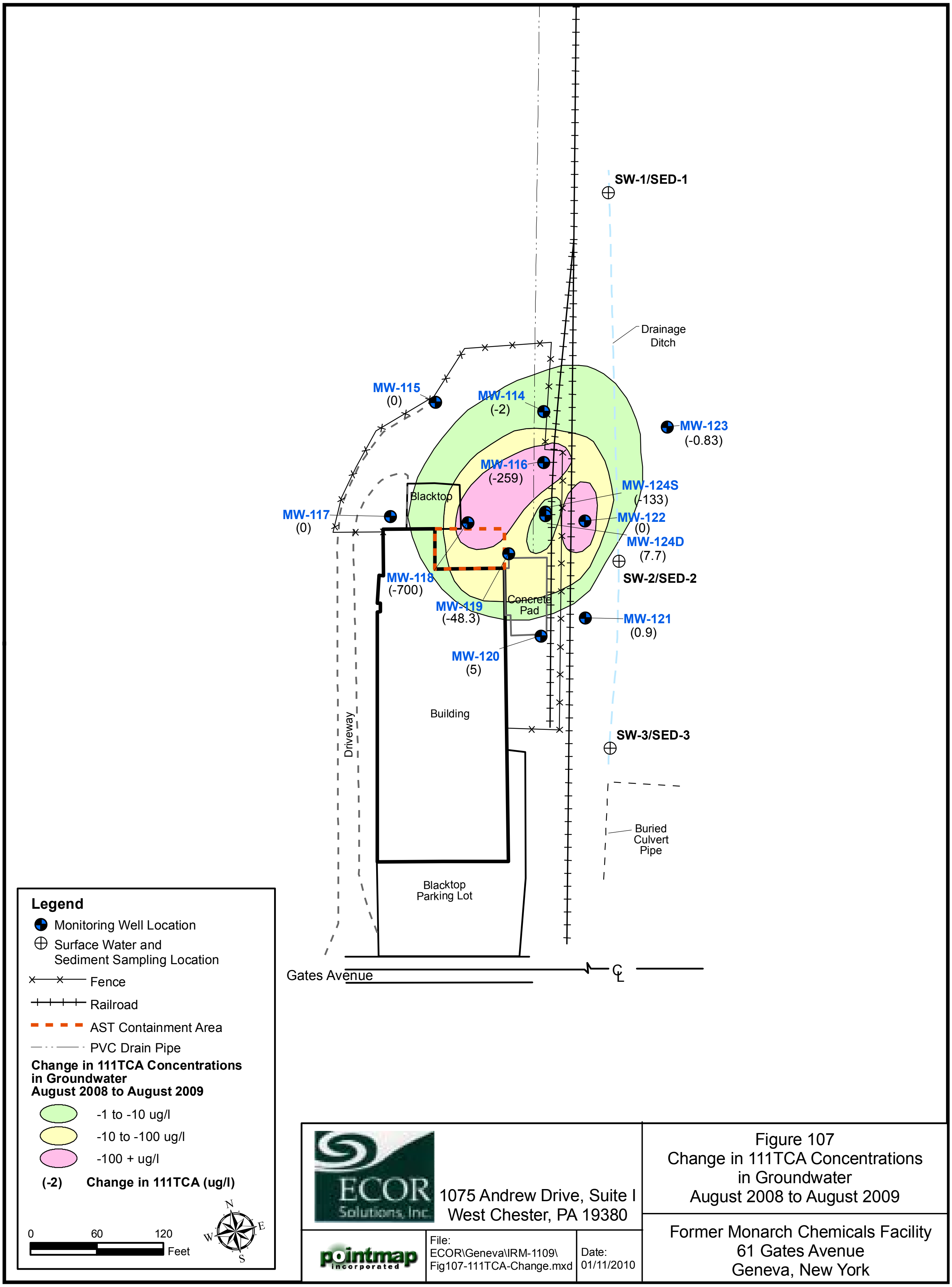

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Figure 107
Change in 111TCA Concentrations
in Groundwater
August 2008 to August 2009

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Fig107-111TCA-Change.mxd

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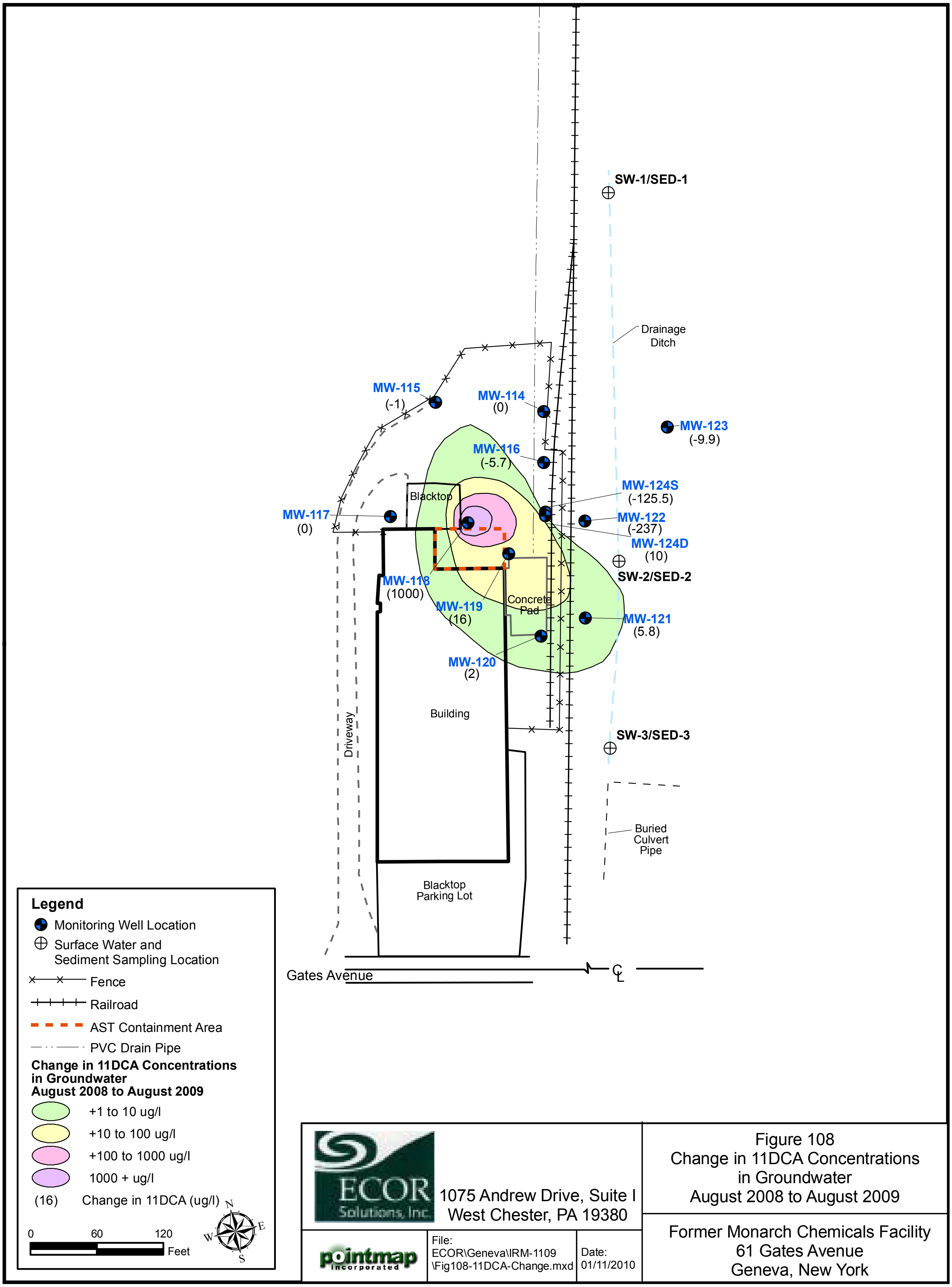

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Figure 108
Change in 11DCA Concentrations in Groundwater August 2008 to August 2009

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\Fig108-11DCA-Change.mxd

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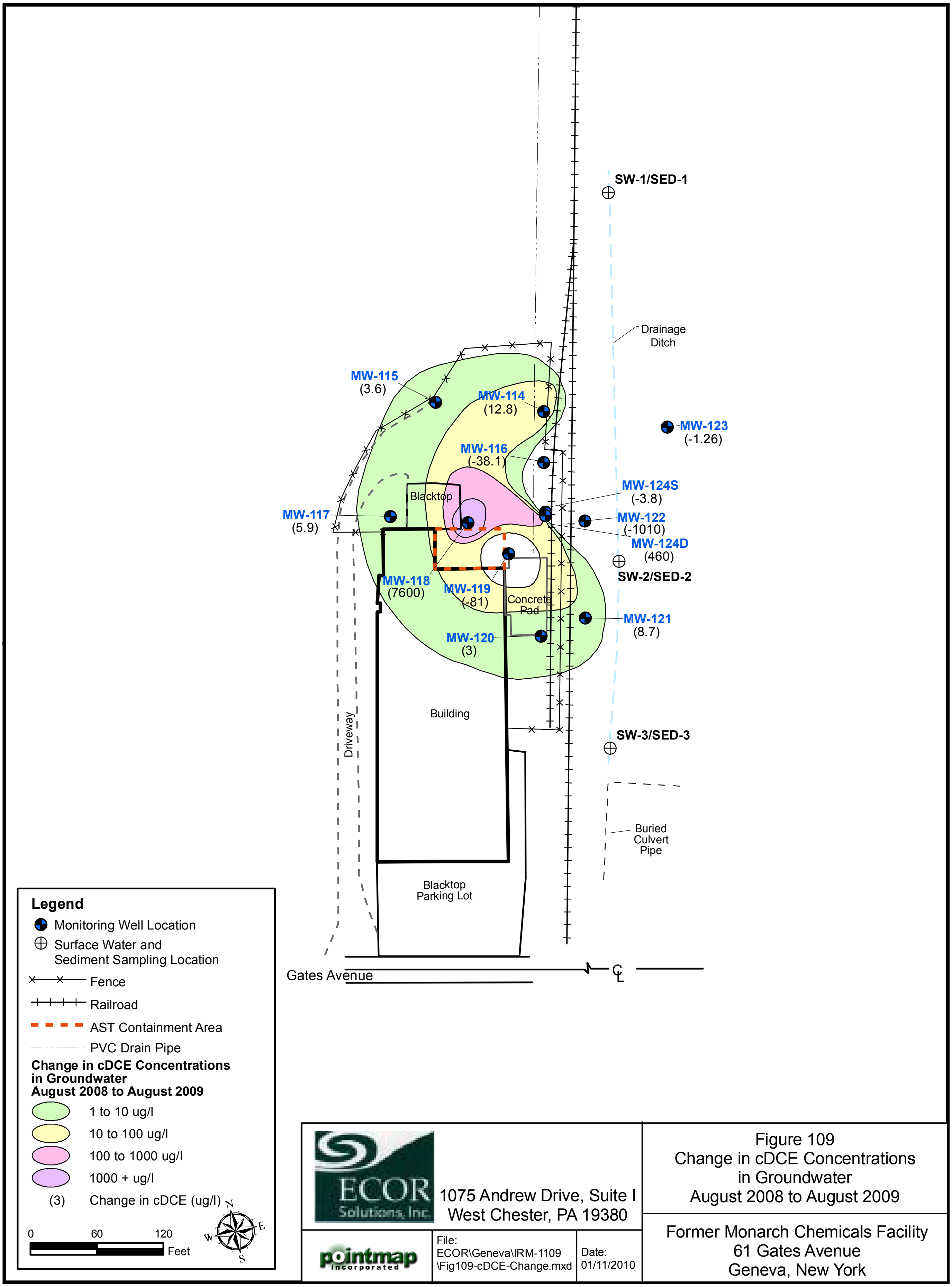

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Figure 109
Change in cDCE Concentrations in Groundwater August 2008 to August 2009

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\Fig109-cDCE-Change.mxd

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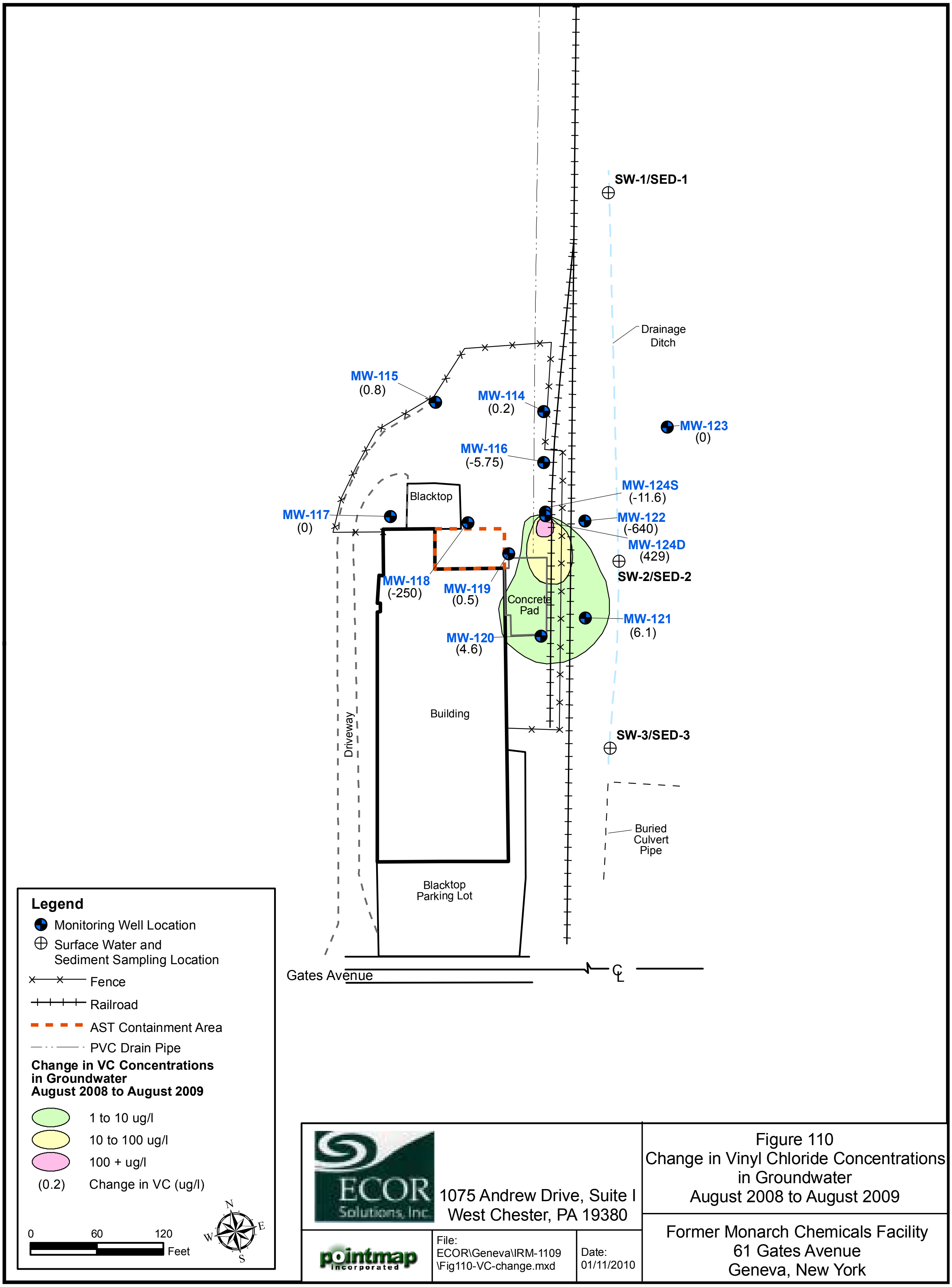

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Figure 110
Change in Vinyl Chloride Concentrations
in Groundwater
August 2008 to August 2009

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