RECORD OF DECISION

Shenandoah Road Groundwater Contamination Superfund Site

Hamlet of Hopewell Junction, Town of East Fishkill
Dutchess County, New York

United States Environmental Protection Agency
Region II
New York, New York
September 2012

145590

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Shenandoah Road Groundwater Contamination Superfund Site
Hamlet of Hopewell Junction, Town of East Fishkill, Dutchess County, New York

Superfund Identification Number: NYSFN0204269

STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) documents the U.S. Environmental Protection Agency's selection of a remedy for the Shenandoah Road Groundwater Contamination Superfund site (Site). The selected remedy is chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA), 42 U.S.C. Sections 9601-9675, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300. This decision document explains the factual and legal basis for selecting the remedy for the Site. The attached index (see Appendix III) identifies the items that comprise the Administrative Record, upon which the selection of the remedy is based.

The New York State Department of Environmental Conservation (NYSDEC) was consulted on the planned remedy, in accordance with CERCLA Section 121(f), 42 U.S.C. Section 9621(f), and concurs with the selected remedy (see Appendix IV).

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to human health or welfare or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The response action described in this document represents the only planned remedial action at the Site which addresses contaminated groundwater.

The major components of the selected remedy are as follows:

- Continued operation and maintenance of the existing source extraction and treatment system to address the DNAPL source area;

- Natural attenuation of the groundwater plume through the processes of dispersion, dilution, degradation and sorption of VOCs in the groundwater plume in order to reduce VOC concentrations to federal and more stringent state maximum contaminant levels (MCLs) or standards;

- Comprehensive monitoring program: Groundwater – It is estimated that 60 monitoring wells and/or FLUTe® intervals would be proposed for sampling. The sampling frequency and well selection are expected to be divided into five-year intervals for the 15-year (source control) and 30-year (monitored natural attenuation) periods. With each five-year interval, the specific frequency of sampling and the number of wells to be sampled are expected to be reduced. Surface water and sediment – It is estimated that five groundwater seep and surface water/sediment sampling locations would be sampled. For each five-year interval for years one to 30, sampling at select locations would occur quarterly, semiannually and annually, respectively.

- Maintenance of the four existing vapor mitigation systems, the continuation of the vapor intrusion monitoring program and the installation of additional mitigation systems if monitoring results demonstrate that they are warranted.

- Institutional controls in the form of existing governmental controls consisting of local laws that limit exposure to contaminated groundwater by restricting the drilling of private residential wells and their use as a domestic supply within established public water districts, as well as proprietary institutional controls in the form of environmental easements and/or restrictive covenants placed on the Facility property to ensure that no construction or other invasive activities are conducted on the property which would interfere with existing remedial components, including the source extraction and treatment system.

- Because it will take more than five years to achieve health-based cleanup levels in the groundwater, a review will be conducted within five years after initiation of remedial action to ensure that the remedy as selected is protective of human health and environment. Such reviews will be conducted no less often than once every five years until cleanup standards are achieved.

DECLARATION OF STATUTORY DETERMINATIONS

The selected remedy meets the requirements for remedial actions set forth in CERCLA Section 121, 42 U.S.C. Section 9621, because it meets the following requirements: 1) it is protective of human health and the environment; 2) it meets a level or standard of control of the hazardous substances, pollutants or contaminants, which at least attains the legally applicable or relevant and appropriate requirements under Federal and state laws; 3) it is cost-effective; and, 4) it utilizes permanent solutions and technologies to the maximum extent practicable.

Because this remedy will require more than five years to achieve health-based levels, a policy review will be conducted no less often than five years after initiation of remedial action to ensure that the selected remedy is protective of human health and the environment.

ROD DATA CERTIFICATION CHECKLIST

The ROD contains the remedy selection information noted below. More details may be found in the Administrative Record file supporting this ROD.

- Contaminants of concern and their respective concentrations (see ROD, pages 7-12; Figures 5-7);

- Baseline risk represented by the contaminants of concern (see ROD, pages 12-17; Tables 1-8);

- Cleanup levels established for contaminants of concern and the basis for these levels (see ROD, pages 2, 17-18 and 33-34);

- Manner of addressing source materials constituting principal threats (see ROD, page 26);

- Current and reasonably-anticipated future land use assumptions and current and potential future beneficial uses of groundwater relied upon in the baseline risk assessment and ROD (see ROD, pages 5, 12-13, 19, and 30-31);

- Potential land and groundwater use that will be available at the Shenandoah Road site as a result of the selected remedy (see ROD, pages 12 and 30);

- Estimated capital, annual operation, maintenance and monitoring, and present-worth costs, discount rate and the number of years over which the remedy cost estimates are projected (see ROD, pages 21, 25 32 and 34-35; Table 11); and,

- Key factors used in selecting the remedy (*i.e.*, how the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision) (see ROD, pages 26-26).

AUTHORIZING SIGNATURE

Walter E. Mugdan, Director
Emergency and Remedial Response Division
EPA – Region II

Sept. 30, 2012
Date

RECORD OF DECISION FACT SHEET
EPA REGION II

Site

Site name: Shenandoah Road Groundwater Contamination Superfund Site

Site location: Hamlet of Hopewell Junction, Town of East Fishkill, Dutchess County, New York

HRS score: 50

Listed on the NPL: June 14, 2001

Record of Decision

Date signed: September 30, 2012

Selected remedy: Continued operation of the source extraction and treatment system; monitored natural attenuation in the groundwater plume; implementation of a long-term groundwater, surface water and sediment monitoring program; implementation of institutional controls in the form of local ordinances and other proprietary controls.

Capital cost: $0

Annual O&M cost: $205,837

Present-worth cost: $2,661,060

Lead EPA

Primary Contact: Damian J. Duda, Remedial Project Manager, (212) 637-4269

Secondary Contact: Sal Badalamenti, Section Chief, (212) 637-3314

Main PRPs IBM Corporation

Waste

Waste type: Volatile organic compounds

Waste origin: On-site spills/discharges

Contaminated media: Groundwater

DECISION SUMMARY

Shenandoah Road Groundwater Contamination Superfund Site

Hamlet of Hopewell Junction, Town of East Fishkill
Dutchess County, New York

United States Environmental Protection Agency
Region II
New York, New York
September 2012

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ATTACHMENTS

SITE NAME, LOCATION AND DESCRIPTION

The Shenandoah Road Groundwater Contamination Superfund site (Site) is located within the Town of East Fishkill (Town), Dutchess County, New York in an area known as Shenandoah, approximately one mile southwest of the intersection of Interstate 84 and the Taconic State Parkway and one-and-one-half miles southeast of the Hudson Valley Research Park, as shown on Figure 1. The Site is in a rural area consisting of residential subdivisions intermingled with extensive farmland and patches of woodlands. The topography is dominated by a northeast/southwest trending valley and ridge complex.

The majority of the approximate 140 impacted homes within the Shenandoah Town Water District (STWD) have now been connected to a municipal water supply (East Fishkill Public Water Supply (PWS) System) and use septic systems for sanitary wastewater disposal.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

Between 1965 and 1975, Jack Manne, Inc. and its founder Jack Manne operated a business to clean and repair computer chip racks supplied to it under a contract with International Business Machines (IBM) at a rented facility at 7 East Hook Cross Road in East Fishkill (the Facility). Available information indicates that during these operations, solvents, including tetrachloroethene or PCE, a volatile organic compound (VOC) and the primary contaminant or chemical of potential concern (COPC) for the Site, and metals, including lead, were disposed of in a septic tank and an in-ground pit located at the Facility. Additionally, nitric and sulfuric acid wastes were reportedly disposed of in another pit at the Facility.

Residential well sampling conducted at the Site by the New York State Department of Health (NYSDOH) in April and May of 2000 indicated that 24 residential wells were contaminated with PCE above the Federal and state maximum contaminant level (MCL) of 5 micrograms per liter (µg/L). One well was also found to be contaminated with the VOC trichloroethene or TCE above the MCL of 5 µg/L. Additional residential well sampling indicated that a total of 60 wells in the area were contaminated with PCE above the MCL.

In June 2000, following the discovery of contamination in the residential wells, EPA initiated an emergency response action at the Site and began delivery of bottled water to the affected residences. Of the then 60 known contaminated residential wells, 20 had contamination exceeding the removal action level (RAL) for PCE (70 µg/L). Under the Superfund Program, if any contaminant concentration exceeds its RAL, EPA is authorized to take immediate, short-term action to address that contamination. As a result, point-of-entry treatment (POET) systems were installed by EPA in homes where wells were contaminated at or above New York State Department of Health Drinking

Water Standards (NYS standards) to ensure a safe supply of water. POET systems include a cartridge particulate filter, two granular-activated carbon (GAC) tanks and an ultraviolet light. These actions were taken to protect the health of the public until a more permanent solution could be implemented.

In November and early December 2000, EPA began removal activities at the Facility with the excavation of a septic tank and the removal of its contents to an off-site treatment and disposal facility. EPA also excavated contaminated soil associated with the septic tank and temporarily stockpiled it at the Site. Based on field screening results and post-excavation soil sampling results collected by EPA, it was evident that high levels of PCE still remained in the soil beneath a building at the Facility. As a result, it was necessary for EPA to demolish the building at the Facility prior to excavation of the underlying contaminated soil. During the excavation of the soil, which extended to the water table, two additional PCE-disposal areas were discovered. During this period, EPA removed approximately 1600 tons of contaminated soil for off-site treatment and disposal.

In February of 2001, EPA notified IBM and Jack Manne (Jack Manne, Inc. was defunct) of their status as potentially responsible parties (PRPs).

In May 2001, an Administrative Order on Consent for a Removal Action (Removal AOC) was executed between IBM and EPA. Under the Removal AOC, IBM assumed responsibility for the remaining soil removal at the Facility. Also, under the Removal AOC, a separate provision was included to allow for additional response work that the two parties could agree should be performed.

In August 2001, under the Removal AOC with EPA oversight, IBM removed approximately 4,000 tons of stock-piled PCE-contaminated soils associated with the former septic tank and the two PCE-disposal areas and transported them for off-site treatment and/or disposal. Prior to backfilling, at the request of EPA, IBM installed groundwater collection pipes at various locations at the base of the excavation for future groundwater monitoring.

At the same time, EPA discovered a buried acid pit behind the Facility. Field sampling of the soil surrounding the acid pit revealed high concentrations of PCE. In January 2002, IBM, under the Removal AOC with EPA oversight, excavated and transported for off-site treatment or disposal approximately 4,500 tons of additional contaminated soil.

Also, in August 2001, IBM proposed to evaluate and to construct an alternate water supply under the provisions of the Removal AOC. In December 2001, EPA approved IBM's final work plan to evaluate six different water supply alternatives. Subsequently, in November 2003, the EPA-approved Alternate Water Supply Evaluation Report was issued. EPA held a public meeting on November 20, 2003, identifying its preferred response action. On August 23, 2004, EPA issued its decision and selected the Town of Fishkill Municipal Water Supply as the permanent drinking water source for affected Shenandoah area residents.

Subsequently, IBM implemented EPA's decision and constructed the public water supply (PWS) system within the Town's newly-formed Shenandoah Town Water District (STWD). The PWS system work included the installation of transmission and distributions lines, a water storage tank and all house connections. The PWS system was completed and deemed fully operational in March 2009. The STWD community is now being serviced by a permanent PWS system.

Except for eight homeowners within the STWD who elected to keep their uncontaminated residential wells, all residential wells located on Shenandoah Road, Old Shenandoah Road, Seymour Lane, Burbank Road, Jackson Road, Townsend Road, Old Townsend Road, Jaycox Lane, Stone Ridge Lane and East Hook Cross Road have been disconnected from the home plumbing systems and are no longer in use. The eight homeowners within the STWD who still use their private wells continue to have the opportunity to connect to the PWS at any time, now or in the future at their own expense.

During the 2001 removal action, IBM completed an Initial Groundwater Investigation report, pursuant to the Removal AOC, to provide preliminary groundwater contamination information in the Site area.

The Site was added to the National Priorities List on June 14, 2001. Subsequently, in September 2002, EPA and IBM entered into a second Administrative Order on Consent to perform the Remedial Investigation and Feasibility Study (RI/FS-AOC) phase of the project. IBM's RI/FS Work Plan was approved in late 2005. Subsequently, a Conceptual Site Model was developed for the Site (Figure 2).

In 2004, EPA began an ongoing investigation of the vapor intrusion pathway at the Site. To date, EPA has sampled the subslab and/or indoor air at over 80 properties in the Shenandoah area. Currently, EPA samples the sublab and indoor air at 13 residential properties. EPA evaluated all sampling results and determined that four residences required mitigation systems to abate the vapor intrusion pathway. These four systems will continue to be maintained. The subslab and indoor air will continue to be monitored at those four properties, as well as the nine other properties. EPA documented the basis for this action in a 2008 action memorandum, and the systems were installed in 2009. The action levels that were identified in that action memorandum will be updated to include any EPA Integrated Risk Information System (IRIS) revisions and will be the action levels used to determine whether or not additional mitigation systems are warranted in the future.

In 2011, during the course of the RI work, IBM determined that residual pure-phase PCE liquid (also known as dense non-aqueous liquid or DNAPL) is present in the groundwater and within the fractured bedrock underlying the Facility. As a result of this finding of DNAPL, EPA determined that conducting a non-time critical-removal action to control the DNAPL source would be beneficial.

Subsequently, pursuant to the Removal AOC with EPA oversight, IBM prepared a Non-Time-Critical Source Removal Action (NTCSRA) work plan to address the DNAPL source. Results of a long-term aquifer test, conducted during April-May 2011 as part of the RI/FS, were used to determine the configuration of the alternatives to address the cleanup of the DNAPL source. In August 2011, EPA approved the final NTCSRA Report. This report was determined to be equivalent to EPA's Engineering Evaluation and Cost Analysis (EE/CA) required for removal actions.

Subsequently, EPA prepared a Proposed Response Action Document (PRAD) to discuss the proposed alternatives for the source removal action. A public notice was published in the Poughkeepsie Journal on November 9, 2011 announcing a public comment period. The NTCSRA Report and the PRAD were made available for public comment from November 9, 2011 through December 9, 2011. On November 16, 2011, EPA conducted a public meeting in Town to discuss the preferred response action and to receive public comments on the NTCSRA and the PRAD. In December 2011, EPA issued a Decision Document identifying the selection of the source removal action to control the DNAPL source contamination at the Facility.

The source removal action was constructed in 2012 and consists of four groundwater extraction wells and two granulated activated-carbon (GAC) adsorption vessels in series to treat the contaminated groundwater (Figure 3). The treated groundwater is then discharged to a designated storm water conveyance in compliance with substantive permit requirements. A configuration of four extraction wells at the Facility provides the most robust response in the surrounding bedrock aquifer. Groundwater extraction from all four wells at the Facility is expected to achieve the overall objectives of reducing the DNAPL source in the fractured bedrock and of controlling groundwater chemical flux from the source area to the groundwater plume. DNAPL concentrations at the source were found to be as high as 16,000 µg/L of PCE. The capture zone of the extraction well network is approximately 16 acres surrounding the Facility.

The principal goal of the NTCSRA action is to reduce and to contain VOC concentrations in the source area at the Facility to levels that reduce the mass flux from the source significantly to levels that will permit cleanup standards to be met within the bedrock aquifer.

Since the source removal action will remain an active part of the selected remedy, it will now be referred as "source extraction and treatment system" in all future discussion herein.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

The RI, the Feasibility Study (FS) and Risk Assessment reports describe the nature and extent of the groundwater contamination at the Site, identify the risk to human health and the environment and evaluate remedial alternatives to address the contamination. EPA and NYSDEC's preferred remedy and the basis for that preference were identified in a Proposed Plan. These documents, including the Proposed Plan, were made available to the public in information repositories maintained at the EPA Docket Room in the Region 2 offices at 290 Broadway, 18th Floor, New York, New York and the East Fishkill Community Library, 348 Route 376, Hopewell Junction, New York.

A notice of the commencement of the public comment period, the public meeting date, a description of the preferred remedy, EPA contact information and the availability of the above-referenced documents was published in the *Poughkeepsie Journal*, a local newspaper, on August 29, 2012. The 30-day public comment period ran from August 29, 2012 until September 28, 2012. EPA held a public meeting on September 12, 2012 at 7:00 P.M. at the East Fishkill Fire District Administration Building to present the findings of the RI/FS and to answer questions from the public about the Site, the remedial alternatives and the proposed remedy. The meeting sign-in sheet identified that 14 persons, not including Federal, state and local governmental officials, attended the meeting. Those in attendance included area business people, residents and a journalist. IBM and its contractors provided support to EPA during the public meeting.

SCOPE AND ROLE OF THE SELECTED REMEDY

The cleanup of a Superfund site can be divided into a number of operable units, depending on the complexity of the problems of the site. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Section 300.5, defines an operable unit as a discrete action that comprises an incremental step toward comprehensively addressing a site's problems.

The remedy selected in this Record of Decision (ROD) addresses the groundwater contamination at the Site and is considered the final remedy for the Site. The previously conducted source removal, alternate water supply and other cleanup actions have significantly reduced the threat of release and potential impact to groundwater. EPA expects that the selected remedy will alleviate the source of any further groundwater impacts and restore the aquifers to beneficial use.

SUMMARY OF SITE CHARACTERISTICS

The RI activities, including sampling of the various media, were conducted from 2006 to 2012. The majority of the investigation was conducted within the limits of the Site constituents which, historically, represent the boundary of site-related COPCs that have been detected in groundwater above the NYS standard of 5 ug/L (Figure 4) and show the extent of the groundwater plume containing PCE and its related constituents, as well as the surface water impacted by them. The RI report also includes the pre-RI sampling efforts that were conducted from 2002 until 2006. During the RI, all affected media were investigated, including surface soils, groundwater, surface water, sediments and soil gas. The results of this investigation are summarized below.

Site Hydrogeology

The northern and eastern portions of the Site are underlain by unconsolidated Pleistoicene glacial deposits that overlie complexly folded and faulted, and highly fractured and weathered dolostone, a calcium/magnesium carbonate, of the Lower Paleozoic Wappinger Group and the Poughquag quartzite (valleys). The heterogeneous glacial overburden deposits range from zero to 90 feet thick and include glacial till, ice-contact deposits and glacio-lacustrine deposits. The surficial geology of these valleys is dominated by glacial sediments except where a few small dolostone and quartzite outcrops occur at the surface.The southern portion of the Site occupies the east flank of Shenandoah Mountain which is underlain by up-thrown fault blocks of the Precambrian gneiss bedrock (ridges).

The glacial overburden and bedrock aquifers represent two distinct aquifer systems in the East Fishkill area (Figure 4). Underlying the Facility is a shallow saturated bedrock zone in the gneiss bedrock that contains remnants of DNAPL which constitute a continuing source zone for contamination in the groundwater plume. Groundwater flows in gneiss bedrock from the Facility to the north, east and south (Figure 4). To the north groundwater flows from the gneiss into the quartzite and dolostone and then into the overlying glacial deposits. This transition occurs along Shenandoah Road between its intersections with Griffin Lane and Jackson Road. Groundwater then flows northward within both the bedrock and the glacial ice-contact deposits in the direction of the wetland north of Townsend Road, identified as NYSDEC HJ-54 (HJ-54). This northern wetland is the discharge zone for most of the groundwater originating at the Facility.

A small portion of the groundwater which originates at the Facility flows to the east and slightly south and may discharge to an unnamed stream and its associated wetland, identified as NYSDEC HJ-59 (HJ-59), that lie east of Shenandoah Road between Shenandoah Mountain and Hosner Mountain.

Based on the pattern of PCE detections and the magnitude of those detections, the groundwater flow direction away from the Facility to the east is toward Burbank Road and Shenandoah Road. The highest concentrations found in residential wells occur in wells on Burbank Road directly east of the Facility on the other side of the ridge. This suggests that groundwater transport through the vertical joint system in this ridge has also been significant. Detection of PCE in residential wells south of the former Facility suggests groundwater flow to the south along an apparent structural discontinuity (shear zone), most likely discharging into the unnamed stream between the two mountains.

Overall, the hydrogeology is quite complex in the area of the Site. However, in spite of the discharge of groundwater originating at the Facility into streams to the north and east, groundwater and surface water samples show that no dissolved PCE or its degradation products of TCE or cis-1,2-dichloroethene (cis-1,2 DCE) reach any of the streams draining the Site. This occurs because various attenuation mechanisms in groundwater and wetlands remove, dilute or disperse the PCE as it is flowing toward these streams.

Nature and Extent of Contamination

Groundwater Sampling

Discrete sampling of groundwater occurred at each of the monitoring well locations as shown on Figure 4 which also shows the limits of Site constituents, some of the geologic formations and the direction of groundwater flow. There are 11 monitoring wells that were fitted with FLUTe® systems with a total of 41 separate sampling intervals defined for these wells. The FLUTe® system is a multi-level monitoring well system where a flexible liner is installed down the well and allows for groundwater to be sampled at select intervals along the liner at specific depths. The use of a FLUTe® system alleviates the need to install multiple wells at a single location. There are an additional 35 conventional monitoring wells in place as well as 27 residential wells which have been converted into monitoring wells. Three distinct rounds of groundwater samples were collected from the monitoring well locations installed during the RI. During the third round of sampling, samples were also collected from residential wells that were converted to monitoring wells. Many of these wells will be part of the long-term groundwater monitoring program.

During December 2007, the initial round of sampling began for the full target compound list (TCL) (VOCs) and target analyte list (metals) parameters. Subsequently, wells were sampled for COPCs, as well as other water quality parameters.

Groundwater (Facility)

In 2001, during the soil excavation removal action, pit water samples collected of the bedrock groundwater exhibited PCE concentrations as high as 9900 µg/L. During the backfilling of the soil removal excavation conducted at the Facility, groundwater collection pipes were installed throughout the excavated areas. In the former Acid Pit area, three separate groundwater collection pipes were installed at three locations (northern, central and southern). In the former Large Pit area, three connected groundwater collection pipes were installed at three locations (northern, central and southern). The water that collects in these systems is shallow groundwater that accumulates within the clean backfill that was placed in the pits following excavation of the contaminated soil.

In June 2009 and March and June 2012, samples were collected from three of the four collection systems constructed. During all sampling events, the Acid Pit's southern collection pipe and the Large Pit's northern collection pipe were either dry or inaccessible and could not be sampled. During the June 2012 sampling event, all collection pipes in the Large Pit system were dry and could not be sampled.

COPCs that were detected in the groundwater of the various collection pipes are as follows:

- In the Acid Pit-Central Pipe: in June 2009, 660 and 630 µg/l PCE and 5.3J and 4.8J µg/L TCE in split samples; in March 2012, 150 µg/L PCE and 0.72J µg/L TCE; and, in June 2012, 200 µg/L PCE and 1.2J µg/L TCE.

- In the Acid Pit-Northern Pipe: in June 2009, 480 µg/L PCE and 5.2J µg/L TCE; in March 2012, 160 µg/L PCE and 1.9J µg/L TCE; and, in June 2012, 350 µg/L PCE and 4.8J µg/L TCE.
- In the Large Pit-Southern Pipe: in June 2009, 130 µg/L PCE and non-detect TCE; in March 2012, 87 µg/L PCE and 0.49J µg/L TCE.

- In the Large Pit-Central Pipe: in June 2009, 120 µg/L PCE and non-detect TCE; in March 2012, 94 µg/L PCE and 0.5J µg/L TCE.

Comparison of these results to the maximum pit water concentration (9900 µg/L) shows more than an order of magnitude reduction in shallow soil groundwater concentrations following the soil removal action.

During the comprehensive round of groundwater sampling conducted during the RI, the highest concentration of PCE detected in the bedrock groundwater at the Facility was at SRMW-18RA at 16,000 µg/l, which is the shallowest monitoring well interval on the Facility.

Groundwater (Plume)

Since March of 2009 when the PWS system was installed and residential well use ceased, the highest concentrations of PCE in groundwater beyond the Facility were observed along the west side of Burbank Road. Outside of the Facility, the highest concentration of PCE detected was 490 µg/L at BRB005D (a converted residential well along the west side of Burbank Road). TCE was also detected at 50 µg/L at BRB005D. Historically, prior to the installation of the PWS, the highest PCE (2100 µg/L) and TCE

(52 µg/L) concentrations in residential wells were observed near this location at BRB009. Further downgradient from BRB005 to the east, a PCE concentration at 190 µg/L was observed in the gneiss bedrock in SEY006. These well locations are shown on Figure 4.

Maximum concentrations of TCE in several other residential wells along the west side of Burbank Road were also measured at concentrations ranging from 29 µg/L to 42 µg/L. Other than these locations, maximum TCE detections of 39 µg/L and 21 µg/L were also present at SHN487 and SEY001, respectively.

In March 2012, the highest concentration of TCE detected in the Paleozoic bedrock aquifer (dolostone and quartzite) was 7.6 µg/L at SRMW-12RA. At SRMW-2R and SRMW-2RA, no PCE was detected, and TCE was the principal COPC and was found at 9.0 µg/L and 4.3 µg/L, respectively. TCE was not detected above 1 µg/L in any well completed in the glacial sediments.

Further east of the Facility, within the Paleozoic bedrock aquifer east of the easternmost fault line, the highest concentration of PCE found was 14 µg/L at SEY005S. Neither PCE nor any of its degradation products was detected above the 5 µg/L groundwater standard in any other bedrock well east of the easternmost fault line.

In October 2011, within the Paleozoic bedrock aquifer to the north, the highest concentration of PCE observed, since the use of residential wells for water supply ceased was 39 µg/L at SRMW-12RA. This is the most downgradient bedrock monitoring location in this portion of the flow system. By contrast, the maximum concentration of PCE in residential wells on either side of Shenandoah Road between its intersections with East Hook Cross Road and Jackson Road ranged from 160 µg/L to 440 µg/L. This location is where the crossover of groundwater flow from the bedrock to the glacial ice-contact deposits occurs

The highest concentrations of PCE outside the gneiss bedrock since use of residential wells ceased occur in three wells that monitor groundwater quality in these glacial ice-contact deposits, SRMW-12S: 49-57 µg/L, SRMW-12SA: 48-74 µg/L and SRMW-14S: 44-53 µg/L. The concentrations of PCE in the overlying glacial ice-contact deposits (45-49 µg/L) are greater than the concentrations in the underlying glacial till (3.0 µg/L) and in the underlying shallow bedrock (20-21 µg/L).

Other VOCs detected at the Site include cis-1,2 DCE, 1,1 DCE and vinyl chloride (VC) which are degradation products of PCE. With a maximum concentration of cis-1,2 DCE at 42 µg/L at SRMW-17R, cis-1,2 DCE was also detected above 5.0 µg/L in samples from various depth intervals at only three wells, SRMW-15R, SRMW-16R and SRMW-17R. VC was detected only at trace levels in one well, SRMW-15R. 1,1 DCE was detected at trace levels in only three wells, SRMW-15R, SRMW-16R and SRMW-17R. Figure 5 shows the results of the comprehensive groundwater data sampling.

Groundwater Fate and Transport

The following observations have been made regarding groundwater transport of dissolved VOCs away from the residual DNAPL source in bedrock at the Facility:

- Transport of dissolved VOCs in groundwater from the Facility occurs in three general directions: north, east and south; transport to the west of the Facility is impeded by a groundwater flow divide underlying the ridge to the west and a shear zone that passes through the Facility.
- The structural geology of the Site exerts considerable control over the pattern and magnitude of contaminant transport in the bedrock.
- The leading edge of the plume in the bedrock extending north of Townsend Road is dissipated by strong upward vertical gradients caused by artesian conditions in the deeper bedrock wells that drive the contaminated groundwater from the bedrock aquifer into the overlying till where concentrations appear to be attenuated by dilution and sorption onto the organic carbon fraction of aquifer solids.
- Concentrations of PCE are present in the ice-contact-deposit glacial aquifer extending north-northeast from the intersection of Shenandoah Road and Jackson Road to HJ-54, which are higher than concentrations in the underlying bedrock aquifer. Groundwater flux from this soil aquifer to surface water at the edge of the wetland just north of Townsend Road produces measureable concentrations of PCE in surface water as a result of the groundwater seeps. The presence of PCE in the ice-contact-deposit glacial aquifer is believed to have resulted from the upwelling of bedrock groundwater into the glacial sediments near the intersection of Shenandoah Road and Griffin Lane at a time when the concentrations in bedrock were roughly an order of magnitude higher than current values.

Surface Water

Sampling was conducted in two New York State (NYS)-regulated wetlands (HJ-54 and HJ-59) (Figure 6). The only site-related COPC detected, *i.e.*, PCE, was detected in the northern wetlands (HJ-59). The southeastern wetlands showed non-detect in surface water and sediments.

There were three groundwater seeps identified in HJ-54. The maximum PCE concentrations that were detected in these seeps ranged from 12 µg/L to 60 µg/L. These data were obtained where the lowest field-measured temperature was recorded (SRSP-3). Since groundwater temperatures are much lower than surface water, this indicated that this sample was collected from groundwater as it seeped out of the ground and before there was any mixing with surface water or other groundwater seepage. TCE and cis-1,2 DCE were not detected in any of the seep samples. These concentrations at SRSP-3 are very similar to the recent groundwater sampling results at well SRMW-12S, located just south of this seep on the edge of Townsend Road.

Groundwater discharging from these seeps collects in a constructed pond (SRSW-13). At the southeast inlet, the maximum concentration of PCE is 21 µg/L showing warmer surface water temperatures. The southwest inlet of the pond (SRSW-12) exhibits only a trace of PCE at 0.42J µg/L and similar water temperatures to the southeast inlet.

Water that accumulates in this pond discharges at the north end of the pond through a breach in the berm at sampling location SRMW-14. The observed maximum PCE concentration at this outlet is 9.7 µg/L, which is roughly 45% of the concentration of PCE of the groundwater entering the pond at SRSW-13.

Beyond the pond, surface water samples were collected from eleven locations within the wetland south of Stream No. 3 (SRSW-15 to 25) and three locations in that stream (SRSW-7 to 9), which drains HJ-54. No site-related COPCs were detected in any samples collected directly from Stream No. 3. Between this stream and the constructed pond, only one site-related COPC was detected above 1 µg/L and at only one of the 11 sampling locations. SRSW-18 showed a maximum PCE concentration of 2 µg/L. TCE and cis-1,2 DCE were not detected at any of the groundwater seep locations. All other surface water locations, including Streams 1 and 2, showed non-detect for the COPCs.

Sediments

Site-related COPCs were detected in several of the sediment locations that were identified and added following analysis of groundwater transport pathways within HJ-54 just north of Townsend Road (Figure 7). These locations include SRSD-11, just north of the storm water culvert beneath Townsend Road, the two inlets to the constructed pond (SRSD-12 and SRSD-13), the outlet from the constructed pond (SRSD-14) and one location northeast of the constructed pond (SRSD-22). Concentrations of site-related VOCs (corrected for moisture) in the sediment ranged from non-detect to 3.7 J µg/kg for PCE, non-detect to 1.3 J µg/kg for TCE, and cis-1,2 DCE was not detected at any sediment sampling location.

Site-related CPOCs were not detected at any other sediment sampling location, including locations SRSW-7 to SRSW-9 located within Stream Number 3, located north of the constructed pond.

Soils

Once the soil excavation and removal at the Facility was completed by EPA and IBM, EPA confirmed that NYS Technical and Administrative Guidance Memorandums (TAGMs) for soil were achieved for the ingestion of soils and protection of groundwater pathway, based on the analysis of over 100 soil samples.

In 2012, in order to ensure that no residual surficial soil contamination was present at the Facility, additional soil samples were taken in the 0-6 inch range. Samples were analyzed for full TCL VOCs. COPCs were not detected above NYS Part 375 Soil Cleanup Objectives (SCOs).

Soil Gas

In 2003, in order to evaluate soil gas conditions within the Site soils, IBM collected and analyzed foundation level soil gas samples at forty-eight (48) locations along public right-of-ways within the boundaries of the Site. Concentrations of CPOCs in these soil gas samples ranged from non-detect (with a detection limit of 10 µg/m^3) to 8200 µg/m^3 for PCE, non-detect to 99 µg/m3 for TCE and non-detect to 39 µg/m^3 for cis-1,2 DCE.

Subsequently, as discussed above, EPA assessed the soil gas data and performed a vapor intrusion investigation on a building-by-building basis throughout the Site area. Since then, EPA has performed annual vapor intrusion sampling at a limited number of affected properties and has installed four residential subslab mitigation systems as a preventative measure. There are no unaddressed public health issues related to vapor intrusion at the Site.

CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

The Site is zoned residential. The groundwater underlying the Site has a New York State classification of Class GA pursuant to 6 NYCRR Part 703. The best use of Class GA groundwater (all fresh groundwater in New York State is Class GA) is as a source of potable water.

SUMMARY OF SITE RISKS

As part of the RI/FS, EPA conducted a baseline risk assessment to estimate the current and future effects of contaminants on human health and the environment. A baseline risk assessment is an analysis of the potential adverse human health and ecological effects of releases of hazardous substances from a site in the absence of any actions or controls to mitigate such releases, under current and future land uses. The baseline risk assessment includes a human health risk assessment and an ecological risk assessment. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. The risks and hazards presented in the baseline risk assessment will be summarized in this section.

Human Health Risk Assessment

A four-step process is utilized for assessing site-related human health risks for a reasonable maximum exposure scenario: *Hazard Identification* – uses the analytical data collected to identify the contaminants of potential concern at the site for each medium, with consideration of a number of factors explained below; *Exposure*

Assessment - estimates the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways, *e.g.*, ingesting contaminated well-water, by which humans are potentially exposed; *Toxicity Assessment* - determines the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of adverse effects (response); and *Risk Characterization* - summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site-related risks. The risk characterization also identifies contamination with concentrations which exceed acceptable levels, defined by the NCP as an excess lifetime cancer risk greater than 1 x 10^{-4} to 1 x 10^{-6} or one in ten thousand to one in one million, an excess of lifetime cancer risk greater than 1 x 10^{-6} , *i.e.*, point of departure, combined with site-specific circumstances, or a Hazard Index (HI) greater than 1.0; contaminants at these concentrations are considered chemicals of concern (COCs) and are typically those that will require remediation at the site. Also included in this section is a discussion of the uncertainties associated with these risks.

Hazard Identification

In this step, the COPCs in each medium were identified based on such factors as toxicity, frequency of occurrence, fate and transport of the contaminants in the environment, concentrations, mobility, persistence, and bioaccumulation. The risk assessment focused on groundwater, surface water and sediment contaminants related to the Shenandoah Road site which may pose significant risk to human health. Analytical information that was collected to determine the nature and extent of contamination revealed the presence of VOCs in the groundwater as COPCs.

A comprehensive list of all COPCs can be found in the BHHRA, entitled "Shenandoah Road Groundwater Contamination Superfund Site Baseline Human Health Risk Assessment" (BHHRA) (2012). This document is available in the Administrative Record file. The contaminated media, concentrations detected, and concentrations utilized to estimate potential risks and hazards for the COCs at the site are presented in Table 1.

Exposure Assessment

Consistent with Superfund policy and guidance, the BHHRA is a baseline human health risk assessment and therefore assumes no remediation or institutional controls to mitigate or remove hazardous substance releases. Cancer risks and noncancer hazard indices were calculated based on an estimate of the reasonable maximum exposure (RME) expected to occur under current and future conditions at the site. The RME is defined as the highest exposure that is reasonably expected to occur at a site. For those contaminants for which the risk or hazard exceeded the acceptable levels, the central tendency estimate (CTE), or the average exposure, was also evaluated.

The Site is in a rural area consisting of residential subdivisions intermingled with extensive farmland and patches of woodlands. It is anticipated that the future land use for this area will remain consistent with its current use. The BHHRA evaluated potential risks to populations associated with both current and potential future land uses.

Exposure pathways were identified for each potentially exposed population and each potential exposure scenario for exposure to groundwater, surface water and sediment. Exposure pathways assessed in the BHHRA are presented in Table 2 and included exposure to contaminated media for recreators/trespassers, construction/utility workers, and residential exposure through incidental ingestion, dermal contact, and inhalation. Typically, exposures are evaluated using a statistical estimate of the exposure point concentration, which is usually an upper-bound estimate of the average concentration for each contaminant, but in some cases may be the maximum detected concentration. A summary of the exposure point concentrations for the COCs in groundwater can be found in Table 1, while a comprehensive list of the exposure point concentrations for all COPCs can be found in the BHHRA.

Toxicity Assessment

Under current EPA guidelines, the likelihood of carcinogenic risks and noncancer hazards due to exposure to site chemicals are considered separately. Consistent with current EPA policy, it was assumed that the toxic effects of the site-related chemicals would be additive. Thus, cancer and noncancer risks associated with exposures to individual COPCs were summed to indicate the potential risks and hazards associated with mixtures of potential carcinogens and noncarcinogens, respectively.
Toxicity data for the human health risk assessment were provided by the IRIS database, the Provisional Peer Reviewed Toxicity Database (PPRTV), or another source that is identified as an appropriate reference for toxicity values consistent with EPA's directive on toxicity values. This information for the COCs is presented in Table 3 (noncancer toxicity data summary) and Table 4 (cancer toxicity data summary). Additional toxicity information for all COPCs is presented in the BHHRA.

Risk Characterization

Noncarcinogenic risks were assessed using an HI approach, based on a comparison of expected contaminant intakes and benchmark comparison levels of intake (reference doses, reference concentrations). Reference doses (RfDs) and reference concentrations (RfCs) are estimates of daily exposure levels for humans (including sensitive individuals) which are thought to be safe over a lifetime of exposure. The estimated intake of chemicals identified in environmental media, *e.g.*, the amount of a chemical ingested from contaminated drinking water, is compared to the RfD or the RfC to derive the hazard quotient (HQ) for the contaminant in the particular medium. The HI is obtained by adding the hazard quotients for all compounds within a particular medium that impacts a particular receptor population.

The HQ for oral and dermal exposures is calculated below. The HQ for inhalation exposures is calculated using a similar model that incorporates the RfC, rather than the RfD.

HQ = Intake/RfD

Where: HQ = hazard quotient
Intake = estimated intake for a chemical (mg/kg-day)
RfD = reference dose (mg/kg-day)

The intake and the RfD will represent the same exposure period, *i.e.*, chronic, subchronic or acute.

As previously stated, the HI is calculated by summing the HQs for all chemicals for likely exposure scenarios for a specific population. An HI greater than 1.0 indicates that the potential exists for noncarcinogenic health effects to occur as a result of site-related exposures, with the potential for health effects increasing as the HI increases. When the HI calculated for all chemicals for a specific population exceeds 1.0, separate HI values are then calculated for those chemicals which are known to act on the same target organ. These discrete HI values are then compared to the acceptable limit of 1.0 to evaluate the potential for noncancer health effects on a specific target organ. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. A summary of the noncarcinogenic hazards associated with these chemicals for each exposure pathway is contained in Table 5.

The HI for noncancer effects (Table 5) is elevated for future adult and child residents due to concentrations of VOCs, *i.e.*, cis-1-2 DCE, PCE and TCE) in groundwater.

For carcinogens, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to a carcinogen, using the cancer slope factor (SF) for oral and dermal exposures and the inhalation unit risk (IUR) for inhalation exposures. Excess lifetime cancer risk for oral and dermal exposures is calculated from the following equation, while the equation for inhalation exposures uses the IUR, rather than the SF:

Risk = LADD x SF

Where: Risk = a unitless probability (1 x 10^{-6}) of an individual developing cancer
LADD = lifetime average daily dose averaged over 70 years (mg/kg-day)
SF = cancer slope factor, expressed as [1/(mg/kg-day)]

These risks are probabilities that are usually expressed in scientific notation (such as 1 x 10^{-4}). An excess lifetime cancer risk of 1 x 10^{-4} indicates that one additional incidence of cancer may occur in a population of 10,000 people who are exposed under the conditions identified in the assessment. Again, as stated in the NCP, the point of departure is 10^{-6} and the acceptable risk range for site-related exposure is 10^{-4} to 10^{-6}.

A summary of the estimated cancer risks are presented in Table 6. The results indicated that there are elevated cancer risks for the combined future adult/child residents due to VOCs, *i.e.*, cis-1,2 DEC, PCE and TCE, in the groundwater.

Uncertainties

The procedures and inputs used to assess risks in this evaluation, as in all such assessments, are subject to a wide variety of uncertainties. In general, the main sources of uncertainty include:

- environmental chemistry sampling and analysis
- environmental parameter measurement
- fate and transport modeling
- exposure parameter estimation
- toxicological data

Uncertainties in the exposure assessment are related to estimates of how often an individual would actually come in contact with the chemicals of concern, the period of time over which such exposure would occur, and in the models used to estimate the concentrations of the chemicals of concern at the point of exposure.

More specific information concerning public health risks, including a quantitative evaluation of the degree of risk associated with various exposure pathways is presented in the BHHRA report.

Ecological Risk Assessment

A Screening Level Ecological Risk Assessment (SLERA) was conducted to evaluate the potential for ecological risks from the presence contaminants in surface water and sediment. The SLERA focused on evaluating the potential for impacts to sensitive ecological receptors from site-related constituents of concern through exposure to surface water and sediment in the wetlands that receive groundwater discharge. Surface water and sediment concentrations were compared to ecological screening values as an indicator of the potential for adverse effects to ecological receptors. A complete summary of all exposure scenarios can be found in the SLERA.

Surface Water

The potential for adverse effects to ecological receptors (invertebrates, reptiles, amphibians, birds, and mammals) from exposure to contaminated surface water due to groundwater discharge was evaluated in the SLERA. The hazard indices for the site-related compounds were below an HI of 1 for both lower effect levels (LEL) and chronic values which indicates limited potential for adverse ecological effects (Table 7). Although the hazard indices were less than the acceptable value of 1, additional monitoring of the surface water is recommended to ensure that concentrations remain at acceptable values.

Sediment

The potential for adverse effects to ecological receptors (invertebrates, reptiles, amphibians, birds, and mammals) from exposure to contaminated sediment due to groundwater discharge was also evaluated in the SLERA. The hazard indices for the site-related compounds were below an HI of 1 for both LEL and chronic values which indicates limited potential for adverse ecological effects (Table 8). Although the hazard indices were less than the acceptable value of 1, additional monitoring of the sediment is recommended to ensure that concentrations remain below acceptable values. Based on the results of the ecological risk assessment, which indicated a completed pathway for surface water and sediments due to groundwater discharge with limited potential for any adverse effects, an active remedial action is not necessary to protect the environment from actual or threatened releases of hazardous substances. As noted above, additional surface water/sediment monitoring in the HJ-54 area would be performed as part of the preferred remedy to ensure that concentrations remain at acceptable values.

Vapor Intrusion

As noted above, EPA has been investigating vapor intrusion at the Site since 2004. Currently, sub-slab and indoor air VOC sampling is being performed at 13 residential properties. EPA evaluated the sampling results and determined that four of those residences required mitigation systems to abate the vapor intrusion pathway. EPA documented the basis for this action in a 2008 action memo. The nine other residential properties continue to be monitored for this pathway. To date, sampling results for those residences have been below levels warranting mitigation.

Risk Assessment Summary

In summary, VOCs at the Site contributed to unacceptable risks and hazards to adults and children through exposure to groundwater. Based on the results of the human health risk assessment, the response action selected in the Record of Decision is necessary to protect the human health from actual or threatened releases of contaminants into the environment.

REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) are based on available information and standards, such as applicable relevant and appropriate requirements (ARARs) and risk-based levels established in the SLERA and the BHHRA. The specific RAOs identified for the Site are listed below:

- To restore groundwater to MCLs consisting of NYS Groundwater Quality Class GA Standards (6 NYCRR Part 703) of 5 µg/L for PCE, TCE and cis-1,2 DCE.

- To reduce and to control the residual DNAPL source in fractured gneiss bedrock beneath the Facility and to prevent migration to the groundwater.

- To reduce VOC concentrations in the source area until the aquifer is attenuating sufficiently to achieve NYS MCLs.

- To prevent ingestion/direct contact of residential human receptors with groundwater having a concentration of PCE, TCE or cis-1,2 DCE or their degradation products which exceed NYSDOH Drinking Water Standards (10 NYCRR, Part 5, Subpart 5-1) of 5 µg/L for principal organic contaminants and with vapors derived from these contaminants in groundwater that may come to be present at significant concentrations.

DESCRIPTION OF REMEDIAL ALTERNATIVES

CERCLA §121(b)(1), 42 U.S.C. §9621(b)(1), mandates that remedial actions must be protective of human health and the environment, cost-effective, comply with ARARs and utilize permanent solutions and alternative treatment technologies and resource recovery alternatives to the maximum extent practicable. Section 121(b)(1) also establishes a preference for remedial actions which employ, as a principal element, treatment to permanently and significantly reduce the volume, toxicity, or mobility of the hazardous substances, pollutants and contaminants at a site. CERCLA §121(d), 42 U.S.C. §9621(d), further specifies that a remedial action must attain a level or standard of control of the hazardous substances, pollutants, and contaminants, which at least attains ARARs under Federal and state laws, unless a waiver can be justified pursuant to CERCLA §121(d)(4), 42 U.S.C. §9621(d)(4).

Common Elements

All or some of the alternatives include certain common components. Alternative #1 – No Further Action, Alternative #2 - Monitored Natural Attenuation (MNA) for Groundwater Plume and Source Extraction and Treatment and Alternative #3 - Extraction and Treatment of Bedrock Aquifer, MNA in Glacial Aquifer and Source Extraction and Treatment all include the continuation of the source extraction and treatment system which consists of four groundwater extraction wells and two GAC adsorption vessels piped in series to treat the contaminated groundwater. The treated groundwater is discharged to the designated storm water conveyance in compliance with substantive permit requirements.

All of the alternatives also include the operation and maintenance (O&M) of the four existing vapor mitigation systems, the continuation of the vapor intrusion monitoring program and the installation of additional mitigation systems if monitoring results demonstrate that they are warranted.

All alternatives include institutional controls in the form of existing governmental controls consisting of local laws that limit exposure to contaminated groundwater by restricting the drilling of private residential wells and their use as a domestic supply within established public water districts.

Alternatives #2 and #3, also include proprietary institutional controls in the form of environmental easements and/or restrictive covenants placed on the Facility property to ensure that no construction or other invasive activities are conducted on the property which would interfere with existing remedial components, including the source extraction and treatment system.

Alternatives #2 and #3 include a comprehensive groundwater, surface water and sediment sampling program would be developed. Approximately 60 monitoring wells and/or FLUTe® intervals would be proposed for sampling. For the first five years, it is estimated that approximately 27 wells and/or FLUTe® intervals would be sampled quarterly, 18 sampled semiannually and 15 annually. For years six to 15, it is estimated that the sampling frequency for monitoring wells initially sampled quarterly would be reduced to semiannual, and those sampled semiannually would be reduced to annual. The initial annual wells would all still be sampled on that frequency to provide a full snapshot of concentrations throughout the plume each year. At the end of the 15th year, it is estimated that the source extraction system would be shut down, based on the supporting groundwater data, and post-termination sampling would be performed. So, for years 16-18, it is estimated that the frequency of sampling would be returned to quarterly for those wells identified for years one through five. Sampling frequencies for years six to 15 at all other wells would continue. For years 19 to 30, only the glacial aquifer and the groundwater seeps and surface water would be monitored. Frequency of that monitoring is expected to be semiannual. Similarly, five groundwater seep and surface water/sediment sampling locations in the affected area of HJ-54 would be sampled quarterly, semiannually and annually in order to provide a sufficient number of results to permit more accurate projections and modeling of cleanup times, *i.e.*, reduction in VOCs in the groundwater plume.

Because it will take more than five years to achieve health-based cleanup levels in the groundwater, a review will be conducted within five years after initiation of remedial action to ensure that the remedy as selected is protective of human health and environment. Such reviews will be conducted no less often than once every five years until cleanup standards are achieved.

The source extraction and treatment system that is already in place and operating was designed to control the groundwater chemical flux from the source area at the Facility, namely VOCs, and to diminish the DNAPL source in bedrock until VOC levels in the groundwater meet NYS standards. Since the soil contaminated with levels of PCE typical of a DNAPL source was removed, the remaining DNAPL zone in the bedrock beneath the Facility constitutes the only remaining primary source of continued contamination to the groundwater. The system is expected to operate for approximately 15 years.

Current data from the operation of the source extraction and treatment system show that PCE concentrations in SRMW-18RA are being reduced. The reduction in PCE concentrations in this well indicates that pumping this well is drawing groundwater with lower PCE concentrations than existed prior to pumping. This is a positive sign that the hydraulic influence of this well extends to areas of the Facility with cleaner groundwater and drawing cleaner groundwater through the DNAPL source zone would enhance 1) dissolution of DNAPL in fractures and 2) back diffusion of dissolved PCE from the rock matrix. The operating data indicates that DNAPL mass is being removed from the source area at a rate of approximately 50 pounds per year.

All alternatives include ongoing groundwater monitoring to ensure the continued effectiveness of the source extraction and treatment system. The four extraction wells are sampled monthly for O&M purposes and for compliance with discharge requirements. Alternatives #2 and #3 include the expanded monitoring of the groundwater plume to determine the effectiveness of MNA, as well as surface water/sediment sampling.

The construction time for each alternative reflects only the time required to construct or to implement the remedy and does not include the time required to design the remedy, to negotiate the performance of the remedy with any PRPs or to procure contracts for design and construction.

The various costs for the remedial alternatives are discussed below. All O&M costs are addressed as operation, maintenance and monitoring (OM&M) costs. Note that the present worth costs provided in this document have been adjusted from those presented in the Proposed Plan and FS, in that they have been derived using a 7% discount rate that is suggested by EPA guidance, which is higher than the discount rate used in the Proposed Plan and FS and which results in somewhat lower costs for all remedies.

Detailed descriptions of the remedial alternatives for addressing the Site contamination can be found in the FS report. The three remedial alternatives are as follows:

Alternative #1: No Further Action

Capital Cost	N/A
Present Worth (PW) (15 years)	$1,331,207
Annual OM&M	$143,787
Construction Time	N/A

The NCP requires that a “No Action” alternative be developed as a baseline for comparing other remedial alternatives. Alternative #1 satisfies the EPA requirement in that no actions beyond that of the existing source extraction and treatment system would be taken to address Site risks.

For further information, refer to earlier Common Elements section.

Alternative #2: Monitored Natural Attenuation for Groundwater Plume and Source Extraction and Treatment

Capital Cost	N/A
Present Worth	$2,661,060
Annual OM&M	$205,837
Construction Time	N/A

Alternative #2 includes 1) the continued operation of the existing source extraction and treatment system, 2) MNA for the groundwater plume and 3) the groundwater and surface water/sediment monitoring program to measure the effectiveness of the MNA remedy for both the bedrock and glacial aquifers. Alternative #2 relies on source control and the MNA mechanisms of dispersion, dilution, sorption and degradation to address the groundwater contamination. Continued monitoring would include periodic recording of groundwater elevations, water quality parameters, groundwater, surface water and sediment sampling data and would establish the progress of the remedial activities. The cleanup times for Alternative #2 are 15 years for the source extraction and treatment for the bedrock aquifer and 30 years for MNA for the glacial aquifer. The cleanup levels are NYS standards for groundwater.

For a complete discussion of MNA at the Site, refer to the Summary of the Rationale for the Selected Remedy section, found later in this report.

For further information, refer to earlier Common Elements section.

Alternative #3: Extraction and Treatment of Bedrock Aquifer, MNA in Glacial Aquifer and Source Extraction and Treatment

Capital Cost	$3,823,160
Present Worth	$8,000,108
Representative Annual OM&M	$395,466
Construction Time	10-12 months

Alternative #3 includes 1) the continued operation of the source extraction and treatment system, 2) the associated groundwater and surface water/sediment monitoring program and 3) bedrock groundwater extraction from four (4) vertical wells installed at a depth of approximately 300 feet with treatment to remove suspended solids by filtration and to remove VOCs by adsorption on aqueous phase granular activated carbon (GAC). Discharge of treated groundwater from the bedrock system would be to surface water. The extraction wells and associated piping would be connected to a new groundwater treatment facility. The cleanup times for Alternative #3 are 10 years for the bedrock aquifer and 30 years for MNA for the glacial aquifer. The cleanup levels are NYS standards for groundwater.

The groundwater treatment facility would include instrumentation to monitor, control and record flow rates and water levels in the extraction wells, as well as GAC vessels to treat the extracted bedrock groundwater.

This alternative would require acquisition of an easement on private property in order to locate and construct the treatment facility. Following design, approvals, bidding and permitting, the construction period is expected to be 10 to 12 months.

For further information, refer to earlier Common Elements section.

COMPARATIVE ANALYSIS OF ALTERNATIVES

During the detailed evaluation of remedial alternatives, each alternative is assessed against nine evaluation criteria set forth in the NCP: overall protection of human health and the environment, compliance with ARARs, long-term effectiveness and permanence, reduction of toxicity, mobility or volume through treatment, short-term effectiveness, implementability, cost and state and community acceptance.
The evaluation criteria are described below.

- Overall protection of human health and the environment refers to whether a remedy provides adequate protection and describes how risks posed through each exposure pathway (based on a reasonable maximum exposure scenario) are eliminated, reduced or controlled through treatment, engineering controls or institutional controls.

- Compliance with ARARs refers to whether a remedy would meet all of the applicable or relevant and appropriate requirements of other Federal and state environmental statutes and requirements or provide grounds for invoking a waiver.
- Long-term effectiveness and permanence refers to the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met. It also addresses the magnitude and effectiveness of the measures that may be required to manage the risk posed by treatment residuals and/or untreated wastes.
- Reduction of toxicity, mobility, or volume through treatment is the anticipated performance of the treatment technologies, with respect to these parameters, a remedy may employ.
- Short-term effectiveness refers to the period of time needed to achieve protection and to address any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.
- Implementability is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.
- Cost includes estimated capital and O&M costs and net present-worth costs.
- State acceptance indicates if, based on its review of the RI/FS and Proposed Plan, the State concurs with the preferred remedy.
- Community acceptance will be assessed in the ROD and refers to the public's general response to the alternatives described in the Proposed Plan and the RI/FS reports.

ANALYSIS USING THE NINE CRITERIA

Overall Protection of Human Health and the Environment

Alternative #2 and Alternative #3 would be protective of overall human health and the environment. Alternative #1 would not be as protective, since it does not include active monitoring throughout the groundwater plume beyond the source control capture zone of the existing source control system at the Facility nor does it include proprietary controls at the Facility. Alternative #3 would achieve ARARs in the bedrock aquifer five years sooner than Alternative #2 and thus is somewhat more protective than Alternative #2.

Compliance with ARARs

Location-specific ARARs would be achieved for all alternatives. Action-specific and chemical-specific ARARs would also be achieved for groundwater by Alternative #2 and Alternative #3. Since the period of time necessary to attain ARARs in the glacial aquifer groundwater is determined by the anticipated future effects of secondary sourcing, *i.e.*, from mass diffused into the matrix of the rock or adsorbed onto aquifer solids, the time to attain groundwater standards in this aquifer cannot be accelerated by any technology that could be applied to this aquifer in this setting. Therefore, the only alternative that more quickly achieves chemical-specific ARARs is Alternative #3, because it accelerates the attainment of groundwater standards in the bedrock aquifer from 15 years to 10 years.

Long-Term Effectiveness and Permanence

Under all alternatives, the O&M of the source extraction and treatment system would provide long-term effectiveness, by continuing to provide an additional means of removing contaminants, namely DNAPL. Source extraction and treatment under all alternatives is considered an effective technology for treatment for the removal of DNAPL-contaminated groundwater, since groundwater plume concentrations would continue if mass flux continued to migrate from the bedrock aquifer under the Facility. The effectiveness of Alternatives #2 and #3 would be further confirmed through a comprehensive groundwater and surface water monitoring program, as well as five-year reviews, to ensure that the remedy is achieving NYS standards over the long-term.

Alternatives #2 and #3 would both provide long-term effectiveness and permanence in that the groundwater plume contamination would be reduced to below NYS standards within similar timeframes. For Alternatives #2 and #3, monitoring data was evaluated to produce estimated aquifer restoration goals for COCs in the groundwater of approximately 30 years for the glacial aquifer under either alternative.

All action alternatives rely on governmental and proprietary institutional controls to help limit potential future exposure to groundwater for drinking water purposes until such time as cleanup standards are achieved. Alternative #2 and Alternative #3 achieve this criterion more than Alternative #1, since they rely on a more robust and reliable set of institutional controls that include local laws to limit installation of groundwater wells and environmental easements and/or restrictive covenants, which would help to restrict any interference with remedial components at the Facility. Alternative #1 does not provide for this. The operations identified in Alternative #3 could have potential long-term impacts to the northern wetlands as a result of the discharge of large volumes of treated water from the additional treatment system into those wetlands.

Reduction of Toxicity, Mobility or Volume Through Treatment

As discussed above, all of the alternatives include the source extraction and treatment system as a component of the remedial action. This system would produce the greatest amount of mass removal from the environment of any activity included in all of the alternatives. The alternatives are equivalent in terms of the reduction of toxicity and volume of the source and the reduction of contaminant migration into the groundwater. Alternative #3 would do the most to reduce toxicity and mobility since it extracts additional PCE and would further reduce the mobility of the PCE in the bedrock aquifer.

The other two alternatives, which include only source extraction and treatment as an active remedial measure, do not achieve this additional reduction.

Short-term Effectiveness

Since Alternative #1 does not rely on new construction or activities in public areas other than the current source extraction and treatment, there are no short-term impacts. Alternative #2 adds additional groundwater and surface water/sediment sampling but no added short-term impacts, *i.e.*, no additional monitoring wells would be constructed. As a result of the magnitude of construction to be performed under Alternative #3, there would be short-term impacts to workers and the community, as well as to the surface water in the wetlands. Safety techniques would be used to minimize exposure risks and reduce the short-term impacts.

Implementability

All of the alternatives are implementable. Alternative #1 and Alternative #2 are the easiest to implement, since no further construction is required. Alternatives #2 and #3 would require the acquisition of an easement/restrictive covenant at the Facility to restrict activities which would interfere with existing remedial components, including the source extraction and treatment system. Alternative #3 involves myriad technical and administrative issues associated with performing construction work in public rights-of-way and on private property. As described above, this alternative would also require property access and the potential for property purchase and additional easements in order to construct the treatment facility.

Cost

The following table identifies the various cost estimates for the three alternatives.

Alternatives	Capital Cost	Representative Annual OM&M Costs	Total Present Worth Cost
1	$0	$143,787	$1,331,207
2	$0	$205,837	$2,661,060
3	$3,823,160	$395,466	$8,000,108

As shown above, the alternatives rank from most costly to least costly as follows: Alternative #3, Alternative #2 and Alternative #1. Alternative #1 has the lowest present worth at $1,331,207. Alternative #3 has the highest present worth at $8,000,108.

State Acceptance

NYSDEC concurs with the selected remedy (see Appendix IV).

Community Acceptance

On the basis of the comments that were received during the public comment period, EPA has concluded that the public generally supports the proposed groundwater remedy. Public comments were related to historic disposal activities at the Facility, remedial alternatives evaluation, site remediation controls and project schedule. Responses to the comments that were received during the public comment period are included in the Responsiveness Summary (see Appendix V).

PRINCIPAL THREAT WASTE

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP Section 300.430 (a)(1)(iii)(A)). The “principal threat” concept is applied to the characterization of “source materials” at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants or contaminants that 1) act as a reservoir for the migration of contamination to groundwater, surface water or air, or 2) act as a source for direct exposure. Principal threat wastes are those source materials considered to be highly toxic and highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. The decision to treat these wastes is made on a site-specific basis through a detailed analysis of alternatives, using the remedy selection criteria which were described above. The manner in which principal threats are addressed generally will determine whether the statutory preference for treatment as a principal element is satisfied.

As noted above, much of the principal threat waste at the Site was previously addressed by EPA’s cleanup actions performed during the 2000-2002 timeframe. The continued DNAPL source at the Facility is considered a principal threat waste and is being treated by the ongoing source extraction and treatment system.

SELECTED REMEDY

Based upon consideration of the results of the Site investigations, the requirements of CERCLA, the detailed analysis of the alternatives, and public comments, EPA has determined that Alternative #2: Monitored Natural Attenuation for the Groundwater Plume and Source Extraction and Treatment for the Site satisfies the requirements of CERCLA Section 121, 42 U.S.C. §9621, and provides the best balance of tradeoffs among the remedial alternatives with respect to the NCP’s nine evaluation criteria, 40 CFR §300.430(e)(9).

Summary of the Rationale for the Selected Remedy

Alternative #2 - MNA for the Groundwater Plume and Source Extraction and Treatment for the Site would be protective of human health and the environment, comply with ARARs, be cost effective and utilize permanent solutions and treatment technologies to the maximum extent practicable and satisfy the preference for treatment as a primary element, based on the proven reliability, effectiveness and efficiency of the ongoing source extraction and treatment system and MNA. As per the discussion in the previous Comparative Analysis section for all alternatives, EPA believes that Alternative #2 provides the best balance of trade-offs among alternatives with respect to the evaluating criteria.

Monitored Natural Attenuation Component for the Site Remedy

Natural attenuation is the process by which groundwater contaminant concentrations are reduced by various naturally occurring physical, chemical and biological processes. These processes include biodegradation, dispersion, dilution, sorption, matrix diffusion, volatilization and chemical or biological stabilization for the transformation or destruction of contaminants. The processes occur naturally (in-situ) and act to decrease the mass or concentration of contaminants in the subsurface.

MNA, as a component of the selected remedy, is supported by the following observations:

- Source control: The remaining DNAPL zone in the bedrock beneath the Facility constitutes the only remaining primary source of continued contamination to the groundwater. It is expected that the continued operation of the source extraction and treatment system would enhance the effectiveness of the MNA remedy. Although bedrock concentrations have already declined in some areas, elimination of flux from the remaining PCE DNAPL source in bedrock at the Facility will result in declining concentrations in the entire plume area. Based on projections of monitoring data and modeling, reductions in the concentrations of PCE in the glacial deposits to acceptable levels will take place over an extended period of time (decades) while reductions in the bedrock units are expected to reach acceptable levels in less time. Significant enhancement of the existing MNA processes is expected by the continued operation of the source extraction and treatment system.
- Data show that concentrations of PCE in the groundwater plume have already declined and that decreasing contaminant concentrations, in some cases to non-detect for COCs, are located near the boundaries of the plume, creating stable conditions and indicating that the contaminant plume is not expanding (Figures 5, 8 and 9).
- Presence of reducing conditions within the plume. PCE degradation products, TCE and cis-1,2-DCE, are present in some portions of the plume and will also be reduced as PCE concentrations decline.

- Implementation of the alternate water supply response action eliminated the inhalation, ingestion and dermal exposure pathways associated with contaminated groundwater. Since there will be no further demand for groundwater resources as a source of drinking water at the Site, *i.e.*, residential wells are no longer pumping contaminated groundwater, the aquifer is now less affected by pumping demands and, hence, more stable.

The principal attenuation mechanisms responsible for these observed patterns in the plume chemistry after most of the source contamination was removed include dilution and dispersion of existing dissolved mass in the plume, especially when groundwater passes from an aquifer with lower hydraulic conductivity and porosity to one with higher hydraulic conductivity and porosity, *e.g.*, the transition from the deeper fractured dolostone up to the glacial till at the SRMW-12R/S well cluster. These same attenuation mechanisms are expected to result in similar, if not more pronounced, declining trends in concentration throughout the bedrock plume following the elimination of remaining source flux through the operation of the source extraction and treatment system.

Another significant attenuation mechanism is the adsorption of VOCs on organic carbon in the aquifer solids. An example of this is demonstrated at transition from fractured dolostone to glacial till at the SRMW-12R/S well cluster where the glacial sediments exhibit much higher organic carbon content than the dolostone, and the higher surface area-to-volume ratio of aquifer solids increases the significance of adsorption as an attenuation mechanism. Percent organic carbon analyses for the deeper portions of the ice-contact glacial deposits showed much higher percentages than in the shallow portion of this unit, as well as in the underlying glacial till. Therefore, these units have been adsorbing PCE during the period of time when PCE concentrations were higher in the bedrock than in the soil.

The last significant attenuation mechanism that contributes to the attenuation of PCE concentrations in groundwater is reductive dechlorination to TCE, cis-1,2 DCE and VC. Under sulfate-reducing (anaerobic) conditions, the principal VOC (PCE) found in the groundwater at the Site undergoes reductive dechlorination and is transformed into less chlorinated compounds. These reactions are mediated by naturally occurring bacteria. The sequence of reductive dechlorination for the ethene compounds is: PCE→TCE→c-1,2-DCE→VC→Ethene. As the PCE concentrations are reduced so are the transformation or breakdown product concentrations, *i.e.*, TCE and cis-1,2 DCE. This reduction decreases the risk of generating more toxic or mobile transformation products beyond that which already occurs.

Figure 8 shows concentration contours for the total concentrations of these various constituents from both the residential well sampling program and the monitoring well program. The concentrations represented by these contours have been normalized to PCE, *i.e.*, the value shown on each contour represents the concentration of PCE that would be present had no degradation occurred to two of its daughter products, *i.e.*, TCE and cis-1,2 DCE. On Figure 8, three cross sections that are drawn through various portions of the Site display contours showing the distribution of these total PCE-series concentrations. Even though, at the northern tip of the plume, the data shows that groundwater seeps into surface water in Wetland HJ-54 at measurable concentrations, these contours show that no portion of the dissolved plume of COCs reaches a surface water stream at any measurable concentration, providing empirical evidence of plume attenuation from 16,000 µg/L at the source to non-detect with a detection limit of non-detect at 1 µg/L in the streams into which this groundwater discharges.

The above-discussed attenuation mechanisms are responsible for the observed patterns in the reduction of PCE levels within the groundwater plume chemistry.

The analysis of concentration trends in groundwater following the completion of the soil removal action at the Facility in 2002 indicates that the removal and/or even reduction of the source is having a recognizable and significant effect on concentrations in the bedrock plume, as identified by distinct declining trends in concentrations of PCE in groundwater wells.

Throughout the groundwater plume, trends in groundwater concentrations over time in former residential wells, many of which are now converted monitoring wells, have indicated both declining and stable concentrations of PCE since the original soil removal action in 2002. The declining trends are evident in time versus concentration plots for ten wells as shown on Figure 9. The specific trend analysis showing decreasing concentrations over time these wells is shown in Table 9. The stable trends are evident in time versus concentration plots for six other residential wells and are shown on Figure 10. The specific well locations are shown on Figure 4.

The trend in PCE concentration over time in each well can be used to forecast future concentrations in that well and to predict when concentrations may attain groundwater standards.

PCE concentration trends were also analyzed at three monitoring wells completed in the ice-contact glacial deposits that exhibited decreasing PCE concentration trends. As a result, the projected dates for achieving a 50% reduction throughout the plume in concentrations range from the years 2020 to 2024 or in eight to twelve years. The projected dates for achieving the lower 5 µg/L groundwater standard range from 2039 to 2048 or 27 to 36 years (see Table 10). The specific well locations are shown on Figure 4.

There is substantial evidence of natural attenuation of the concentrations of site-related COCs in groundwater, as follows:

- Overall, concentrations in the plume drop by at least an order of magnitude from the DNAPL source zone at the Facility (16,000 µg/L), to the nearby monitoring wells on Burbank Road (<1000 µg/L) and again by another order of magnitude as the plume crosses into the Paleozoic rocks and from there into the ice-contact deposits (<100 µg/L).

- Even though the substantial dimensions of this plume covering 225 acres and extending to depths greater than 400 feet below ground surface and measurable concentrations of PCE were found at the localized groundwater seeps in HJ-54, there were no unacceptable risks and, thus, site-related COCs have not adversely impacted the surface water or sediment of the three streams, draining the area of the Site. This indicates that the mass flux within this plume is completely attenuated before reaching any of these streams. The north-south orientation of the plume axis also reflects the strong structural controls on plume migration such that concentrations are rapidly attenuated as groundwater crosses certain faults to the west and east (Figure 8).
- The portion of the plume containing lower PCE concentrations located in the east central portion of the Site attenuates to less than 5 µg/L as that plume crosses Fault A in the vicinity of Jackson Road and Old Townsend Road.
- The portion of the plume with higher PCE concentrations, extending to the northern plume boundary, is attenuated by upwelling clean groundwater associated with artesian conditions in deeper groundwater and by adsorption onto organic carbon in the glacial till and the basal portion of the ice-contact deposits as it passes through these units before discharging to HJ-54 or Stream No. 3.
- Overall, the majority of the groundwater data to date shows that the boundary of the groundwater plume appears to be stable or reducing.

As a result of capture, containment and treatment of the PCE plume in the bedrock units under the Facility, PCE concentrations in the groundwater in the ice-contact glacial aquifer between Jackson Road and HJ-54 are expected to decline. The decline in PCE concentrations here will be determined by the rate of flushing with clean water, the degree to which PCE was adsorbed to the solids and the rate at which the PCE is released. The degree of sorption of PCE on these ice-contact sediments will be determined principally by the organic carbon content of the aquifer solids and the organic carbon partition coefficient.

The ultimate objective for the selected remedy is to restore contaminated groundwater within the underlying aquifers to their beneficial use. Alternative #2 can be implemented in an expeditious manner, has all the necessary discharge permits and access agreements in place to continue the source extraction and treatment system and is cost effective.

Because this alternative will require more than five years to achieve health-based levels, the remedy will be reviewed at least once every five years. Also, provisions will be made for periodic reviews of the institutional and engineering controls. If justified by these reviews, additional remedial actions may be implemented at the Site.

Description of the Selected Remedy

The major components of the selected remedy are as follows:

- Continued operation and maintenance of the existing source extraction and treatment system to address the DNAPL source area;

- Natural attenuation of the groundwater plume through the processes of dispersion, dilution, degradation and sorption of VOCs in the groundwater plume in order to reduce VOC concentrations to federal and more stringent state maximum contaminant levels (MCLs) or standards;

- Comprehensive monitoring program: Groundwater – It is estimated that 60 monitoring wells and/or FLUTe® intervals would be proposed for sampling. The sampling frequency and well selection are expected to be divided into five-year intervals for the 15-year (source control) and 30-year (MNA) periods. With each five-year interval, the specific frequency of sampling and the number of wells to be sampled are expected to be reduced. Surface water and sediment – It is estimated that five groundwater seep and surface water/sediment sampling locations would be sampled. For each five-year interval for years one to 15, sampling would occur quarterly, semiannually and annually, respectively. From years 16 to 30, sampling is expected to be annually at select locations.

- Maintenance of the four existing vapor mitigation systems, the continuation of the vapor intrusion monitoring program and the installation of additional mitigation systems if monitoring results demonstrate that they are warranted.

- Institutional controls in the form of existing governmental controls consisting of local laws that limit exposure to contaminated groundwater by restricting the drilling of private residential wells and their use as a domestic supply within established public water districts, as well as proprietary institutional controls in the form of environmental easements and/or restrictive covenants placed on the Facility property to ensure that no construction or other invasive activities are conducted on the property which would interfere with existing remedial components, including the source extraction and treatment system.

- Because it will take more than five years to achieve health-based cleanup levels in the groundwater, a review will be conducted within five years after initiation of remedial action to ensure that the remedy as selected is protective of human health and environment. Such reviews will be conducted no less often than once every five years until cleanup standard are achieved.

The source extraction and treatment system that is already in place and operating at the Facility was designed to control the groundwater chemical flux from the source area at the Facility, namely VOCs, and to diminish the DNAPL source in bedrock until VOC levels in the groundwater meet NYS standards. The original soil removal action demonstrated that groundwater can be effectively remediated by Alternative #2 following continuing source remediation and control.

The selected remedy is expected to achieve the Site's remediation goals, *i.e.*, NYS standards, within a reasonable timeframe. EPA expects that the remedy would achieve NYS standards through the MNA mechanisms in the glacial aquifer groundwater plume in approximately 30 years and in the bedrock aquifer at the Facility (source) in approximately 15 years.

Under Alternative #2, there are local institutional controls in place to protect against the installation of drinking water wells within the STWD and to restrict groundwater use at the Site. Alternative #2 also includes the establishment of environmental easements and/or restrictive covenants to be placed on the Facility property to ensure that no construction or other invasive activities would occur which could interfere with existing remedial components, including the source extraction and treatment system, extraction wells, monitoring wells and groundwater collection pipes.

In combination, these actions would achieve groundwater restoration in a reasonable timeframe while utilizing active engineering controls and natural attenuation processes to protect human health and the environment.

In addition, the maintenance of the four existing vapor mitigation systems would continue, as well as the vapor intrusion monitoring program. Although not expected, additional mitigation systems may be installed if monitoring results demonstrate they are warranted. The action levels, identified in the action memo that determined that an action be taken, will be updated for the 2012 IRIS revisions and will be the basis for determining if additional mitigation systems are warranted.

In accordance with EPA Region 2's Clean and Green policy and in order to maximize the net environmental benefits, EPA may evaluate the maximum use of sustainable technologies and practices, as appropriate, for the continued operation of the selected remedy.

Summary of the Estimated Selected Remedy Costs

A detailed cost estimate for the selected remedy can be found in Table 11. The information in the cost estimate summary table is based on the best available information regarding the anticipated scope of the remedy and is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual cost.

Any major cost changes may be documented in the form of a memorandum in the Administrative Record file, an Explanation of Significant Differences or a ROD amendment.

Expected Outcome of the Selected Remedy

Based on historic and current groundwater data, the nature and extent of groundwater contamination discussed in the RI and the alternatives assessment presented in the FS, it is estimated that the implementation of Alternative #2 will achieve the Site groundwater cleanup objectives in several decades through the operation of the source extraction and treatment system and MNA.

STATUTORY DETERMINATIONS

Under CERCLA Section 121 and the NCP, the lead agency must select remedies that are protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), are cost-effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Section 121(b)(1) also establishes a preference for remedial actions which employ treatment to permanently and significantly reduce the volume, toxicity or mobility of the hazardous substances, pollutants or contaminants at a site. For the reasons discussed below, EPA has determined that the selected remedy meets these statutory requirements.

Protection of Human Health and the Environment

The selected remedy will be protective of human health and the environment.

The implementation of the selected remedy would not pose unacceptable short-term risks or cross-media impacts. The selected remedy would also provide overall protection by reducing the toxicity, mobility and volume of contamination through treatment.

Compliance with ARARs, To- Be-Considered (TBC) Guidance and Other Environmental Guidance

A summary of the ARARs, TBCs (which are not formally promulgated) and other guidance which will be met to the extent practicable during implementation of the selected remedy is presented below.

- EPA – National Drinking Water Standards – Safe Drinking Water Act – 40 CFR Part 141.
- EPA – Resource Conservation and Recovery Act – 40 CFR Parts 260-268.
- EPA – Off-Site Disposal Rule, 30 CFR Section 300.440
- EPA – Executive Orders 11988 and 11990 and Appendix A of 40 CFR Part 6 of the National Environmental Policy Act (NEPA) – Protection of Wetlands
- EPA/NYS – Section 401 of the EPA Clean Water Act and regulations promulgated by NYSDEC at 6 NYCRR Part 608.

- NYS – Surface Water Standards and Groundwater Quality Standards – 6 NYCRR Part 703.
- NYS – Drinking Water Standards – 10 NYCRR Part 5.

Cost-Effectiveness

A cost-effective remedy is one whose costs are proportional to its overall effectiveness (NCP Section 300.430(f)(1)(ii)(D)). Overall effectiveness is based on the evaluations of: long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and, short-term effectiveness. Based on the comparison of overall effectiveness (discussed above) to cost, the selected remedy would meet the statutory requirement that Superfund remedies be cost-effective in that it is the least-costly alternative that would achieve the remediation goals in a reasonable time frame.

In the detailed cost analysis, capital and annual operation, maintenance and monitoring costs have been estimated and were used to develop present-worth costs. The estimated present-worth cost of the selected remedy, using a 15-year time interval for the source extraction and treatment system and a 30-year time interval for the MNA, is $2,661,060. The selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner at the Site. Therefore, EPA believes that the selected remedy would provide the best balance in proportion to its overall effectiveness.

Preference for Treatment as a Principal Element

The statutory preference for remedies that employ treatment as a principal element is addressed by the selected remedy, specifically the source extraction and treatment system and the MNA portion of the remedy which identifies four discrete methods of attenuation of the groundwater contamination, representing an additional treatment mechanism.

Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy would provide the best balance of tradeoffs among the alternatives with respect to the balancing criteria set forth in NCP Section 300.430(f)(1)(i)(B), such that it would represent the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the Site. In addition, the selected remedy would provide protection of human health and the environment, long-term effectiveness, would be able to achieve the ARARs and would be cost-effective.

Five-Year Review Requirements

Because this remedy will take more than five years to achieve health-based cleanup levels in the groundwater, a review will be conducted within five years after initiation of remedial action to ensure that the remedy, as selected, is protective of human health and environment. Such reviews will be conducted no less often than once every five years until cleanup standard are achieved.

DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan, released for public comment on August 29, 2012, identified and evaluated three remedial alternatives to address the groundwater contamination at the Site: 1) No Further Action; 2) MNA for the Groundwater Plume and Source Extraction and Treatment; and, 3) Extraction and Treatment of Bedrock Aquifer, MNA in Glacial Aquifer and Source Extraction and Treatment. The Proposed Plan proposed Alternative #2 (MNA and Source Treatment) as the preferred remedy.

All written and verbal comments submitted during the public comment period were reviewed by EPA. All comments and EPA responses are included in the Responsiveness Summary (APPENDIX V). Upon review of these comments, EPA has determined that no significant changes to the selected remedy as it was originally proposed in the Proposed Plan were necessary or appropriate.

Although not a significant change from the Proposed Plan, the cost estimates developed for each alternative have been revised herein. The discount rate(s) used to develop the cost estimates in the FS have now been modified using EPA’s current 7% discount rate for all alternatives, resulting in costs that are somewhat lower than those presented in the Proposed Plan and the supporting documents.

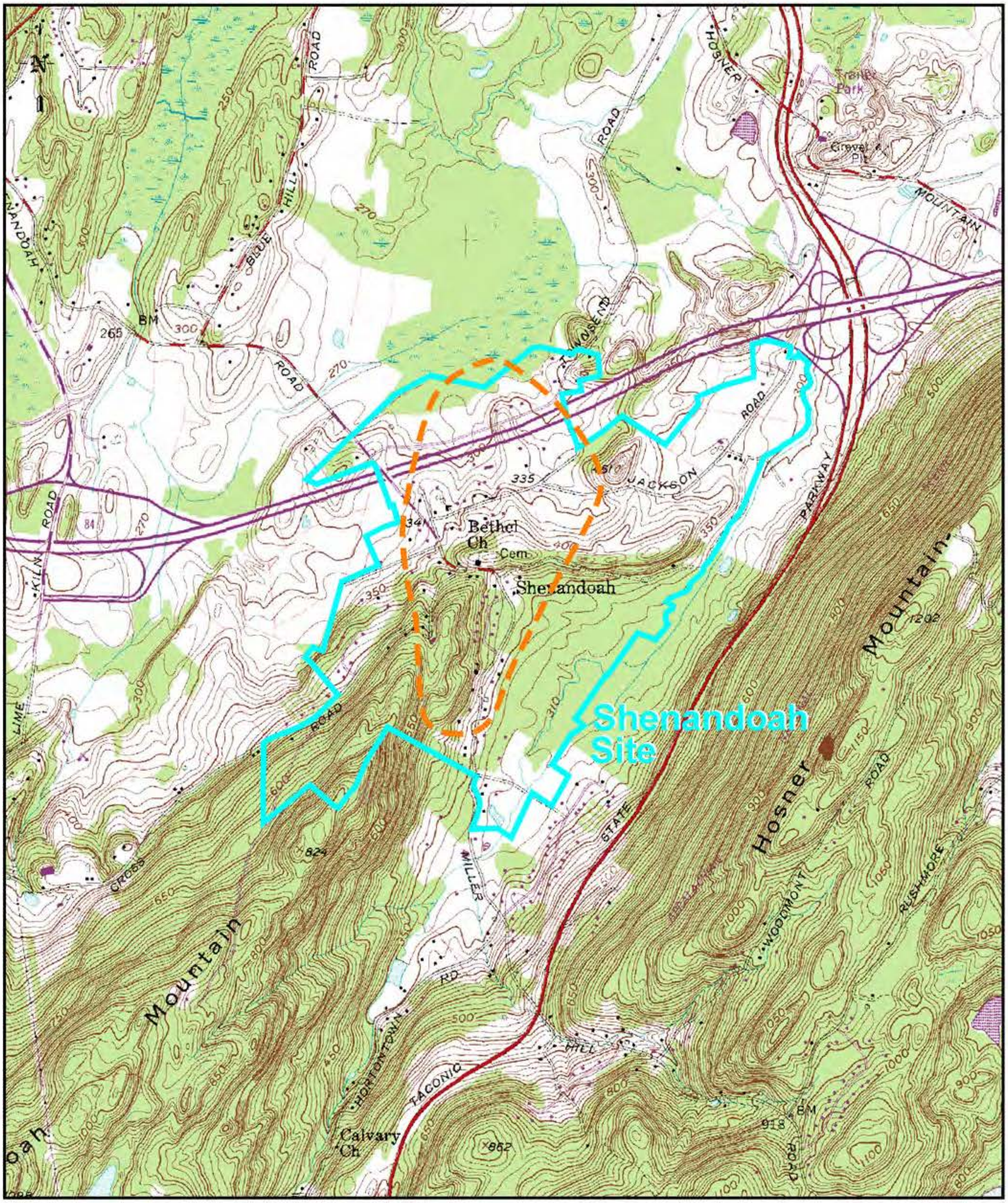
Although not a significant change from the Proposed Plan, the costs for vapor intrusion monitoring and maintenance of subslab mitigation systems were not discussed in the Proposed Plan. The annual cost is estimated to be $35,000 per year. These costs are expected to be within +50 to -30 percent of the actual remedy costs.

SHENANDOAH ROAD GROUNDWATER CONTAMINATION SUPERFUND SITE

RECORD OF DECISION

APPENDIX I

FIGURES



Extent of Individual Site COPCs Detected Above 5 µg/L in Groundwater

Portion of the Hopewell Junction, NY
7.5-Minute NYSDOT Quadrangle

Figure 1
Shenandoah Road Groundwater Contamination Superfund Site
Study Area Setting

Scale
0 1000' 2000'

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21003-002-F12 / 03-30-05

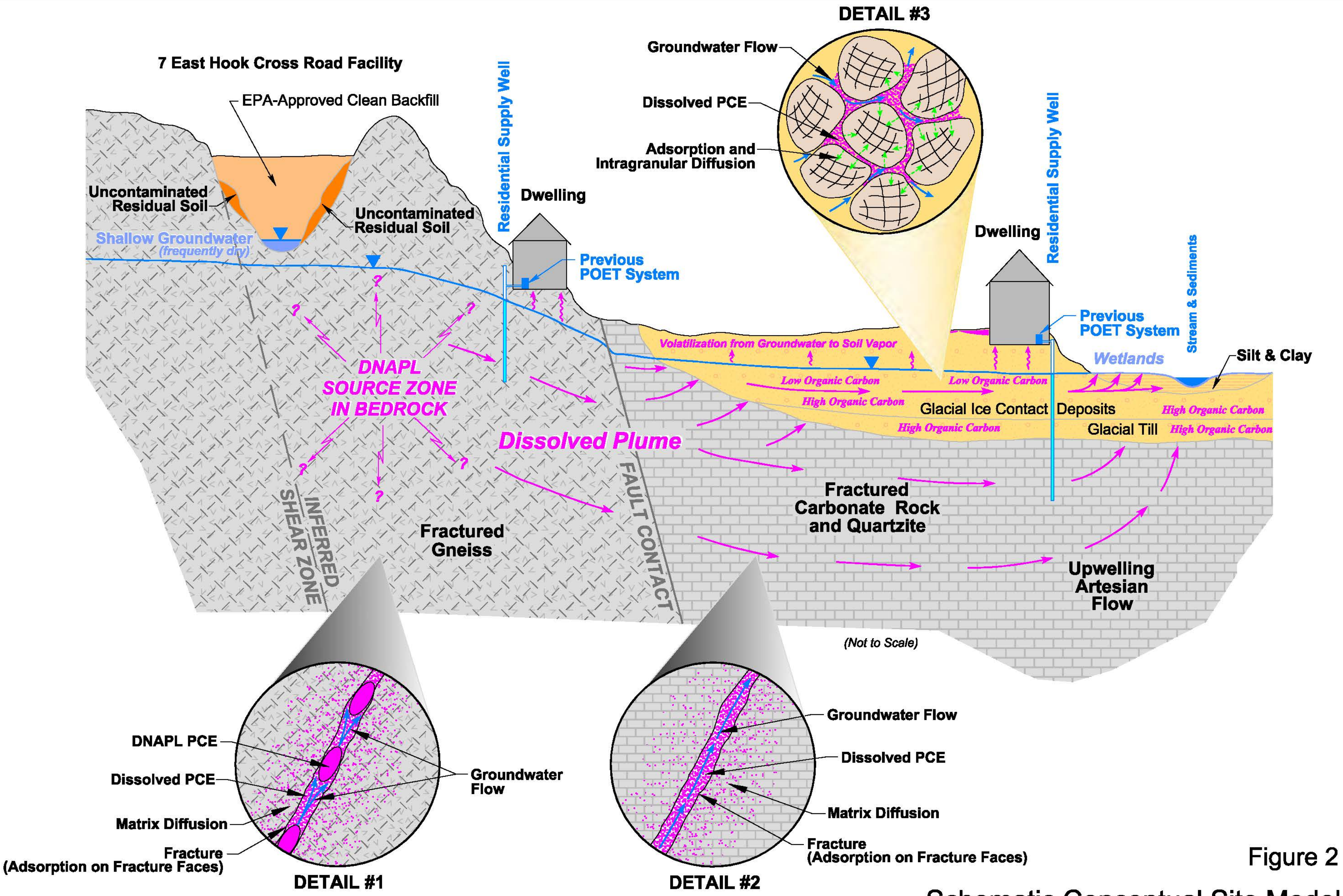

Figure 2

Schematic Conceptual Site Model
Shenandoah Road Groundwater Contamination Superfund Site

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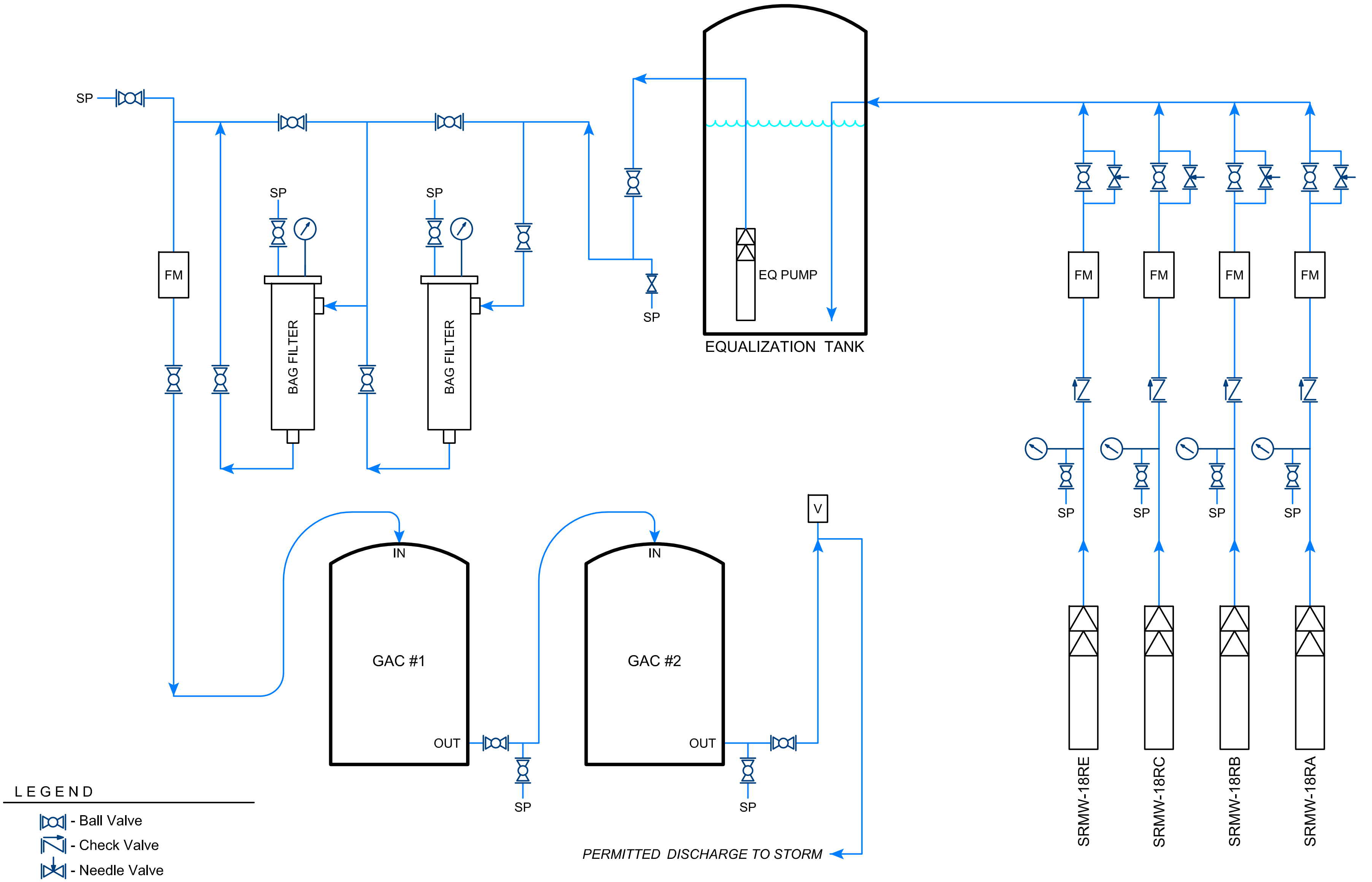
21003-070-E9 / 07-03-12



LEGEND

⋈ - Ball Valve
⊿ - Check Valve
⧖ - Needle Valve
⊘— - Pressure Gauge
← - Direction of Flow
FM - Flow Meter
GAC - Granular Activated Carbon
SP - Sample Port
V - Siphon Break

NOT TO SCALE

Figure 3

Shenandoah Road Groundwater Contamination Superfund Site
Source Extraction and Treatment System Flow Diagram

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21003-083-B2 / 09-06-12

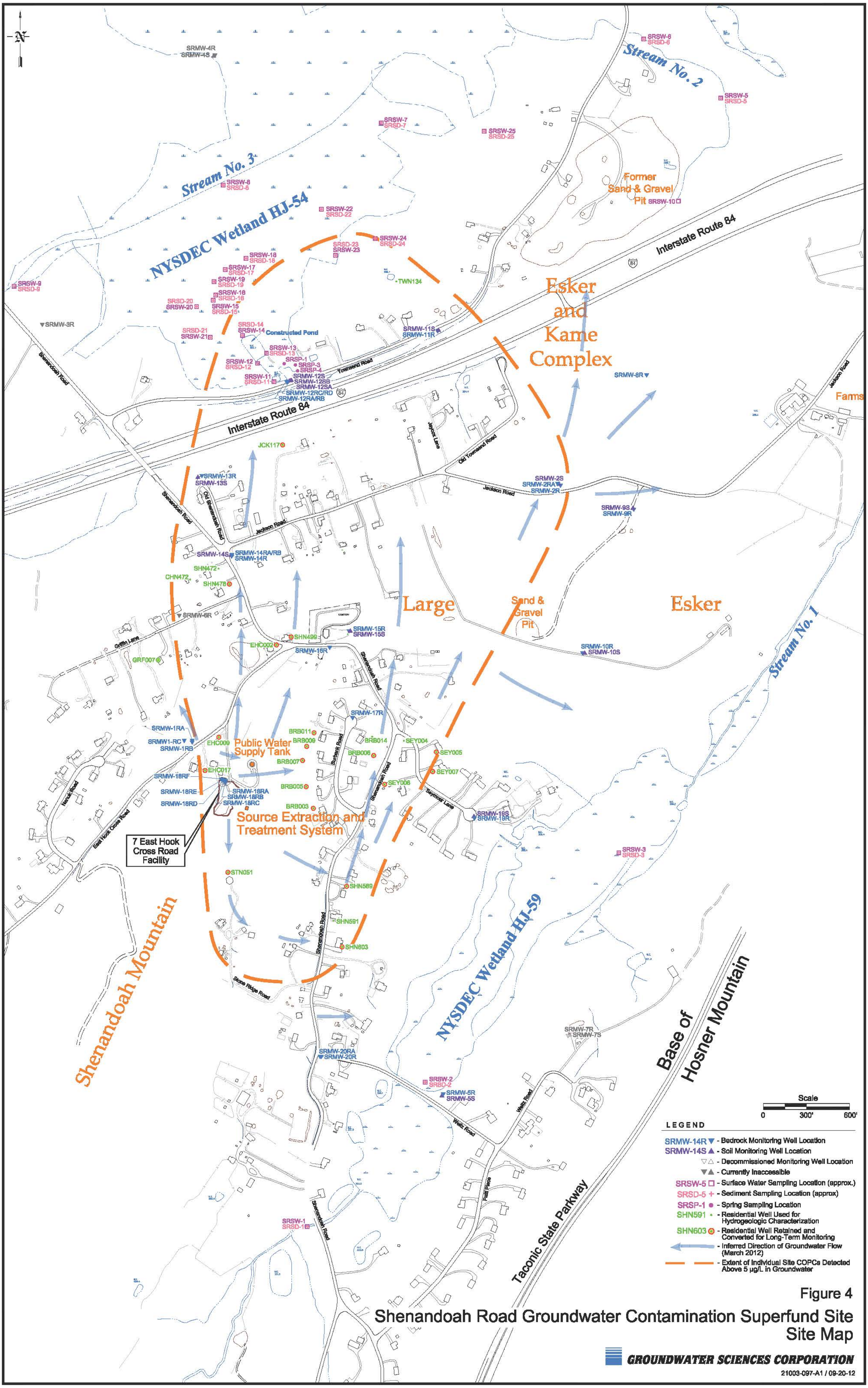

Figure 4

Shenandoah Road Groundwater Contamination Superfund Site
Site Map

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21003-097-A1 / 09-20-12

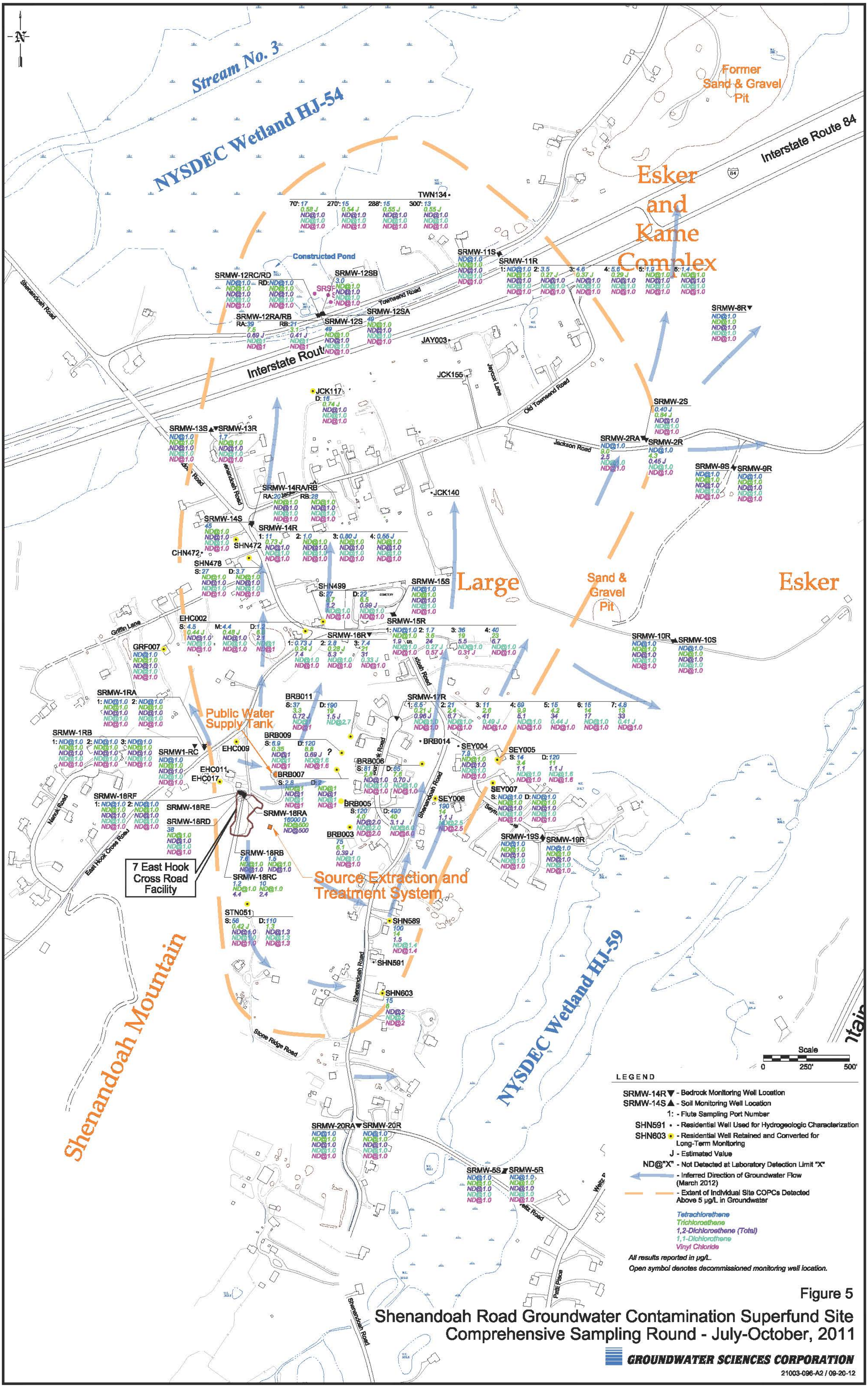

Figure 5

Shenandoah Road Groundwater Contamination Superfund Site
Comprehensive Sampling Round - July-October, 2011

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21003-096-A2 / 09-20-12

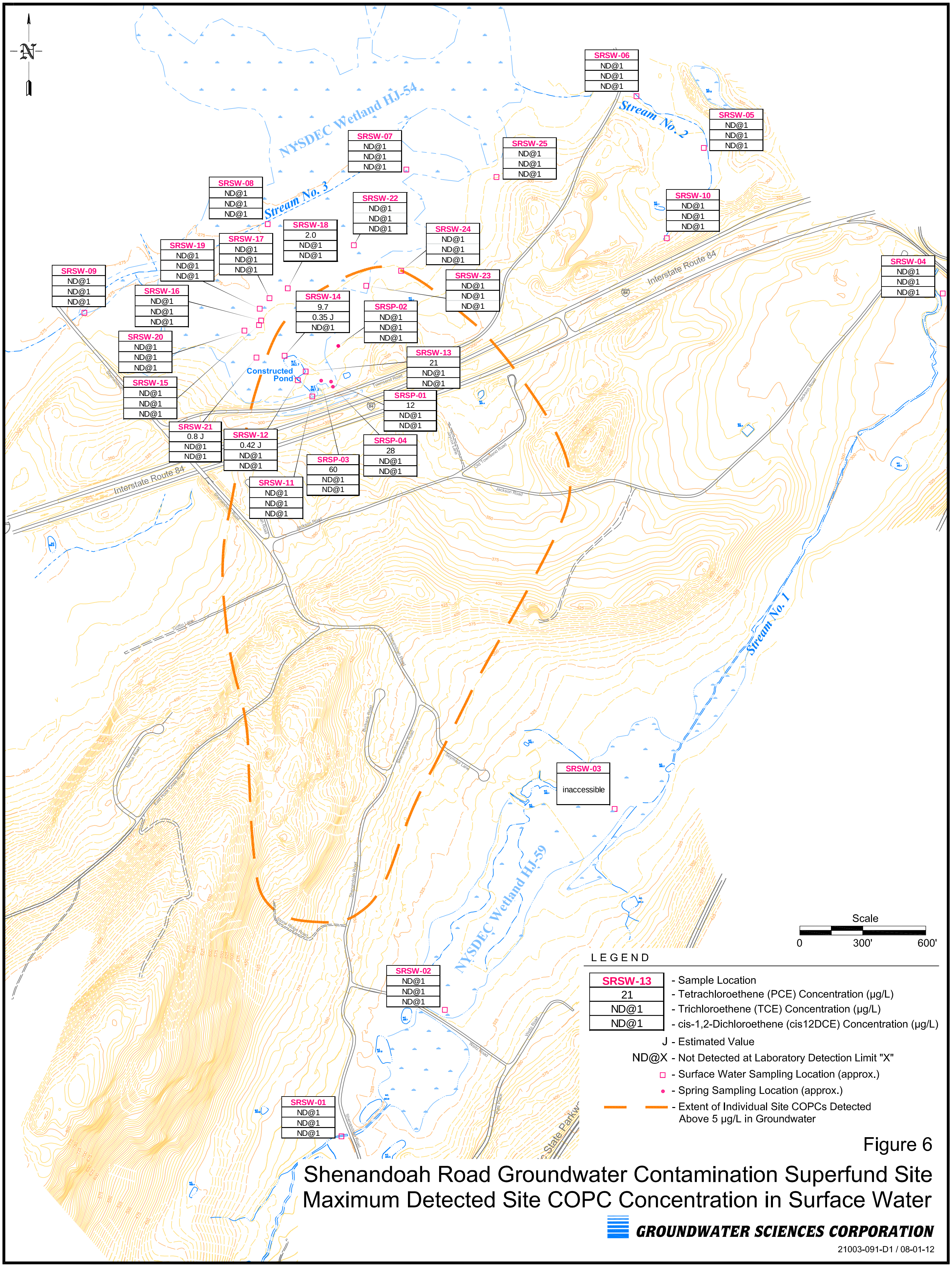

Figure 6

Shenandoah Road Groundwater Contamination Superfund Site
Maximum Detected Site COPC Concentration in Surface Water

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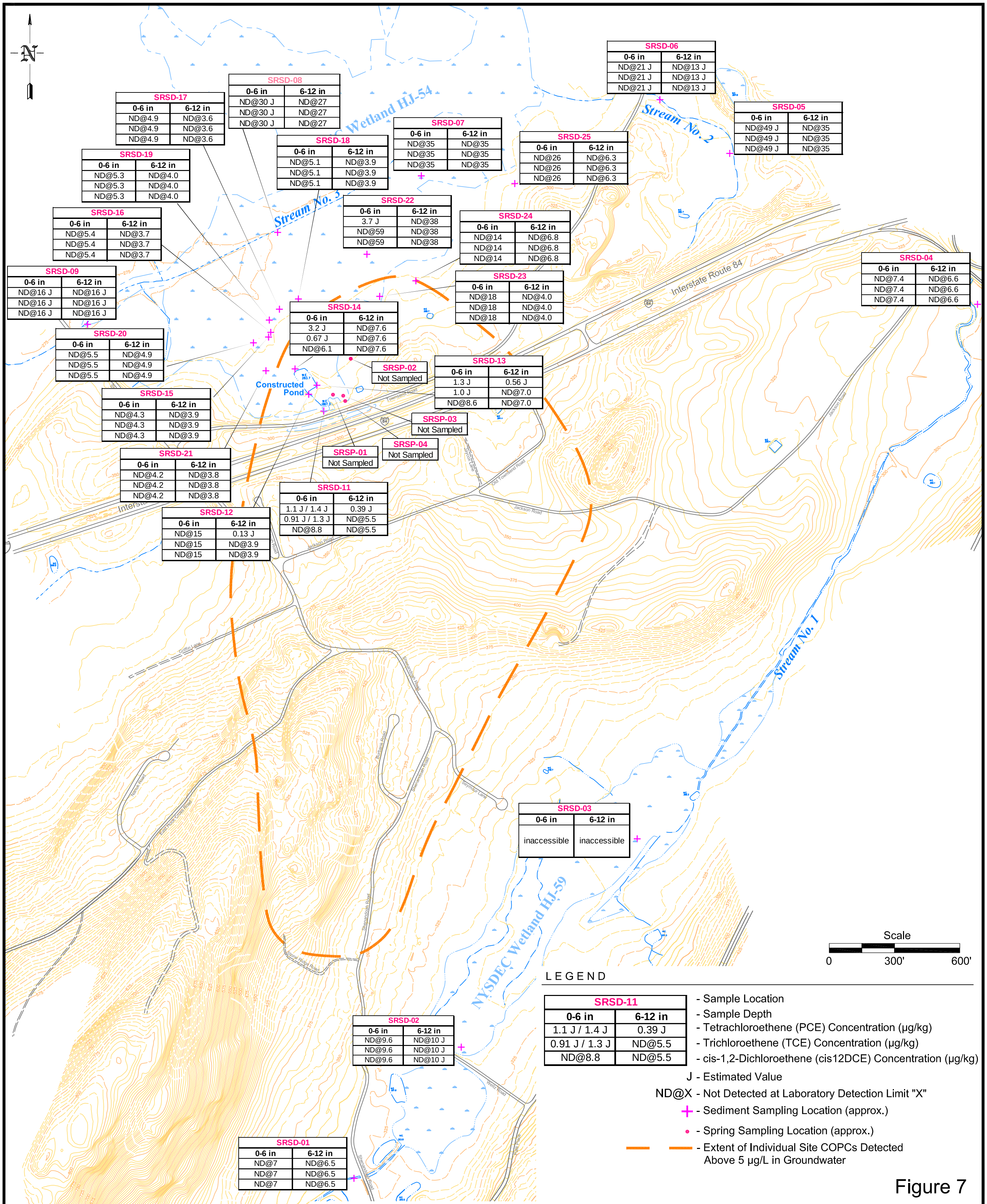
21003-091-D1 / 08-01-12



SRSD-17

0-6 in	6-12 in
ND@4.9	ND@3.6
ND@4.9	ND@3.6
ND@4.9	ND@3.6

SRSD-08

0-6 in	6-12 in
ND@30 J	ND@27
ND@30 J	ND@27
ND@30 J	ND@27

SRSD-06

0-6 in	6-12 in
ND@21 J	ND@13 J
ND@21 J	ND@13 J
ND@21 J	ND@13 J

SRSD-05

0-6 in	6-12 in
ND@49 J	ND@35
ND@49 J	ND@35
ND@49 J	ND@35

SRSD-07

0-6 in	6-12 in
ND@35	ND@35
ND@35	ND@35
ND@35	ND@35

SRSD-18

0-6 in	6-12 in
ND@5.1	ND@3.9
ND@5.1	ND@3.9
ND@5.1	ND@3.9

SRSD-25

0-6 in	6-12 in
ND@26	ND@6.3
ND@26	ND@6.3
ND@26	ND@6.3

SRSD-19

0-6 in	6-12 in
ND@5.3	ND@4.0
ND@5.3	ND@4.0
ND@5.3	ND@4.0

SRSD-22

0-6 in	6-12 in
3.7 J	ND@38
ND@59	ND@38
ND@59	ND@38

SRSD-16

0-6 in	6-12 in
ND@5.4	ND@3.7
ND@5.4	ND@3.7
ND@5.4	ND@3.7

SRSD-24

0-6 in	6-12 in
ND@14	ND@6.8
ND@14	ND@6.8
ND@14	ND@6.8

SRSD-04

0-6 in	6-12 in
ND@7.4	ND@6.6
ND@7.4	ND@6.6
ND@7.4	ND@6.6

SRSD-09

0-6 in	6-12 in
ND@16 J	ND@16 J
ND@16 J	ND@16 J
ND@16 J	ND@16 J

SRSD-23

0-6 in	6-12 in
ND@18	ND@4.0
ND@18	ND@4.0
ND@18	ND@4.0

SRSD-14

0-6 in	6-12 in
3.2 J	ND@7.6
0.67 J	ND@7.6
ND@6.1	ND@7.6

SRSD-20

0-6 in	6-12 in
ND@5.5	ND@4.9
ND@5.5	ND@4.9
ND@5.5	ND@4.9

SRSP-02
Not Sampled

SRSD-13

0-6 in	6-12 in
1.3 J	0.56 J
1.0 J	ND@7.0
ND@8.6	ND@7.0

SRSD-15

0-6 in	6-12 in
ND@4.3	ND@3.9
ND@4.3	ND@3.9
ND@4.3	ND@3.9

SRSP-03
Not Sampled

SRSP-04
Not Sampled

SRSP-01
Not Sampled

SRSD-21

0-6 in	6-12 in
ND@4.2	ND@3.8
ND@4.2	ND@3.8
ND@4.2	ND@3.8

SRSD-11

0-6 in	6-12 in
1.1 J / 1.4 J	0.39 J
0.91 J / 1.3 J	ND@5.5
ND@8.8	ND@5.5

SRSD-12

0-6 in	6-12 in
ND@15	0.13 J
ND@15	ND@3.9
ND@15	ND@3.9

SRSD-03

0-6 in	6-12 in
inaccessible	inaccessible

SRSD-02

0-6 in	6-12 in
ND@9.6	ND@10 J
ND@9.6	ND@10 J
ND@9.6	ND@10 J

SRSD-01

0-6 in	6-12 in
ND@7	ND@6.5
ND@7	ND@6.5
ND@7	ND@6.5

LEGEND

SRSD-11 - Sample Location

0-6 in	6-12 in
1.1 J / 1.4 J	0.39 J
0.91 J / 1.3 J	ND@5.5
ND@8.8	ND@5.5

- Sample Depth
- Tetrachloroethene (PCE) Concentration (µg/kg)
- Trichloroethene (TCE) Concentration (µg/kg)
- cis-1,2-Dichloroethene (cis12DCE) Concentration (µg/kg)

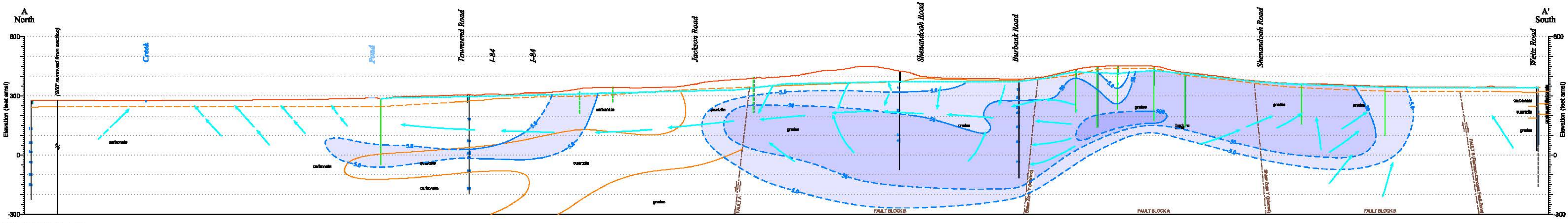
J - Estimated Value
ND@X - Not Detected at Laboratory Detection Limit "X"
\+ - Sediment Sampling Location (approx.)
● - Spring Sampling Location (approx.)
— — - Extent of Individual Site COPCs Detected Above 5 µg/L in Groundwater

Figure 7

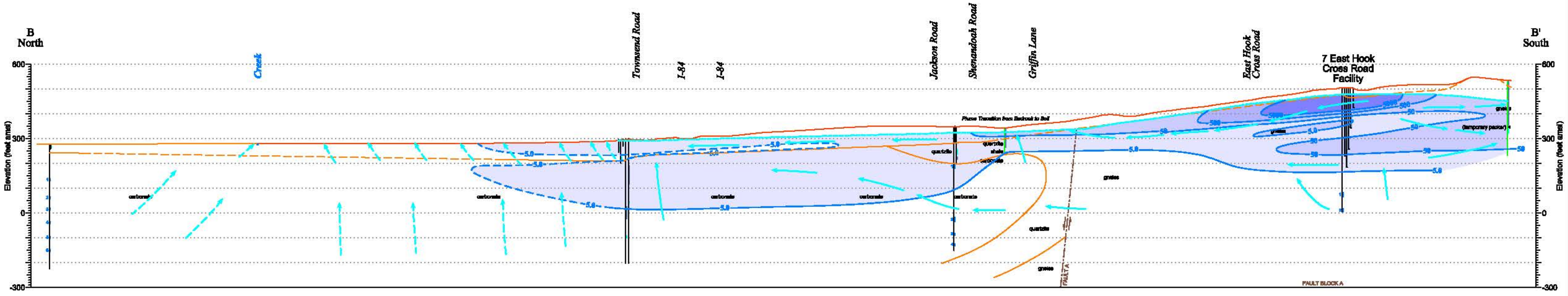
Shenandoah Road Groundwater Contamination Superfund Site
Maximum Detected Site COPC Concentration in Sediments

GROUNDWATER SCIENCES CORPORATION

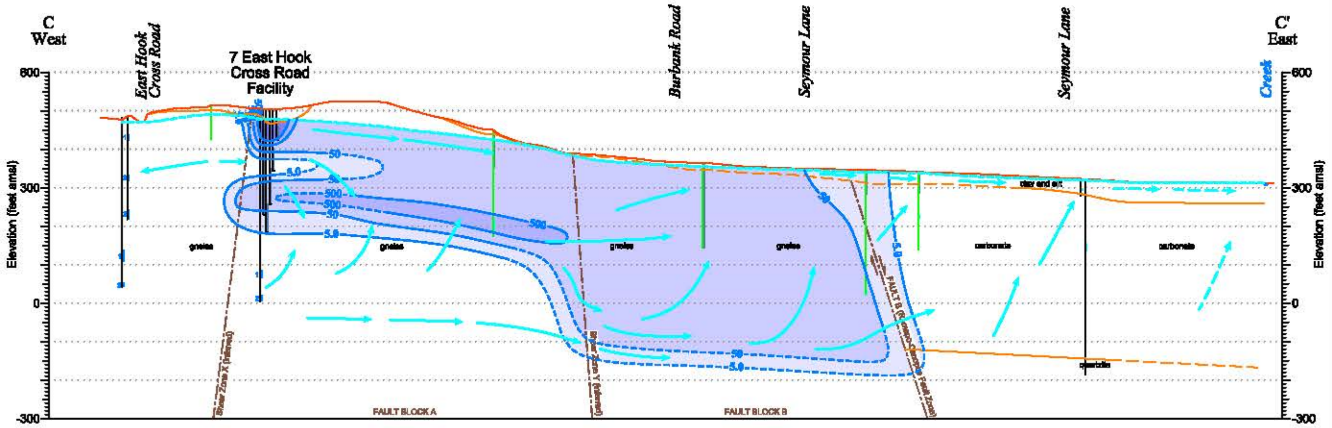
21003-091-D2 / 08-01-12



Cross Section A-A'



Cross Section B-B'



Cross Section C-C'

CROSS SECTION LEGEND

- Ground Surface
- Monitoring Well
- Lithologic Contact (dashed where inferred)
5.0 - PCE Series Concentration Contour
- Water Table (3/23/12; feet amsl)
- Inferred Direction of Groundwater Flow (schematic)
- Screened Interval
- Open Hole Interval
- Flute Interval

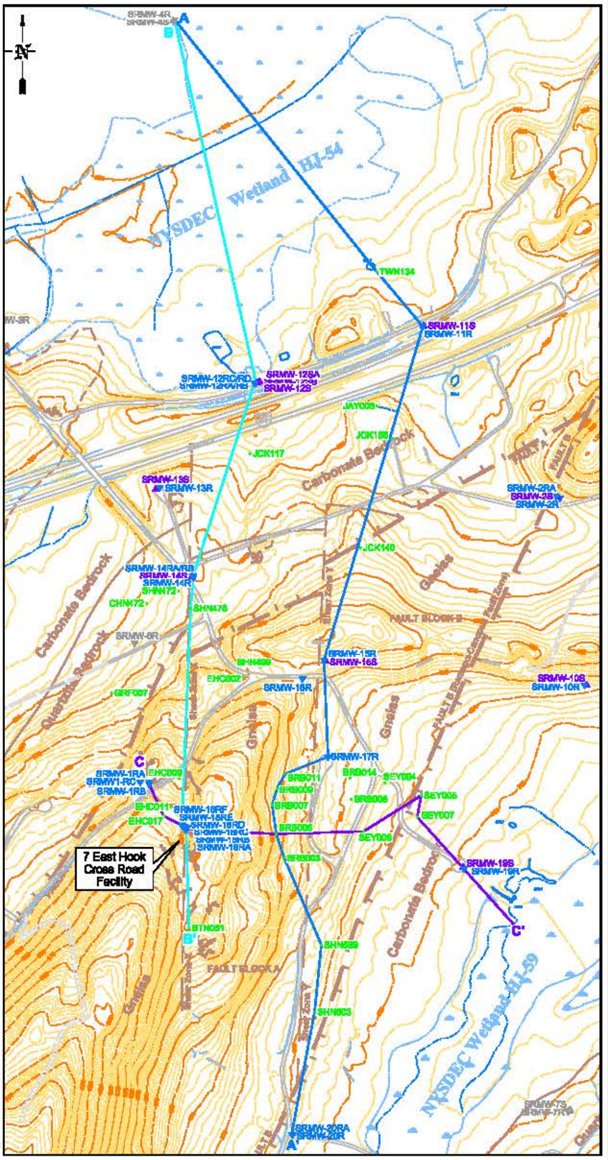
PCE-Series - PCE-normalized total concentration of PCE, TCE, 12-DCE, 11-DCE and VC

Horizontal Scale: 1"=500'
Vertical Scale: 1"=500'
No Vertical Exaggeration

Scale
0 250' 500'

PCE Series Concentrations

▢	5-50 µg/l
▢	50-500 µg/l
▢	500-5000 µg/l
■	> 5000 µg/l



LOCATION MAP LEGEND

▼ - Bedrock Monitoring Well
▲ - Soil Monitoring Well
● - Residential Monitoring Well
- Cross Section Trace
- Bedrock Outcrop
- High-Angle Normal Fault (teeth on downthrown block)
45 - Joint Orientation and Dip Measurement
- Vertical Joint
11 - Foliation Orientation and Dip Measurement
36 - Bedding Orientation and Dip Measurement
- Common High-Angle Joint Orientation

Scale
0 600' 1200'

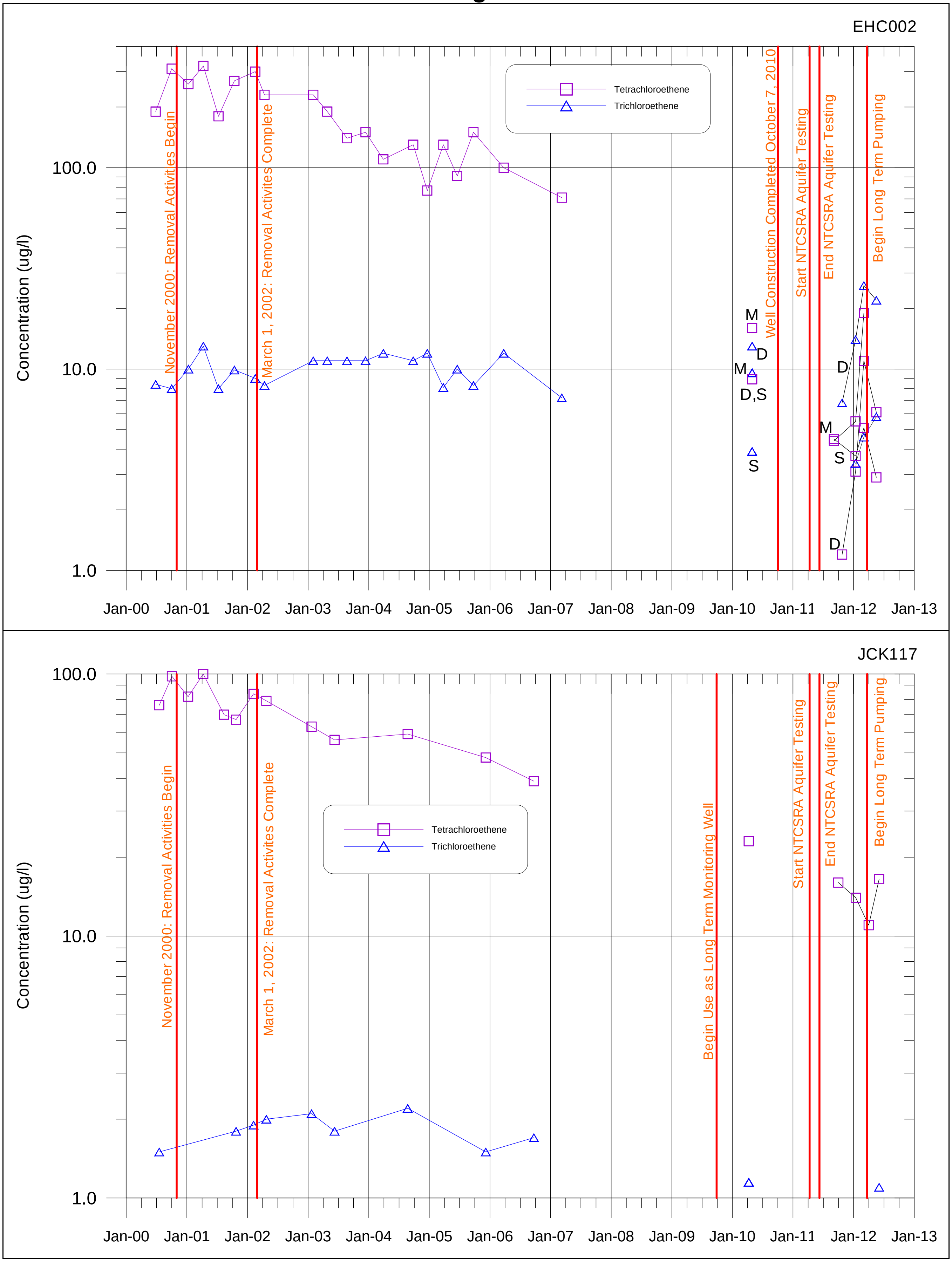
Figure 8

Shenandoah Road Groundwater Contamination Superfund Site Comprehensive Sampling Round - July-October, 2011 - PCE Series Cross Sections

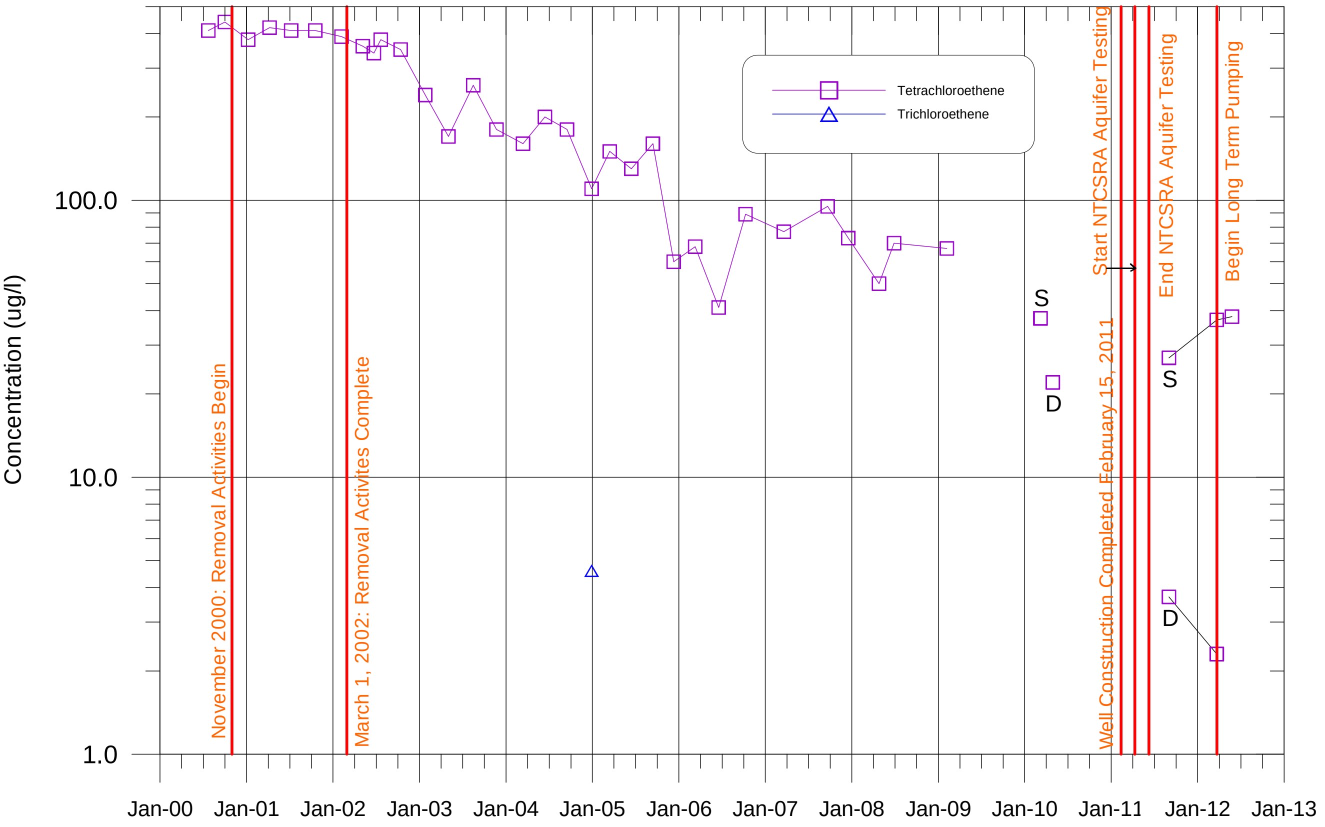
GROUNDWATER SCIENCES CORPORATION

21003-CS09_2 / 09-19-12

Figure 9. Groundwater Concentrations Over Time
Declining Trends



SHN478



SHN499

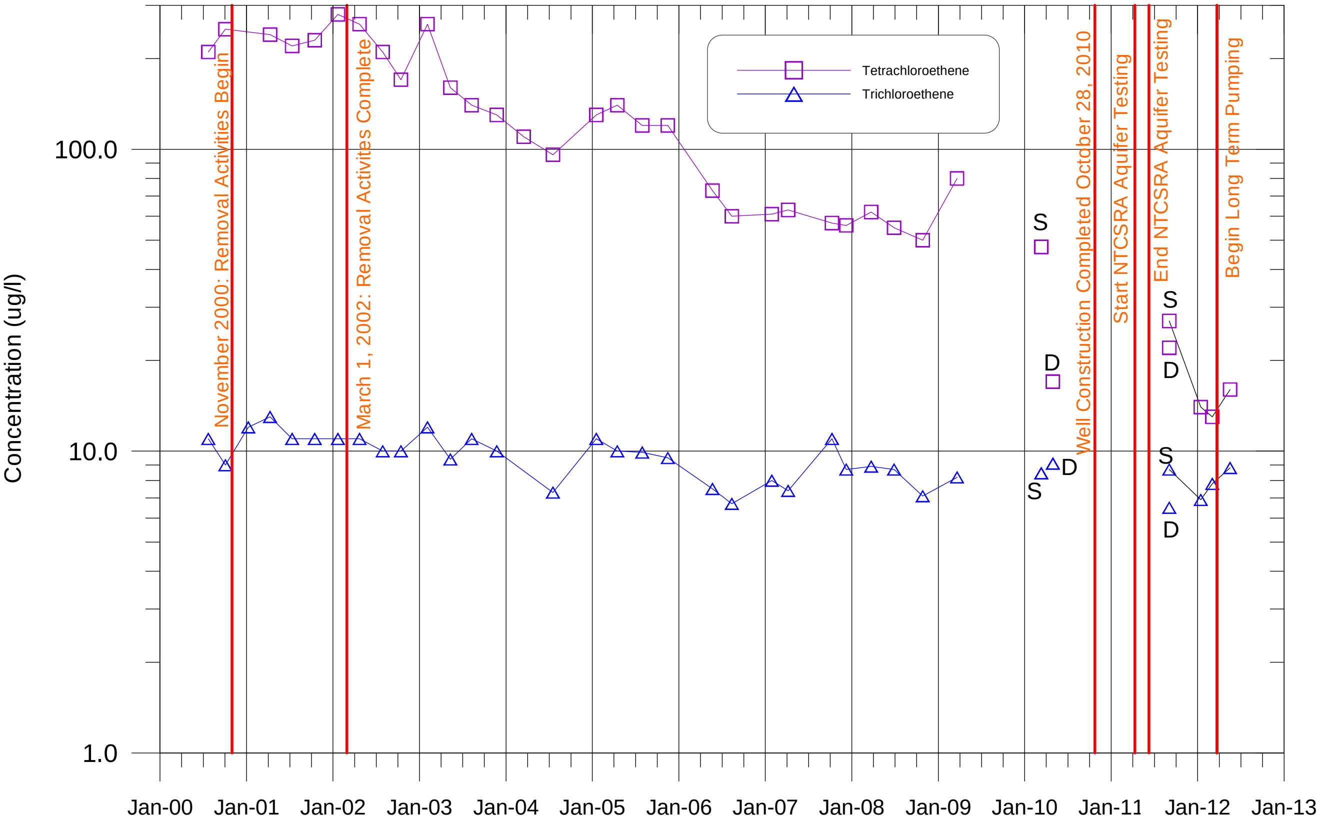
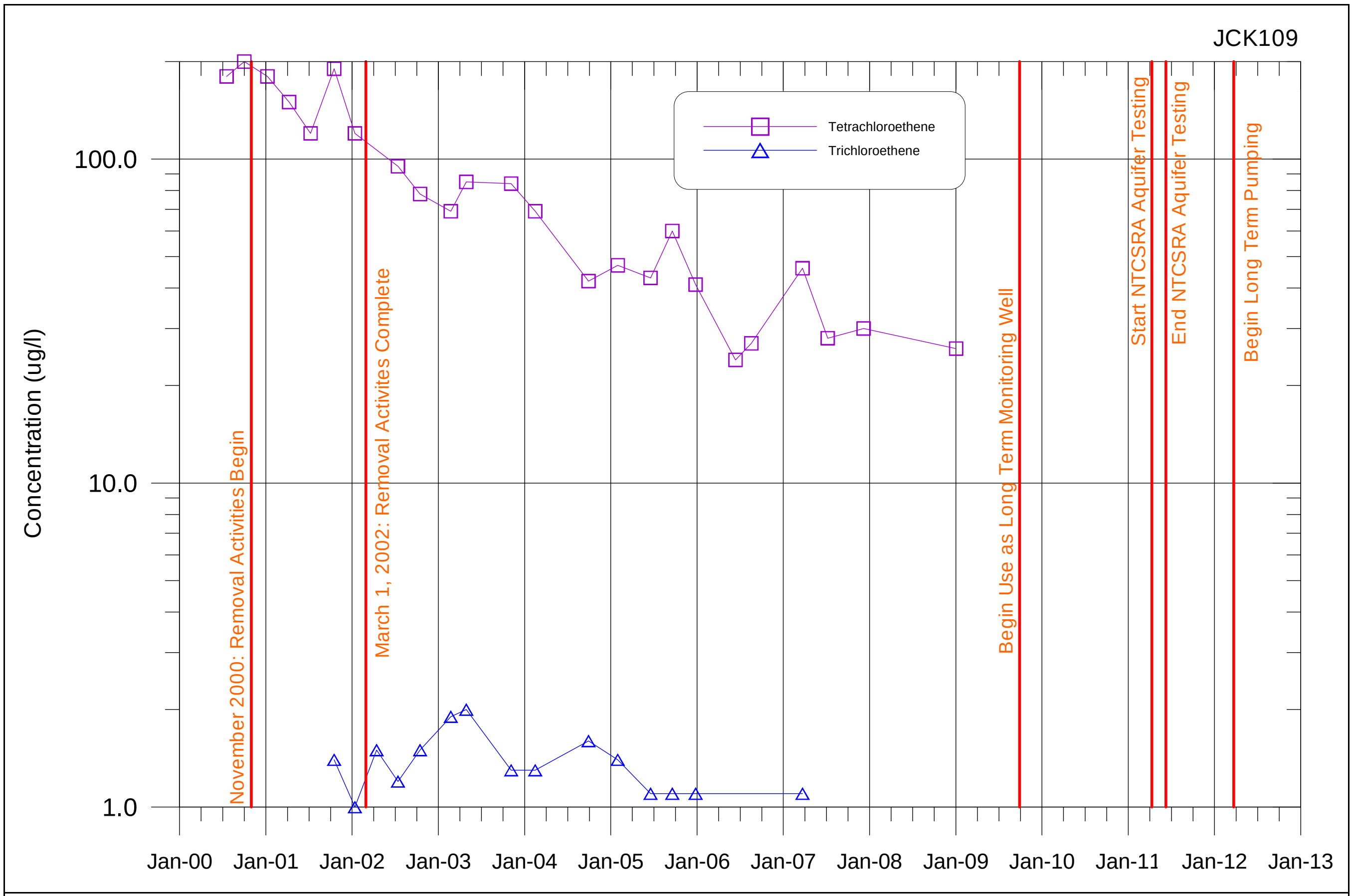
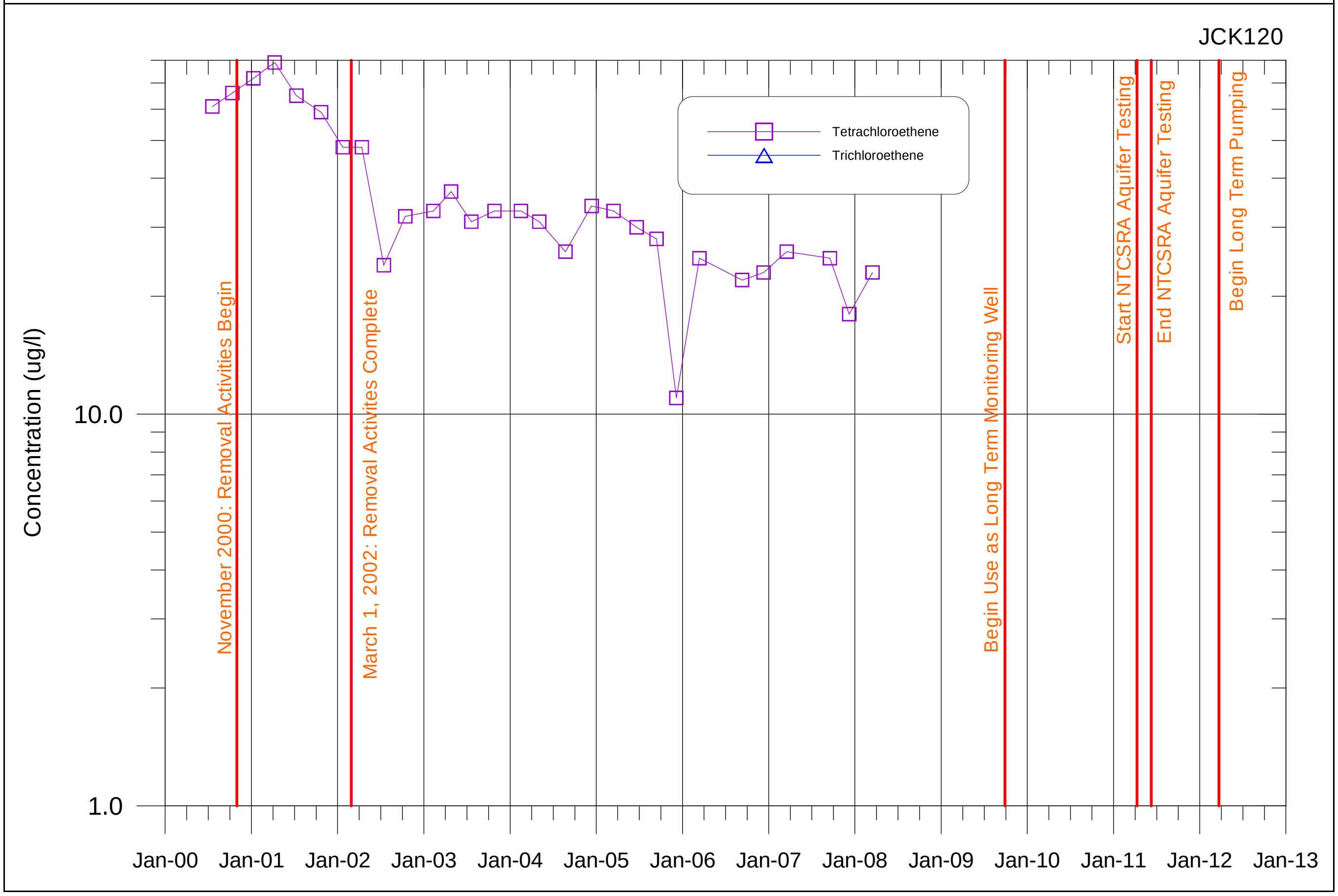
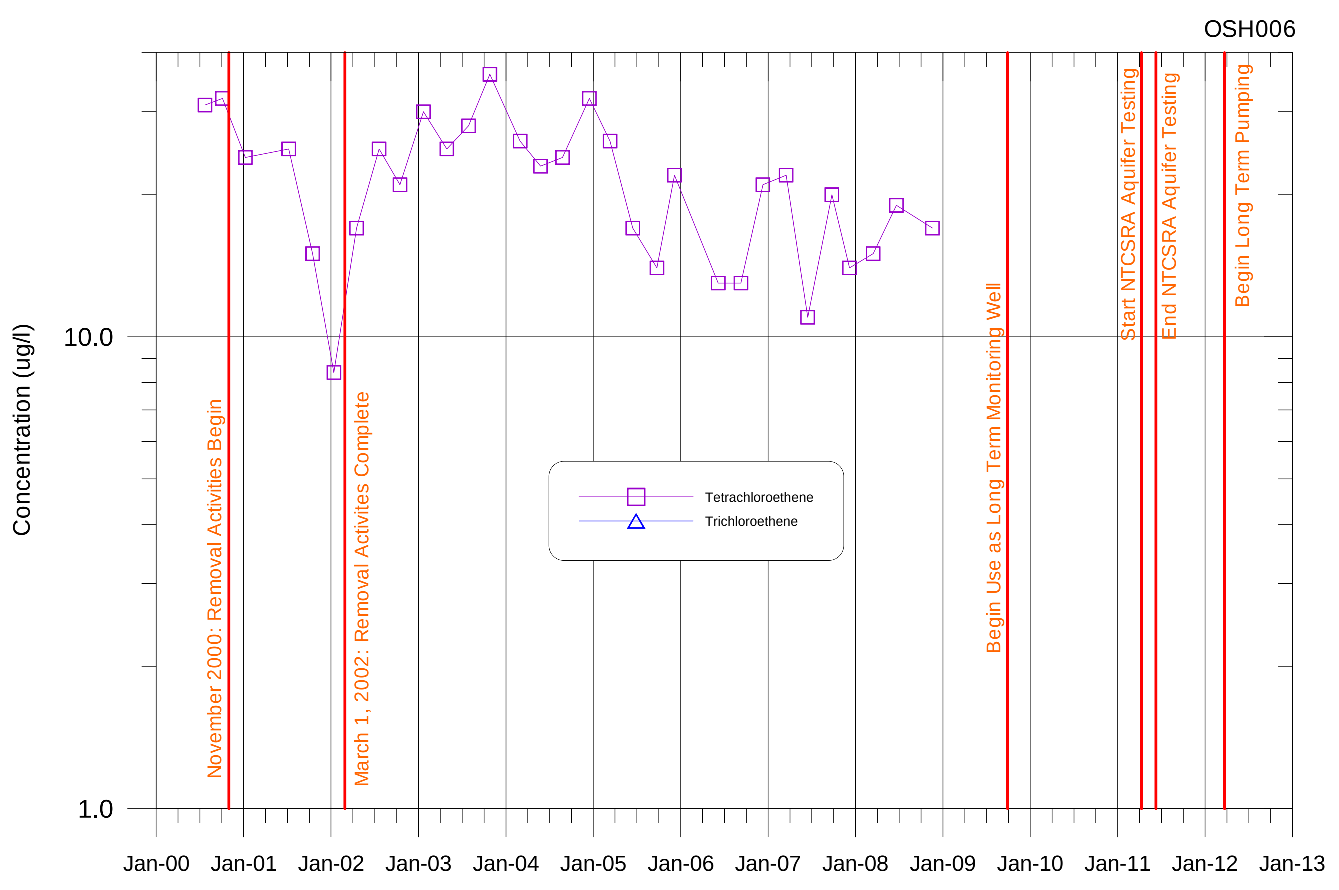
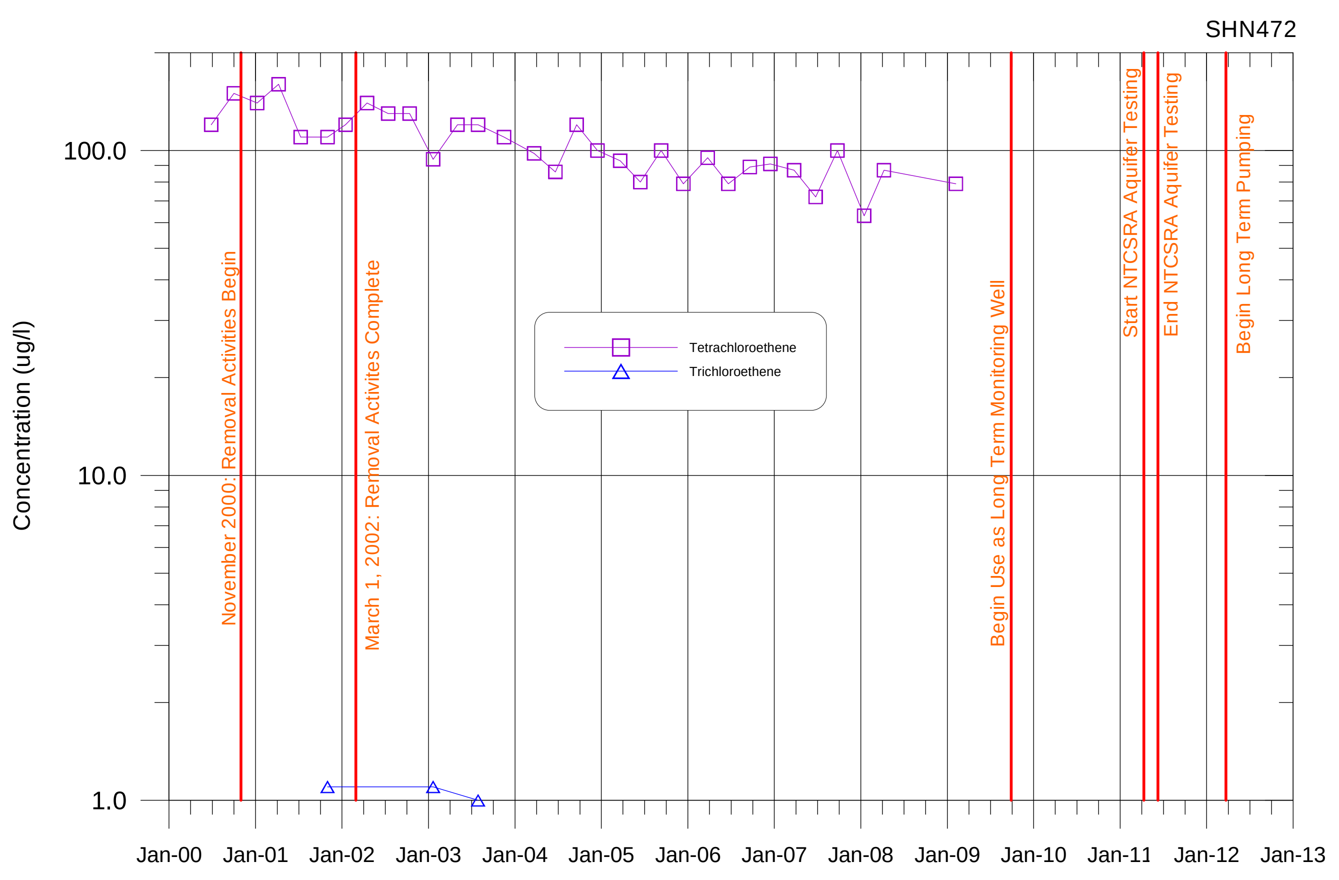


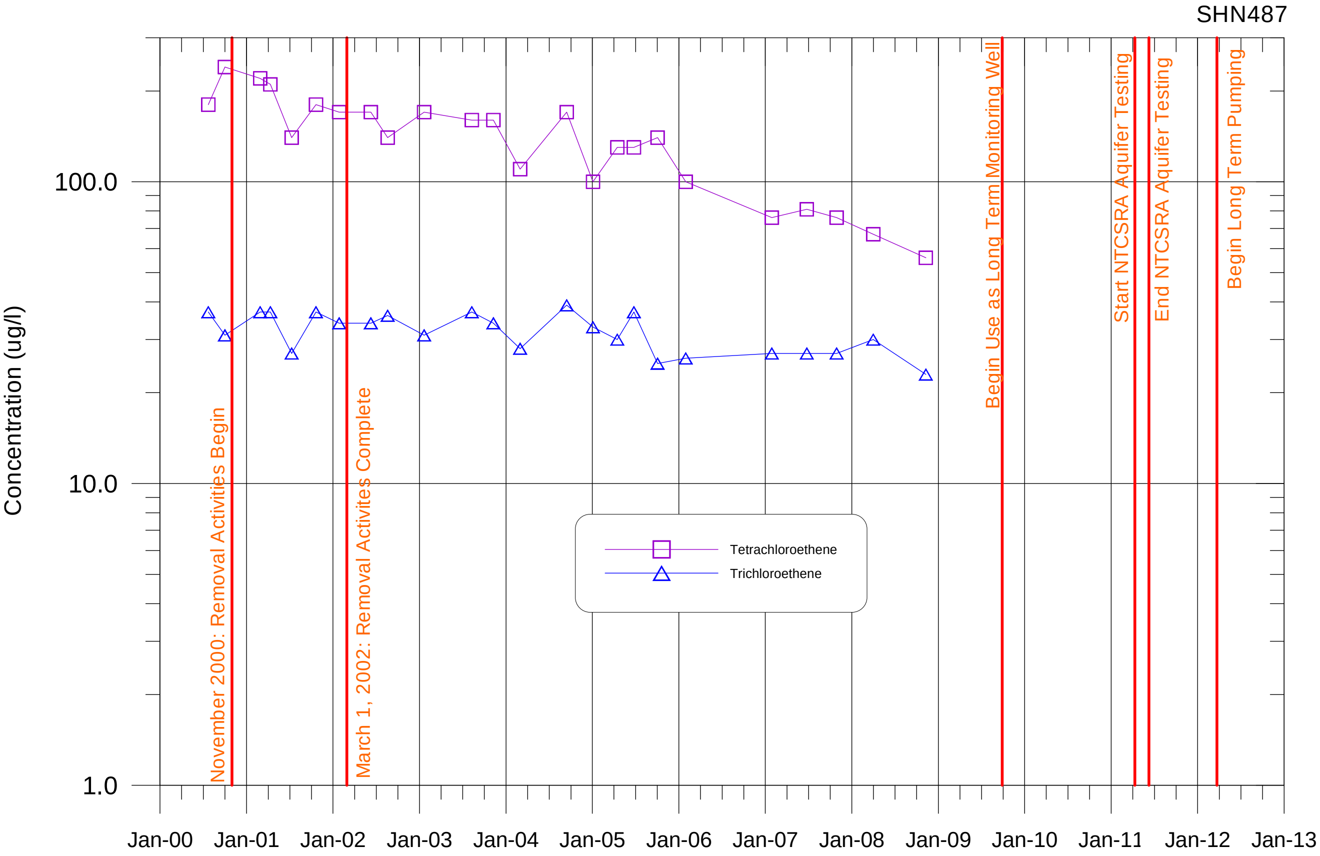
Figure 9


JCK109
Concentration (ug/l)
100.0
10.0
1.0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Tetrachloroethene
Trichloroethene
November 2000: Removal Activities Begin
March 1, 2002: Removal Activites Complete
Begin Use as Long Term Monitoring Well
Start NTCSRA Aquifer Testing
End NTCSRA Aquifer Testing
Begin Long Term Pumping


JCK120
Concentration (ug/l)
10.0
1.0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Tetrachloroethene
Trichloroethene
November 2000: Removal Activities Begin
March 1, 2002: Removal Activites Complete
Begin Use as Long Term Monitoring Well
Start NTCSRA Aquifer Testing
End NTCSRA Aquifer Testing
Begin Long Term Pumping


OSH006
Concentration (ug/l)
10.0
1.0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
November 2000: Removal Activities Begin
March 1, 2002: Removal Activites Complete
Begin Use as Long Term Monitoring Well
Start NTCSRA Aquifer Testing
End NTCSRA Aquifer Testing
Begin Long Term Pumping
Tetrachloroethene
Trichloroethene


SHN472
Concentration (ug/l)
100.0
10.0
1.0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
November 2000: Removal Activities Begin
March 1, 2002: Removal Activites Complete
Begin Use as Long Term Monitoring Well
Start NTCSRA Aquifer Testing
End NTCSRA Aquifer Testing
Begin Long Term Pumping
Tetrachloroethene
Trichloroethene


SHN487
Concentration (ug/l)
100.0
10.0
1.0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
November 2000: Removal Activities Begin
March 1, 2002: Removal Activites Complete
Begin Use as Long Term Monitoring Well
Start NTCSRA Aquifer Testing
End NTCSRA Aquifer Testing
Begin Long Term Pumping
Tetrachloroethene
Trichloroethene

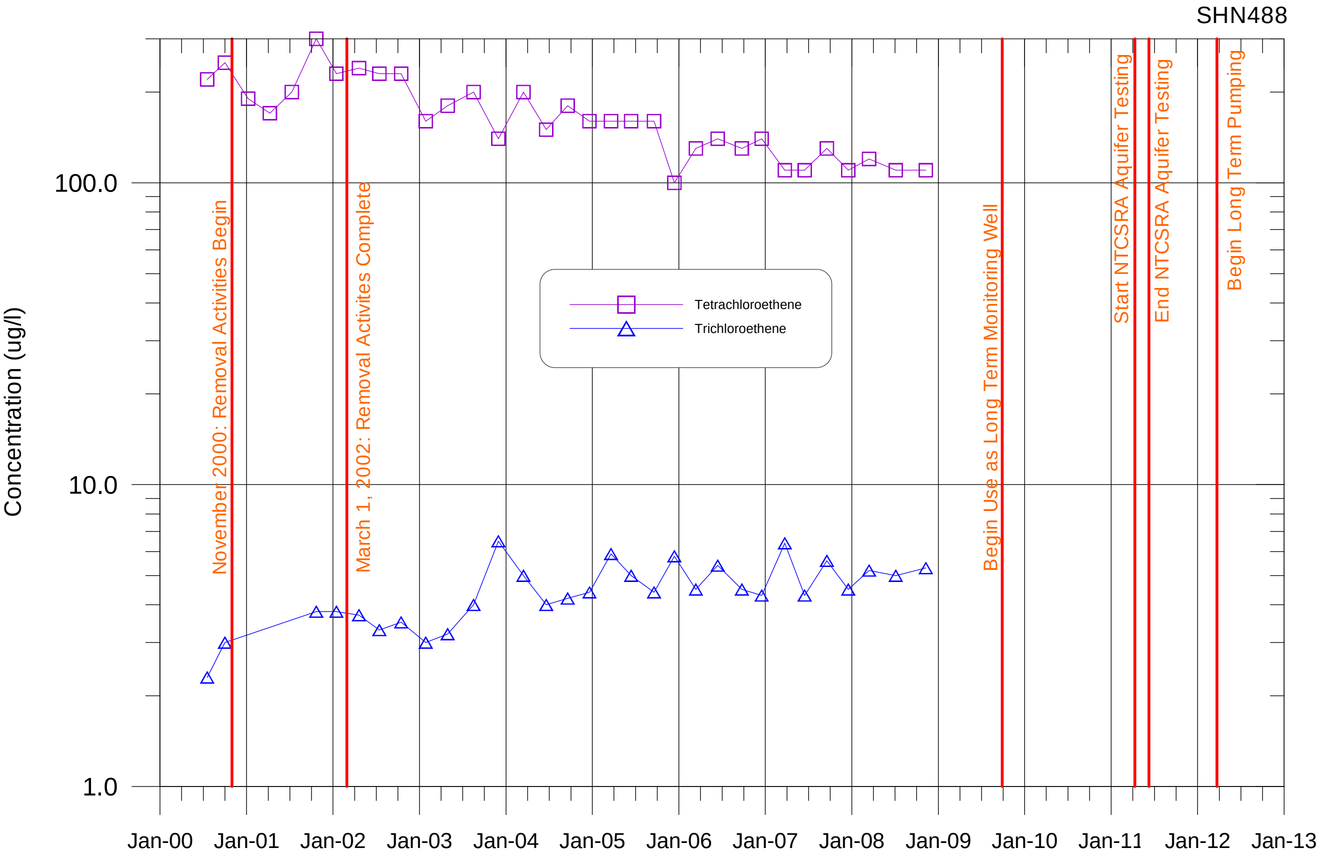
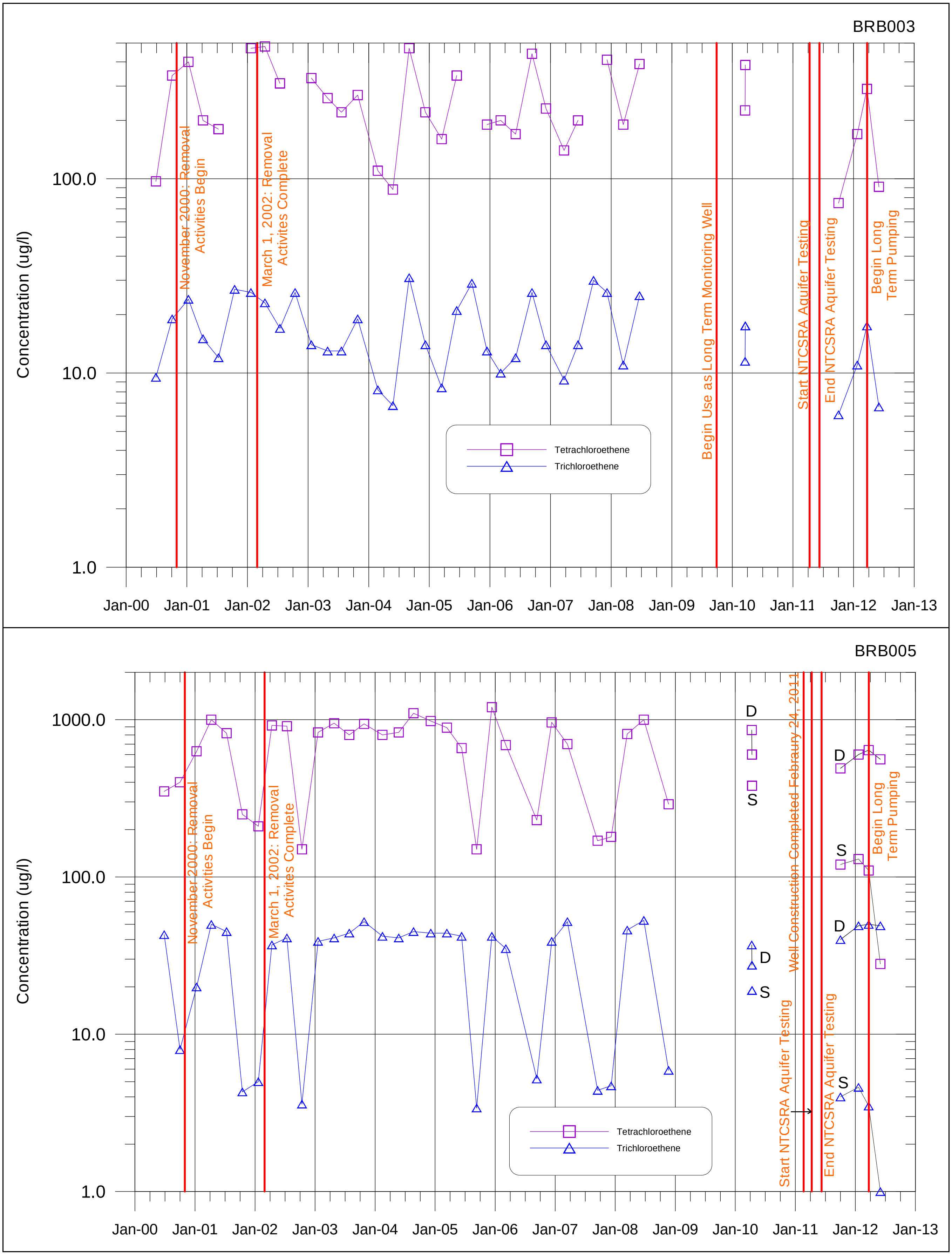
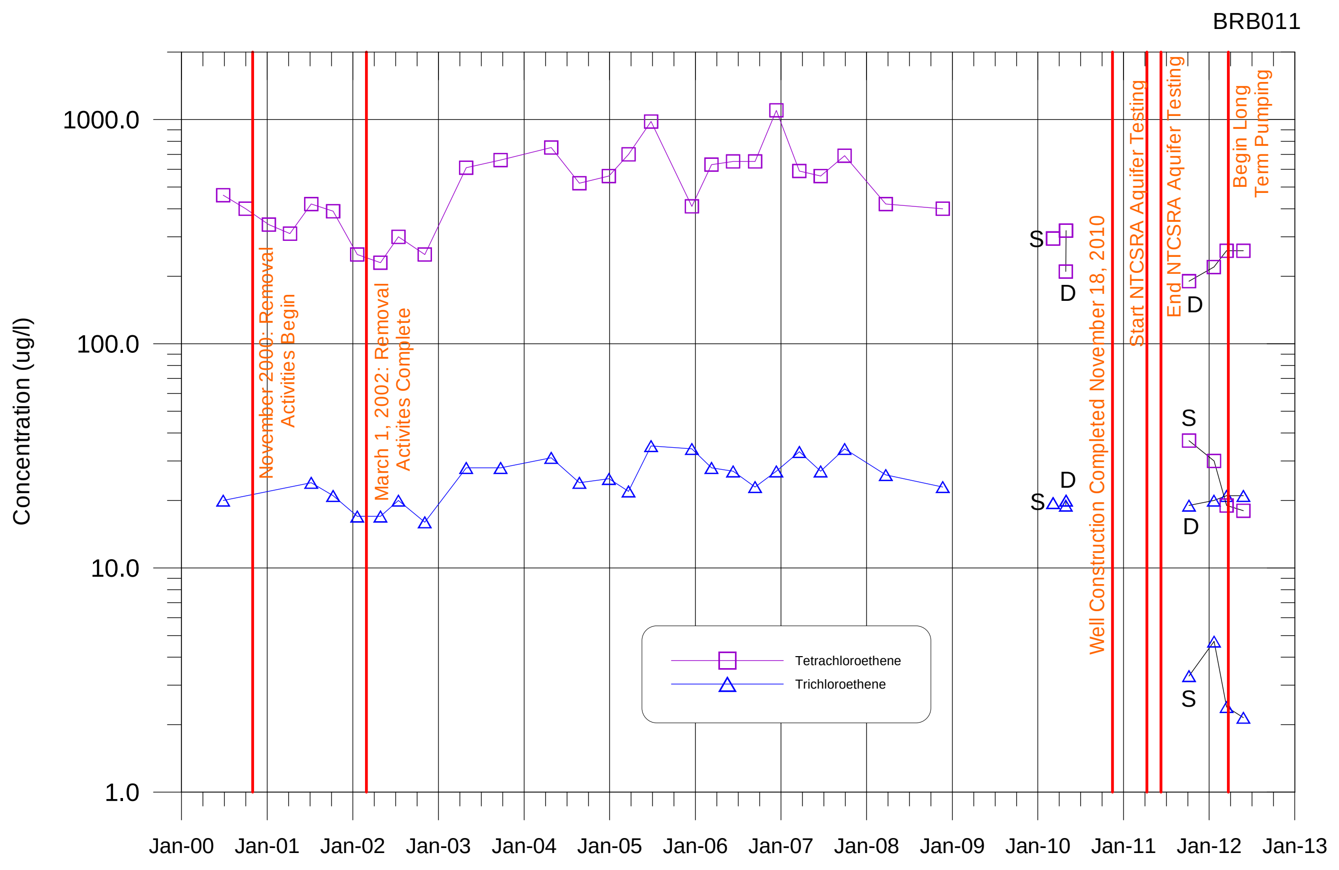

SHN488
Concentration (ug/l)
100.0
10.0
1.0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
November 2000: Removal Activities Begin
March 1, 2002: Removal Activites Complete
Begin Use as Long Term Monitoring Well
Start NTCSRA Aquifer Testing
End NTCSRA Aquifer Testing
Begin Long Term Pumping
Tetrachloroethene
Trichloroethene

Figure 10. Groundwater Concentrations Over Time
Stable Trends




BRB011
Concentration (ug/l)
1000.0
100.0
10.0
1.0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
November 2000: Removal Activities Begin
March 1, 2002: Removal Activites Complete
Well Construction Completed November 18, 2010
Start NTCSRA Aquifer Testing
End NTCSRA Aquifer Testing
Begin Long Term Pumping
S
D
Tetrachloroethene
Trichloroethene

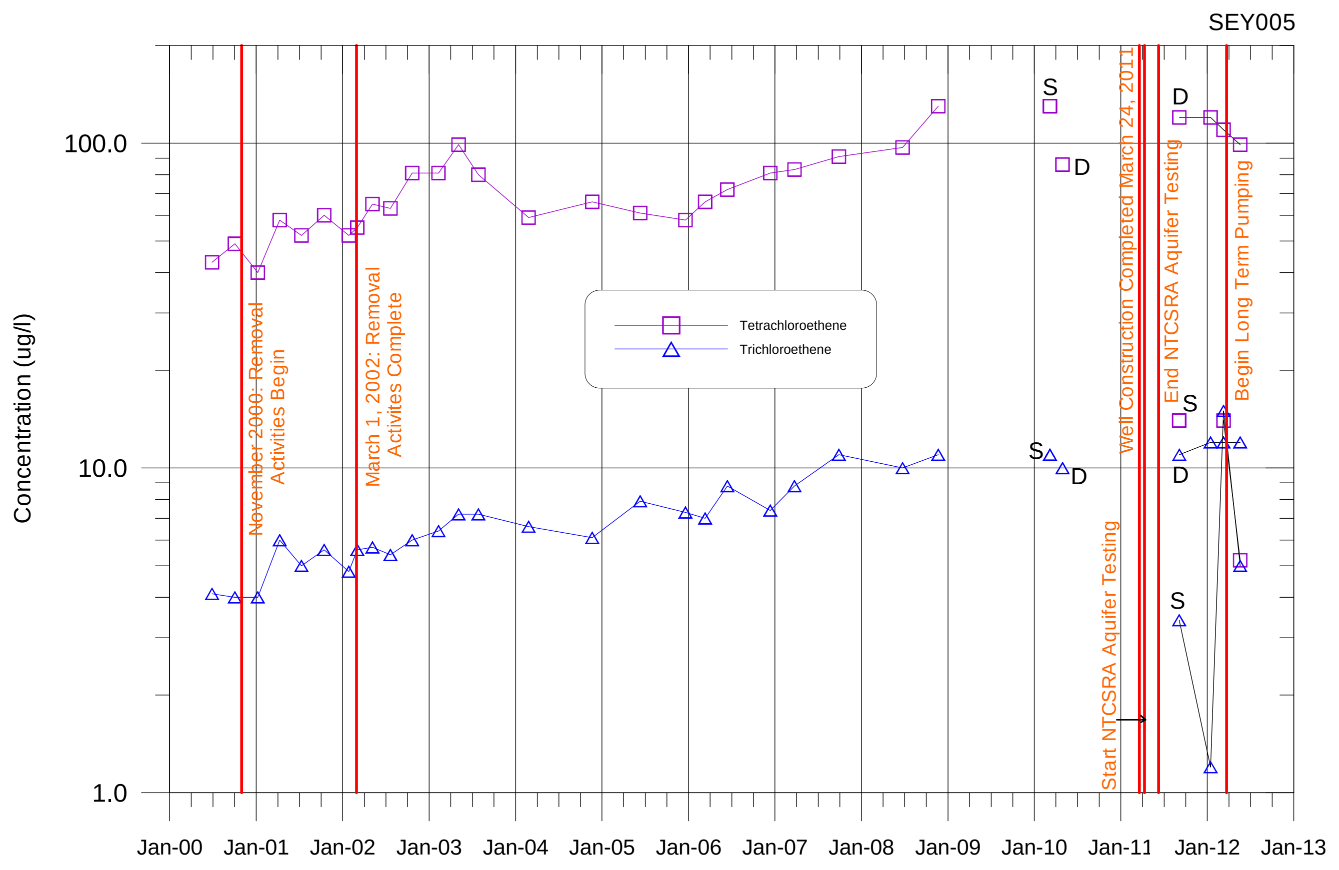
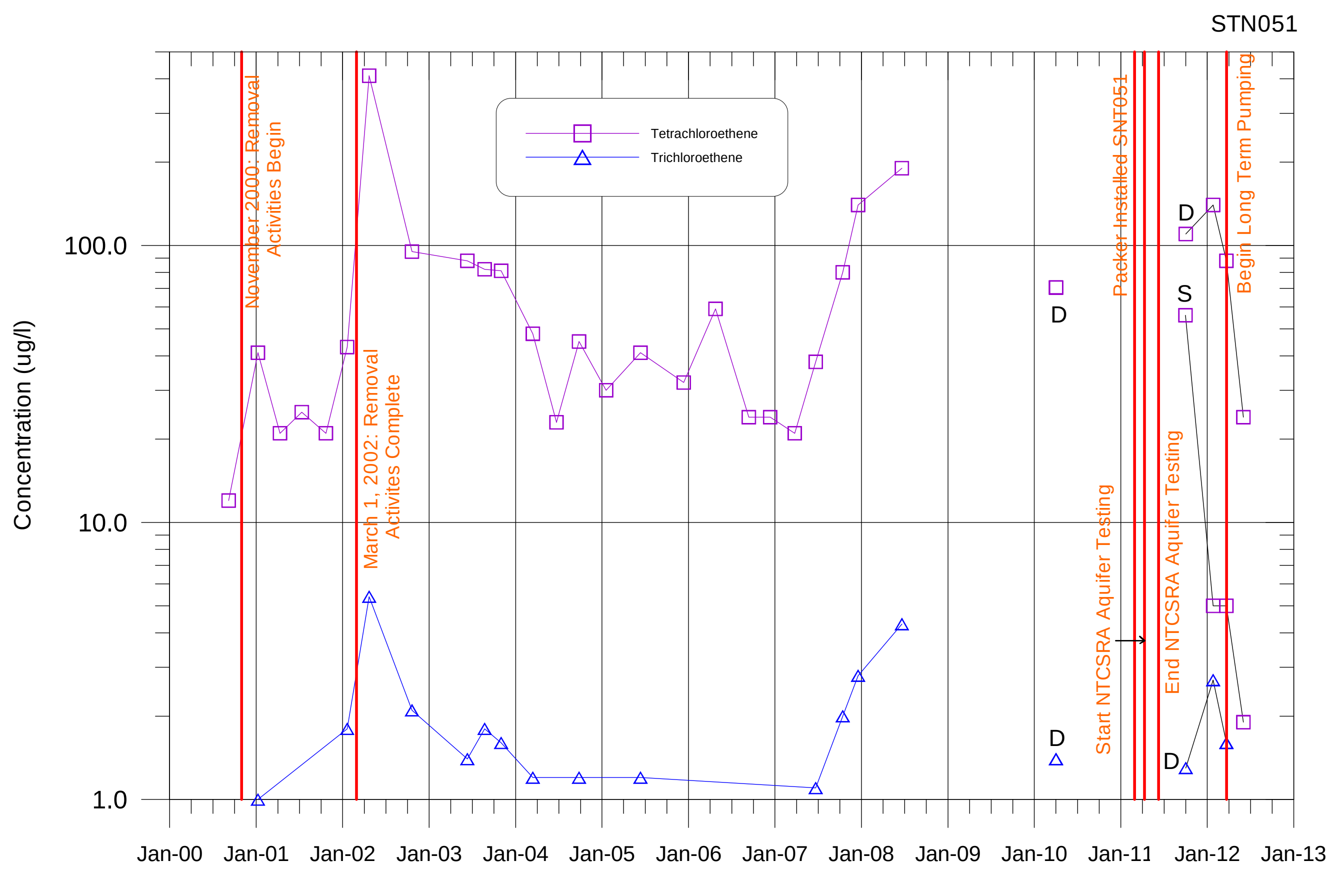

SEY005
Concentration (ug/l)
100.0
10.0
1.0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
November 2000: Removal Activities Begin
March 1, 2002: Removal Activites Complete
Well Construction Completed March 24, 2011
Start NTCSRA Aquifer Testing
End NTCSRA Aquifer Testing
Begin Long Term Pumping
S
D
Tetrachloroethene
Trichloroethene

Figure 10


STN051
Tetrachloroethene
Trichloroethene
Concentration (ug/l)
100.0
10.0
1.0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
November 2000: Removal Activities Begin
March 1, 2002: Removal Activites Complete
Packer Installed SNT051
Start NTCSRA Aquifer Testing
End NTCSRA Aquifer Testing
Begin Long Term Pumping
D
D
D
S
D
D

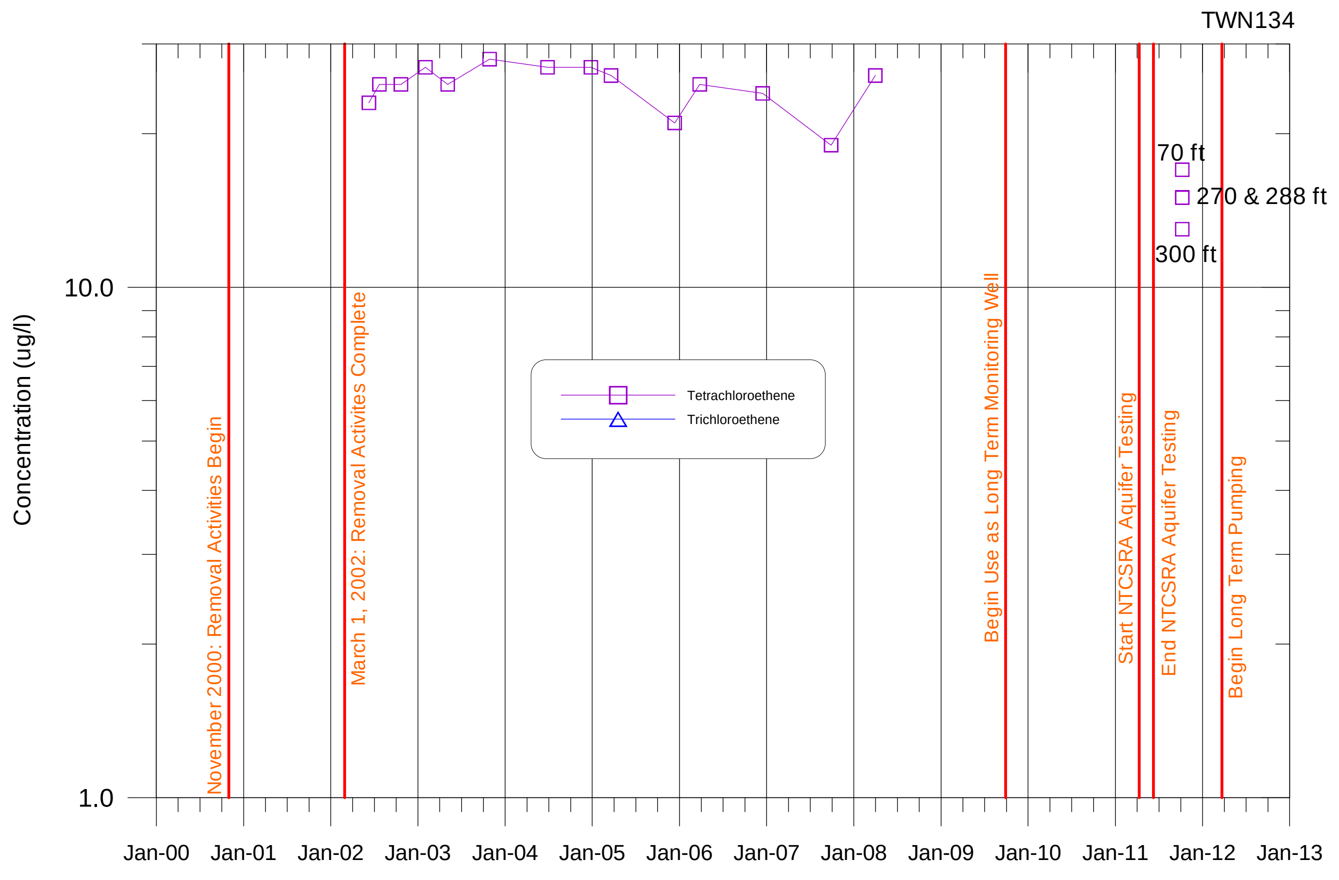

TWN134
Tetrachloroethene
Trichloroethene
Concentration (ug/l)
10.0
1.0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
November 2000: Removal Activities Begin
March 1, 2002: Removal Activities Complete
Begin Use as Long Term Monitoring Well
Start NTCSRA Aquifer Testing
End NTCSRA Aquifer Testing
Begin Long Term Pumping
70 ft
270 & 288 ft
300 ft

Figure 10

SHENANDOAH ROAD GROUNDWATER CONTAMINATION SUPERFUND SITE

RECORD OF DECISION

APPENDIX II

TABLES

TABLE 1
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Tap water

Exposure Point	Chemical of Concern	Concentration Detected		Concentration Units	Frequency of Detection	Exposure Point Concentration (EPC)	EPC Units	Statistical Measure
		Min	Max					
Tap water	cis-1,2-dichloroethene	0.21	41	ug/l	98/426	2.18	ug/l	95% KM (BCA) UCL
	Tetrachloroethene	0.19	16,000	ug/l	320/430	1,424	ug/l	97.5% KM (Chebyshev)
	Trichloroethene	0.21	40	ug/l	199/426	4.217	ug/l	95% KM (BCA) UCL

Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

This table presents the chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs in groundwater. The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC and how it was derived.

TABLE 2
SELECTION OF EXPOSURE PATHWAYS

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Soil	Soil	Facility Property	Trespasser	Adolescent	Ingestion/Dermal	Quant	Trespassers may use vacant landscaped property for recreational purposes
	Groundwater	Sediment		Recreator/Trespasser	Adult/Adolescent	Ingestion/Dermal	Quant	Recreators may use surface water stream beds for recreational purposes
	Groundwater	Surface Water	Properties with surface water receiving streams	Recreator/Trespasser	Adult/Adolescent	Ingestion/Dermal/Inhalation	Quant	Recreators may use surface water stream beds for recreational purposes
	Groundwater	Soil Gas	Residences	Residents	Adult/Child	Inhalation	Qual	EPA directly measuring and addressing indoor air quality for vapor intrusion
Future	Soil	Soil	Facility property	Resident	Adult/Child	Ingestion/Dermal	Quant	Future residents may use property for gardening, play or other activities
				Construction Worker	Adult	Ingestion/Dermal	Quant	Construction/utility workers may have exposure contact with COPCs in soil
	Groundwater	Groundwater	Aquifer – Tap Water	Resident	Adult/Child	Ingestion/Dermal	Quant	Future residents may rely on domestic wells drawing from aquifer
	Groundwater	Air	Water Vapors at Showerhead	Resident	Adult/Child	Inhalation	Qual	Future residents may rely on domestic wells drawing from aquifer
			Soil vapors in trench bottom	Utility Worker	Adult	Inhalation	Qual	Potential for COPCs in groundwater to migrate to trench during construction

Quant = Quantitative risk analysis performed.

Summary of Selection of Exposure Pathways

The table describes the exposure pathways associated with the groundwater that were evaluated for the risk assessment, and the rationale for the inclusion of each pathway. Exposure media, exposure points, and characteristics of receptor populations are included.

TABLE 3

Non-Cancer Toxicity Data Summary

Pathway: Oral/Dermal

Chemical of Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Absorp. Efficiency (Dermal)	Adjusted RfD (Dermal)	Adj. Dermal RfD Units	Primary Target Organ	Combined Uncertainty /Modifying Factors	Sources of RfD: Target Organ	Dates of RfD:
cis-1,2-dichloroethene	Chronic	2E-03	mg/kg-day	1	2E-03	mg/kg-day	Kidney	3000	IRIS	03/29/12
Tetrachloroethene	Chronic	6E-03	mg/kg-day	1	6E-03	mg/kg-day	CNS	1000	IRIS	03/29/12
Trichloroethene	Chronic	5E-04	mg/kg-day	1	5E-04	mg/kg-day	Thymus	100	IRIS	03/29/12

Pathway: Inhalation

Chemical of Concern	Chronic/ Subchronic	Inhalation RfC	Inhalation RfC Units	Inhalation RfD	Inhalation RfD Units	Primary Target Organ	Combined Uncertainty /Modifying Factors	Sources of RfD: Target Organ	Dates:
cis-1,2-dichloroethene	-----	-----	-----	-----	-----	-----	-----	-----	-----
Tetrachloroethene	Chronic	4E-02	mg/m^3	-----	-----	CNS	1000	IRIS	03/30/12
Trichloroethene	Chronic	2E-03	mg/m^3	-----	-----	Thymus/Heart	100	IRIS	03/30/12

Key

-----: No information available
IRIS: Integrated Risk Information System, U.S. EPA
CNS: Central Nervous System

Summary of Toxicity Assessment

This table provides non-carcinogenic risk information which is relevant to the contaminants of concern in groundwater. When available, the chronic toxicity data have been used to develop oral reference doses (RfDs) and inhalation reference doses (RfDi).

TABLE 4

Cancer Toxicity Data Summary

Pathway: Oral/Dermal

Chemical of Concern	Oral Cancer Slope Factor	Units	Adjusted Cancer Slope Factor (for Dermal)	Slope Factor Units	Weight of Evidence/ Cancer Guideline Description	Source	Date
cis-1,2-dichloroethene	-----	$(mg/kg/day)^{-1}$	-----	$(mg/kg/day)^{-1}$	-----	-----	-----
Tetrachloroethene	2.1E-03	$(mg/kg/day)^{-1}$	2.1E-03	$(mg/kg/day)^{-1}$	Likely	IRIS	03/30/12
Trichloroethene	4.6E-02	$(mg/kg/day)^{-1}$	4.6E-02	$(mg/kg/day)^{-1}$	Carc	IRIS	03/31/12

Pathway: Inhalation

Chemical of Concern	Unit Risk	Units	Inhalation Slope Factor	Slope Factor Units	Weight of Evidence/ Cancer Guideline Description	Source	Date
cis-1,2-dichloroethene	-----	-----	-----	-----	-----	-----	-----
Tetrachloroethene	2.6E-07	$1(ug/m^3)$	-----	-----	Likely	IRIS	03/30/12
Trichloroethene	41E-06	$1(ug/m^3)$	-----	-----	Carc	IRIS	03/30/12

Key:

IRIS: Integrated Risk Information System. U.S. EPA
-----: No information available animals
routes

EPA Weight of Evidence:

Carc – Carcinogenic to humans
Likely – likely to be carcinogenic to humans by all

A – Known human carcinogen
B2 – Probably human carcinogen

Summary of Toxicity Assessment

This table provides carcinogenic risk information which is relevant to the contaminants of concern in groundwater. Toxicity data are provided for both the oral and inhalation routes of exposure.

TABLE 5

Risk Characterization Summary - Noncarcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Risk			
					Ingestion	Dermal	Inhalation	Exposure Routes Total
Groundwater	Tap water	Tap water	cis-1,2-dichloroethene	Kidney	3E-02	1.3E-03	-----	3.1E-02
			Tetrachloroethene	CNS	6.5E+00	8.3E-01	1.0E+01	1.7+01
			Trichloroethene	Thymus	2.3E-01	1.0E-02	6.3E-01	8.7E-01
							Hazard Index Total=	19

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Risk			
					Ingestion	Dermal	Inhalation	Exposure Routes Total
Groundwater	Tap water	Tap water	cis-1,2-dichloroethene	Kidney	7E-02	2E-03	-----	7.2E-02
			Tetrachloroethene	CNS	1E+01	1.3E+00	4.1E-01	1.17E+01
			Trichloroethene	Thymus	5E+01	1.7E-02	1.4E-02	5E+00
							Hazard Index Total=	17
							Adult/Child Combined Hazard Index=	36

----- – not available at this time due to no reference dose being available – non-cancer hazards are underestimated
CNS: Central Nervous System

Summary of Risk Characterization - Non-Carcinogens

The table presents hazard quotients (HQs) for each route of exposure and the hazard index (sum of hazard quotients) for exposure to groundwater. The Risk Assessment Guidance for Superfund states that, generally, a hazard index (HI) greater than 1 indicates the potential for adverse non-cancer effects.

TABLE 6

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Dermal	Inhalation	Exposure Routes Total
Groundwater	Tap water	Tap water	cis-1,2-dichloroethene	-----	-----	-----	-----
			Tetrachloroethene	2.8E-05	3.8E-05	3.6E-06	7E-05
			Trichloroethene	3.4E-06	3.3E-06	1.8E-07	6E-06
						Total Risk =	7.6E-05

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Dermal	Inhalation	Exposure Routes Total
Groundwater	Tap water	Tap water	cis-1,2-dichloroethene	-----	-----	-----	-----
			Tetrachloroethene	1.6E-05	3.7E-07	1.4E-06	1.8E-05
			Trichloroethene	7.2E-06	2.3E-07	2.1E-07	7.6E-06
						Total Risk =	2.5E-05
						Adult/Child Combined Risk=	1.0E-04

Summary of Risk Characterization - Carcinogens

The table presents cancer risks for groundwater exposure. As stated in the National Contingency Plan, the point of departure is 10^{-6} and the acceptable risk range for site-related exposure is 10^{-6} to 10^{-4}.

ECOLOGICAL HAZARD INDICES

Table 7 – Surface Water

Compound	Hazard Index	
	LEL	Chronic
Tetrachloroethene	0.11	0.54
Trichloroethene	0.0008	0.017
There were no site-related COCs identified in the sediment, although the pathway is complete.		

Table 8 – Sediment

Compound	Hazard Index	
	LEL	Chronic
Tetrachloroethene	0.008	0.001
Trichloroethene	0.006	0.00025
There were no site-related COCs identified in the sediment, although the pathway is complete.		

Table 9: Soil Monitoring Wells - Date Projections for PCE Concentration Reduction

Period 2002-2009

Well	Target Conc.* (µg/L)	Years to Attainment of Target Conc.	Projected Date***	Target Conc.** (µg/L)	Years to Attainment of Target Conc.	Projected Date***	R^2	n
SRMW-12S	22	12	2024.2	5	36	2048.4	0.91	4
SRMW-12SA	25	8	2020.4	5	27	2039.6	0.75	6
SRMW-14S	20	12	2024.6	5	35	2047.4	0.86	6

***** Target concentrations represent a 50% reduction from the current levels.

** Target concentration equals the NYSDEC Class GA Groundwater Standard

R^2 = Coefficient of Determination, an estimate of the "goodness of fit" of the data to the equation for a line fitted to the data using linear regression. It represents the percent variation of the data explained by the fitted line; the closer the points to the line, the better the fit. The value of R^2 ranges from 0 (random scatter in the data) to 1 (perfect fit to the regression line).

n = number of discrete samples used in the analysis

***These projections were developed while impacts from the primary DNAPL source in bedrock were still affecting PCE concentrations, *i.e.*, prior to the initiation of the source extraction and treatment system operation and are based on a small number of discrete samples. The accuracy of these predictions made from data collected at these locations will improve as more data are collected to monitor the response to operation of the source extraction and treatment system.

Table 10: Bedrock Wells - Date Projections for Achieving a PCE Concentration of 5 ug/L

			Period 2002-2009				Period 2002-2012			
Residential Well	**Date of Last Record**	**Geologic Unit**	**Years to Attainment**	**Projected Date**	**R^2**	**n**	**Years to Attainment**	**Projected Date**	**R^2**	**n**
EHC002	5-21-12	gneiss	7	2019.1	0.67	13	1	2013.4	0.91	18
JCK117	6-7-12	dolostone	10	2022.9	0.87	6	6	2018.5	0.96	11
SHN478	5-29-12	quartzite	4	2016.8	0.79	25	6	2019.0	0.84	29
SHN499	5-21-12	gneiss	7	2019.7	0.83	23	5	2017.7	0.90	28
JCK109	1-5-09	dolostone**	2	2014.7	0.76	18	NA	NA		
JCK120	3-19-08	quartzite**	10	2022.8	0.36	22	NA	NA		
OSH006*	11-21-08	dolostone**	5	2017.5	0.10	26	NA	NA		
SHN472	2-9-09	quartzite	30	2042.7	0.61	25	NA	NA		
SHN487	11-12-08	quartzite**	12	2024.5	0.81	17	NA	NA		
SHN488	11-12-08	gneiss**	23	2035.9	0.76	26	NA	NA		

* The results of the Kolmogorov-Smirnov Goodness-of-Fit Test, or Z test indicate the first order assumption is likely not appropriate for this well.
** - Probable geologic unit
NA - Not available for sampling from 2009 to 2012
R^2 = Coefficient of Determination, an estimate of the "goodness of fit" of the data to the equation for a line fitted to the data using linear regression. It represents the percent variation of the data explained by the fitted line; the closer the points to the line, the better the fit. The value of R^2 ranges from 0 (random scatter in the data) to 1 (perfect fit to the regression line).
n = number of discrete samples used in the analysis

Shenandoah Road Groundwater Contamination Superfund Site

Table 11. Cost Estimates for Alternative #2

Monitored Natural Attenuation (MNA) for Entire Groundwater Plume and Source Extraction and Treatment

NTCSRA 15-Year Operating Costs	**Unit**	**Qty**	**Unit Cost**	**COST**
Carbon (1200 pounds/yr at $804/yr)	each	15	804	$12,060
Electricity (78,843 kw-hr/yr at $0.14/kw-hr)	each	15	11,038	$165,570
Maintenance (600 manhours/yr)	each	15	48,000	$720,000
O&M Project Management (25 manhours/yr)	each	15	3,750	$56,250
Waste Disposal (2 drums/yr at $150/drum)	each	15	300	$4,500
Equipment Maintenance/Parts/Repairs (5% of Capital Cost per year)	each	15	28,503	$427,539
Subtotal Operations and Maintenance				$1,385,919
Total Estimated 15-Year Costs				**$1,385,919**
Present Worth (7% discount rate, 15 year project life) **Discount rate per USEPA policy**				**$841,522**

Monitoring Costs Associated with MNA for Groundwater Plume	**Unit**	**Qty**	**Unit Cost**	**COST**
Extraction Wells / SPDES Sampling and Reporting	ls	1	585,649	$585,649
Hydraulic Effectiveness Monitoring	ls	1	259,150	$259,150
Site Wide Water Levels	ls	1	129,575	$129,575
Remedial Action Monitoring + MNA Sampling	ls	1	2,065,185	$2,065,185
Annual Reporting	ls	1	241,393	$241,393
Five-Year Reviews	ls	1	122,320	$122,320
Total Monitoring and Reporting Costs				**$3,403,272**
Present Worth (7.0% discount rate, 30 year project life) **Discount rate per USEPA policy**				**$1,819,538**

Alternative #2 Total Costs	***$4,789,191***
Present Worth	***$2,661,060***

SHENANDOAH ROAD GROUNDWATER CONTAMINATION SUPERFUND SITE

RECORD OF DECISION

APPENDIX V

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY
FOR THE
RECORD OF DECISION
SHENANDOAH ROAD GROUNDWATER CONTAMINATION SUPERFUND SITE
HAMLET OF HOPEWELL JUNCTION, TOWN OF EAST FISHKILL
DUTCHESS COUNTY, NEW YORK

INTRODUCTION

This Responsiveness Summary provides a summary of citizens' comments and concerns received during the public comment period for the Shenandoah Road Groundwater Contamination Superfund Site (Site) selected remedy as presented in the Proposed Plan. The Shenandoah Road site lies within the boundaries of both the Hamlet of Hopewell Junction and the Town of East Fishkill (Town). This summary also provides the responses by the U.S. Environmental Protection Agency (EPA) to those comments and concerns. All comments summarized in this document have been considered in EPA's final decision in the selection of a comprehensive remedy.

SUMMARY OF COMMUNITY RELATIONS ACTIVITIES

The Remedial Investigation (RI), the Feasibility Study (FS) and Risk Assessment reports describe the nature and extent of the contamination at the Shenandoah Road site, identify the risk to public health and the environment and evaluate remedial alternatives to address the contamination. EPA, in conjunction with the New York State Department of Environmental Conservation (NYSDEC), identified the preferred remedy and the basis for that preference in an August 2012 Proposed Plan. These documents, including the Proposed Plan, were made available to the public in information repositories maintained at the EPA Docket Room in the Region 2 offices at 290 Broadway, 18th Floor, New York, New York and the Town of East Fishkill Public Library and Museum, 348 Route 376, Hopewell Junction, New York.

A notice of the commencement of the public comment period, the public meeting date, a description of the preferred remedy, EPA contact information and the availability of the above-referenced documents were published in the Poughkeepsie Journal, a local newspaper, on Wednesday, August 29, 2012. The 30-day public comment period ran from August 29, 2012 until September 28, 2012. EPA held a public meeting on September 12, 2012 at 7:00 P.M. at the East Fishkill Fire District Administration Building to present the findings of the RI/FS and to answer questions from the public about the Site, the remedial alternatives and the proposed/preferred remedy. The meeting sign-in sheet identified that 14 persons, not including Federal, state and local governmental officials, attended the meeting. These included area business people, residents, journalists and outside remedial contractors. IBM and its contractors provided support to EPA during the public meeting.

Since 2000, a number of removal actions have been performed at the Site. As a result of these actions, a number of citizen participation activities were undertaken in an effort to inform and educate the public about conditions and activities at the Site.

Attached to the Responsiveness Summary are the following Appendices:

- Appendix A - Proposed Plan
- Appendix B - Public Notice in the Poughkeepsie Journal
- Appendix C - September 12, 2012 Public Meeting Attendance Sheet
- Appendix D - September 12, 2012 Public Meeting Transcript
- Appendix E - Written Comments and E-mails Submitted During the Public Comment Period

SUMMARY OF COMMENTS AND RESPONSES

Comments and/or questions were received at the public meeting and in writing via e-mail. A summary of the comments provided at the public meeting and in writing, as well as EPA's responses, are provided below under various categories.

A. PREFERRED REMEDY

Comment #1: Using your current method, how long will it take to reduce the tetrachlorothene (PCE), trichloroethene (TCE) and cis-1,2 dichlorothene (cis-1,2, DCE)?

EPA Response #1: Exact cleanup timeframes are difficult to determine with currently available methods. EPA estimates that the ongoing source extraction and treatment remedy will achieve water quality standards in the bedrock aquifer in approximately 15 years. EPA expects that the monitored natural attenuation (MNA) remedy will achieve water quality standards in the glacial aquifer in approximately 30 years. The effectiveness of the implemented remedies will be evaluated on a continual basis until remedial action objectives are achieved.

Comment #2: How long does it take for PCE to break down into its transformation products of TCE, cis-1,2 DCE, etc?

EPA Response #2: It is difficult to measure the exact amount of time it takes for PCE to break down into its daughter products, namely TCE or cis-1,2 DCE, since this transformation relies on the specific chemical and/or biological conditions that exist within the aquifer or geologic formation. In some portions of the aquifer, there is measured evidence that PCE has already degraded into TCE and cis-1,2 DCE, and, in other areas, evidence of the transformation is expected. The transformation process probably takes on the order of weeks or months, and not years, but it would probably take many months to many years for groundwater to flow through both the bedrock and glacial aquifer systems.

Comment #3: Will the Site still be monitored after it is deleted from the National Priorities List (NPL)?

EPA Response #3: The Site will remain on the NPL until all applicable and relevant and appropriate (ARAR) cleanup goals and remedial action objectives are achieved. At that point in time, further monitoring would not be necessary and the site would be deleted from the NPL. Also, even though a Superfund site may be deleted from the NPL, EPA has the authority to go back to a site to reevaluate it if the conditions warrant further response.

Comment #4: Is the Proposed Remedy identified in the Proposed Plan the same as the Preferred Remedy?

EPA Response #4: They are the same.

Comment #5: Does the Proposed Plan contain everything in the powerpoint presentation?

EPA Response #5: The powerpoint slides for the presentation and the Proposed Plan reflect the same data and conclusions. The exact wording varied somewhat due to minor final editing revisions.

Comment #6: Was bioremediation considered as a remedial alternative?

EPA Response #6: Yes, an enhanced bioremediation alternative was evaluated but was screened out as a remedial alternative at this Site, since there was not sufficient assurance that PCE would be broken down completely to its final degradation product of ethene gas. If the breakdown process is not completed, an undesirable intermediate step could result in the creation of vinyl chloride which has a New York State (NYS) standard of 2 µg/L. Vinyl chloride is also a Class A carcinogen and is more toxic than PCE.

Comment #7: What are the influent levels of PCE concentration in the current extract and treatment system?

EPA Response #7: The influent concentration from the commingling of the four extraction wells is approximately 1500 µg/L of PCE.

Comment #8: Is there a way to determine how much mass you are removing in your filtration system?

EPA Response #8: Yes. There are individual flow meters on each of the four extraction wells. There are also sampling ports associated with each well. By analyzing the concentrations of PCE over time, as well as the measured flow information from each well, we are able to calculate the amount (mass) of PCE that is removed by the system. As the system continues to operate, the mass of PCE removed over time is continually evaluated.

Comment #9: How often are the carbon filters changed for the source extraction and treatment system?

EPA Response #9: The source extraction and treatment system extracts contaminated groundwater from four wells at the 7 East Hook Cross Road Facility (Facility). The influent groundwater then goes through a treatment train process that includes an equalization tank which combines the extracted water from all four wells, sediment filters which remove suspended solids and two granulated activated carbon (GAC) adsorption vessels which remove all site-related contaminants of concern (COCs), such PCE, TCE and cis-1,2 DCE. Sampling of the final effluent from this system (Outfall 001 - Treated Groundwater Remediation Discharge) is conducted monthly as per the monitoring requirements specified in the NYS equivalency permit. The results are then reported monthly to both the NYSDEC and EPA. When there is evidence of initial breakthrough of the GAC, *i.e.*, a detection of a COC in the sample from between the GAC vessels, the GAC in the vessel will be replaced with virgin carbon. This change-out process is as follows: the spent carbon in the lead GAC filter will be replaced with virgin carbon and the second GAC filter with clean carbon will then be switched to the lead position of the treatment train.

Comment #10: If and when the carbon filters fail, would there be any consequence to plant life or wild life from the use of the water in the stream where the effluent water is eventually discharged? Will our property be affected.

EPA Response #10: As discussed in EPA Response #8, the GAC filters are monitored closely so that if there is any indication in the first filter of breakthrough, the GAC in the vessel will be replaced with virgin carbon, precluding any failure of the system to properly treat the groundwater to limits established in the permit; and, the effluent discharge from the system will continue to meet all requirements of the NYSDEC permit. As part of the permitting process, NYSDEC reviews impacts to surface water and ecological receptors and assigns discharge limitations based on the receiving water body classification. EPA has no indication that any residential property in the Site study area will be affected by the system’s discharge to the storm sewer.

Comment #11: Where does the treated water from the source extraction and treatment system discharge?

EPA Response #11: The treated water which shows non-detect for all COCs is discharged through an underground piping system at around 15 to 20 gallons per minute to a storm drain catch basin at the Facility. The discharged water then travels underground via the storm sewer line on that property. In turn, that sewer line connects with the main sewer line along East Hook Cross Road then to Shenandoah Road then north under Interstate-84 then finally discharges to surface water on NYS Department of Transportation property into a local stream, *i.e.*, a tributary of Wiccopee Creek (Water Index Number H-95-13-3-1, Class C), all in accordance with the NYS surface water discharge equivalency permit.

Comment #12: Has the tributary stream of the Wiccopee Creek ever been monitored? And, if so, were there any results from the monitoring?

EPA Response #12: No, this stream is located outside of the Site study area and was not investigated nor monitored during the remedial investigation of the Site.

Comment #13: Why is the clean water effluent of the source extraction and treatment system being discharged to a storm drain and not returned to the aquifer?

EPA Response #13: During the investigative phase of the source extraction and treatment project, two effluent discharge options were considered: 1) release to storm sewer /surface water and 2) injecting to the groundwater or aquifer. Discharging to groundwater was considered less effective, since retuning clean water to the aquifer could affect the hydraulic capture of the source area. NYSDEC approved the discharge to a storm sewer by issuing an equivalent permit for discharge to storm water/ surface water.

Comment #14: Do you plan to monitor for contamination at the junction of the stream and storm drain discharge point?

EPA Response #14: The discharge from the Source Extraction and Treatment System is permitted and monitored as required at the point of discharge to the storm sewer system, *i.e.*, the storm water catch basin located at the Facility. At this point, the effluent discharge water will meet all NYSDEC discharge limitations. There are no plans to monitor the location where the storm water enters the stream.

Comment #15: How much will this project cost?

EPA Response #15: The estimated present worth cost of the project is approximately $2,700,000.

B. SITE HISTORY

Comment #16: How much PCE was dumped at the Facility?

EPA Response #16: There are no historic records to identify the quantity of PCE that was disposed of at the Facility. EPA estimated that approximately 10,000 tons of contaminated soil, both hazardous and non-hazardous, were excavated and removed from the Facility property. The hazardous portion of the soil contained PCE concentrations anywhere from 17,000 micrograms/kilogram (µg/kg) to 250,000 µg/kg.

Comment #17: How long was PCE released into the environment from the Facility?

EPA Response #17: Jack Manne, Inc. operated at the Facility for 10 years from 1965 until 1975.

Comment #18: How deep was PCE found in the bedrock?

EPA Response #18: The highest PCE groundwater concentration at the Facility (16,000 µg/L) was found at an interval between 65 and 75 feet below the ground surface. No PCE chemistry was found below 250 feet. Beyond the estimated capture zone of 16 acres of the source extraction and treatment system, the concentrations in the groundwater plume are at much lower levels than found at the Facility.

Comment #19: Where did the toxic soil go that was excavated and removed?

EPA Response #19: The contaminated soil was dispatched to two facilities: CWM Chemical Services in Model City, New York (near Buffalo, New York) and the Stablex Facility in Quebec, Canada. Both facilities are permitted Subtitle C landfills which are fully permitted and contained to accept hazardous materials.

Comment #20: How much PCE was found in the 1200 gallon septic tank that was buried in the pit? Was there pure PCE found in the septic tank?

EPA Response #20: The septic tank contained PCE-contaminated water, sludge and oil. Approximately 800 gallons of liquid was found in the tank and was contained and shipped to Cycle Chem, Inc. in Elizabeth, New Jersey for treatment and disposal. Approximately, 250 gallons of waste oil and sludge were drummed and transported to Chemtron, Corp. in Avon, Ohio for incineration. The sampling of the 1) liquid (PCE and water) in the septic tank showed a PCE level of 3210 µg/L, 2) the sludge showed a PCE concentration of 14,100,000 parts per billion and 3) the oil showed a PCE concentration of 934,000,000 parts per billion (93% PCE, which is almost pure). All of these materials were classified as hazardous waste.

EPA excavated approximately 1600 tons of soil and other appurtenances surrounding the septic tank. The soil was sampled and found to be non-hazardous waste. The soil was then contained, transported and disposed of as a non-hazardous waste to the Salem County Utility Authority Landfill in New Jersey, an approved Subtitle D RCRA facility.

C. CURRENT CONDITIONS

Comment #21: Are wildlife and plant life affected by the groundwater contamination?

EPA Response #21: The ecological experts who observed the data and established the ecological risk assessment have determined that any contamination that does reach the wetland does not result in any impairment to plant life or wildlife and in addition, volatilizes rapidly upon discharge to surface water in the wetland.

Comment #22: What is the exposure to the public? What were the depths of the residential wells?

EPA Response #22: The human health risk assessment also determined that there is no unacceptable risk from exposure to surface water. There is an unacceptable risk that could result from ingestion of contaminated groundwater. However, this exposure pathway is not complete, since all of the residences which had contaminated wells and the majority of the community are connected to a public water supply system and, therefore, are not drinking the contaminated groundwater. Residential wells were found at various depths from 100 to 600 feet deep.

Comment #23: What are the current levels of contaminants shown in monitoring wells at the outskirts of the plume?

EPA Response #23: With respect to the latest PCE groundwater data: At the northern end of the plume, the highest PCE concentration of 15 µg/L was found in a converted residential well; at the southernmost end of the plume, a monitoring well showed non-detect for PCE; on the eastern end of the plume, the highest PCE concentration of 120 µg/L was found in a converted residential well; and, on the western end of the plume, the highest PCE concentration was 45 µg/L in a conventional monitoring well. For the most part, outside the boundary of contaminant constituents, the COC levels are non-detect.

Comment #24: How deep is the aquifer below the Facility?

EPA Response #24: The bedrock below the Facility is estimated to be many hundreds of feet thick. The deepest drilling interval at the Facility occurred at 500 feet where clean water was found.

D. OTHER ISSUES

Comment #25: One resident had a question about a previous release unrelated to the Shenandoah Road site, *i.e.*, outside of the study area. The resident was also wondering when their residential well will be sampled.

EPA Response #25: Subsequent to the resident's question at the meeting, there was some discussion amongst some of the audience members about previous residential well sampling that was conducted in the early 1980's, nearly 20 years prior to EPA's involvement at the Site, and was specifically related to some kind of volatile organic compound release in the Hopewell Junction area near the northern end of Shenandoah Road and Blue Hill Road. EPA is currently researching this incident through NYSDEC. If any further information is obtained, EPA will forward that to the commenter.

As part of the Site investigation activities, a number of monitoring wells were located outside the limits of Site constituents or contamination, near the northern boundary. These were installed as sentinel wells, in order to mark the boundary of Site contamination. The data from these wells showed levels of non-detect for PCE. Since the resident's well is well north of these locations, there is a strong likelihood that that residential well does not contain site-related COCs. Since the public water supply system has been installed throughout the Shenandoah Town Water District, there will be no further residential well sampling within the Shenandoah community.

Comment #26: One commenter expressed concern that EPA did not provide enough time for additional questions and answers at the public meeting.

EPA Response #26: During the meeting, the participants did not request additional time for questions and answers when the meeting was adjourned. The Agency would have willingly provided additional time. After the meeting adjourned, Agency and other technical personnel remained at the meeting venue for an additional period of time to meet further with any participants who had additional questions and to provide additional information about the Site project that may not have been addressed during the meeting proper.