DRAFT Pre-Design Investigation Report

Burgess Brothers Superfund Site
Woodford and Bennington, Vermont

May 13, 2013

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REPORT

Pre-Design Investigation Report

Burgess Brothers Superfund Site

Woodford and Bennington, Vermont

Prepared for:
Burgess Brothers Steering Committee

May 13, 2013

Disclaimer: This document is a DRAFT document prepared by the Settling Defendants under a government Consent Decree. This document has not undergone formal review by the EPA and VTDEC. The opinions, findings, and conclusions, expressed are those of the author and not those of EPA and VTDEC.

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EXECUTIVE SUMMARY

The following summarizes the key observations and conclusions from the Pre-Design Investigation PDI) at the Burgess Brothers Superfund Site (Site), required under the September 2011 ROD Amendment to advance the Remedial Design (RD) of additional actions for groundwater remediation. Broadly, the recent PDI activities have confirmed the accuracy of the current Conceptual Site Model (CSM) relative to geology, hydrogeology and the nature and extent of groundwater impact. Most importantly, the results of the PDI support the recommendation that groundwater impacts at the Landfill Compliance Boundary be addressed by a groundwater collection/interceptor trench system and not a Zero Valent Iron Permeable Reaction Barrier (ZVI PRB). While not the specific focus on this Report, the PDI has produced new data subsequent to the Focused Feasibility Study (FFS) and ROD Amendment that supports a recommendation to use a similar groundwater collection system in the downgradient area rather than a ZVI PRB.

The key conclusions from the PDI are as follows:

1. The shallow water-bearing overburden consists of the Kame Sand and Ablation Till layers, which are relatively homogeneous with infrequent lithologic changes within each unit. The boundary between the Ablation Till and the impermeable underlying Lodgement Till is marked by a sharp increase in density and reduction in moisture content.
2. Water table elevation data indicate that seasonal changes in groundwater elevations occur relatively uniformly at the Site, and that hydraulic gradients and groundwater flow directions have limited variability during normal periods of rainfall. Upward hydraulic gradients between the Ablation Till and Kame Sand are greatest near the swales and the Unnamed Stream where groundwater discharge occurs; downward gradients are observed at piezometers farthest from the swales and Unnamed Stream.
3. PDI groundwater sampling results provide a detailed characterization of CVOC concentrations in groundwater both vertically and laterally along the two barrier alignments. These results indicate a heterogeneous distribution of CVOC concentrations within the plume; however, the lateral extent of CVOCs is generally consistent with previous data and the CSM. This detailed CVOC data provided the detailed groundwater quality data needed to design the ZVI bench testing parameters.

4. Groundwater concentrations of several inorganic and wet chemistry parameters are not considered to be at elevated levels that would significantly impact long-term ZVI PRB performance. Priority pollutant metals concentrations in groundwater are below ICLs and MCLs.
5. Soil CVOC concentrations are generally consistent with adsorbed phase VOCs in equilibrium with groundwater and soil organic carbon, which is consistent with the CSM.
6. Bench testing demonstrated that ZVI effectively degraded site CVOCs, and the tests yielded CVOC degradation data that can be used to develop design criteria for a PRB that will achieve groundwater remediation goals. However, duplicate ZVI bench tests produced results that confirm significantly higher-than-expected CVOC half-life values, and degradation half-lives appeared to increase at the end of the bench tests at rates greater than expected. The resulting estimates of the volume of ZVI material needed for initial construction and long term maintenance of a PRB is significantly greater than anticipated in the FFS, which was based on information and testing data from other sites.

Although Site conditions are amenable to ZVI PRB technology, the amount of ZVI needed for the initial PRB construction and for long-term maintenance is significantly greater than originally estimated in the FFS. Therefore, the use of groundwater collection trench technology is recommended at the Landfill Compliance Boundary and should be considered in the Downgradient Barrier area.

1.0 INTRODUCTION

1.1 Regulatory Background

On September 30, 2011 the United States Environmental Protection Agency (EPA) issued a Record of Decision (ROD) Amendment to the 1998 ROD for the Burgess Brothers Superfund Site (the Site) requiring supplemental remedial actions to address impacted groundwater. EPA determined that these additional remedial actions are needed to supplement the existing source control remedy. The objective of these actions is to remediate groundwater from the landfill impacted with volatile organic compounds (VOCs) and to supplement the existing management of migration remedy by restoring contaminated groundwater through an engineering technology.

The selected remedy includes installation of two barrier systems, one at the Landfill Compliance Boundary (herein referred to as the Landfill Compliance Boundary Barrier System) and one near the downgradient edge of the high concentration VOC plume (herein referred to as the Downgradient Barrier System) to address groundwater contamination at the Site. In accordance with the First Modification of Consent Decree issued by the EPA and the Vermont Department of Environmental Conservation (VtDEC) - Appendix B RD/RA Statement of Work (SOW), the Settling Defendants must conduct a Pre-Design Investigation (PDI) to: 1) select the appropriate Landfill Compliance Boundary Barrier System technology, and 2) collect sufficient information that will allow for the design and placement of the Barrier Systems that will meet the required performance standards.

In accordance with the submittal requirements in the SOW, the following documents were approved by EPA and VtDEC prior to the start of the PDI field activities:

1. Pre-Design Investigation (PDI) Work Plan, dated June 12, 2012.

2. Project Operations Plan (POP), dated July 2012 and consisting of the following documents:
   - Site Management Plan (SMP)
   - Quality Assurance Project Plan (QAPP)
   - Field Sampling Plan (FSP), and
   - Site Specific Health and Safety Plan (HASP)

1.2 Site Background

The Burgess Brothers Superfund Site (the Site) is located in southern Vermont in the towns of Woodford and Bennington, between Burgess Road and the Walloomsac Brook, as shown on Figure 1-1. The Site

consists of approximately three acres. A site plan showing the existing conditions at the site is included as Figure 1-2.

The landfill occupies approximately 60,000 square feet (sf) or about one and a half acres, and includes a small, approximately 4,000 sf area at its southern end known as the former Lagoon Area where liquid waste was disposed. The Landfill Area is enclosed by a perimeter fence that encompasses 3.26 acres. The Green Mountain National Forest borders the 60-acre parcel to the north and east. A residential dwelling is located approximately 900 feet northwest of the Site. This residence is connected to the public water system.

The site is broadly divided into three areas to address the remedial design, as shown on Figure 1-2 and described below:

Area A – Upgradient of Landfill Compliance Boundary – The area upgradient of the Landfill Compliance Boundary includes the Landfill Area, former Lagoon Area and the capped portion of the former Marshy Area. Area A contains elevated levels of VOCs in groundwater that are orders of magnitude above Interim Clean-Up Levels (ICLs) set forth in the ROD. The landfill area was graded and capped with an impermeable double-membrane system in 1999. A soil vapor/air sparge system was installed in the Former Lagoon Area and operated between 2000 and 2012, when EPA verbally authorized its shutdown.

The former Marshy Area is located hydraulically downgradient of the former Lagoon Area and Landfill Area. Prior to landfill closure, this area was a low-lying marsh with natural surface water drainage swales and landfill leachate seeps, and was the primary area of discharge for groundwater moving beneath the landfill. The landfill capping system was extended over that portion of the former Marshy Area in Area A. In addition, surface water drainage features within Area A were realigned.

Area B – Downgradient of Landfill Compliance Boundary – This area is located immediately downgradient of the Landfill Compliance Boundary and extends southward approximately 200 feet to the W-09 well cluster location. It encompasses part of the Marshy Area described above. This area contains elevated levels of VOCs in groundwater that are orders of magnitude above the ICLs set forth in the ROD. At the time of the ROD, these elevated levels were found in wells adjacent to the Landfill Compliance Boundary and now exist 100 - 200 feet southward beyond

the compliance boundary. Since the ROD the groundwater contaminant plume also expanded approximately 30 feet to the southeast, towards W-06D.

Area C – Downgradient Plume Area – This area extends downgradient from the W-09 location and to where the VOC plume reaches ICLs, between P-02 and P-08. The Area C plume is essentially unchanged since the ROD was issued in 1998.

A Focused Feasibility Study (FFS) was performed to evaluate the current nature and extent of groundwater contamination, evaluate potential human health risks, and develop a range of remedial alternatives to address contaminated groundwater. The FFS was first submitted to EPA in 2007 and, after receiving EPA's comments on this draft in early 2011, a final version was submitted in July 2011 (Environmental Partners Group, 2011).

In September 2011 EPA issued the ROD Amendment with the selected remedy. Based on the evaluations in the FFS the selected remedy was that described above and referred to in the FFS as Alternative 4 with barrier systems at the Landfill Compliance Boundary to contain further migration from the source area (Area A) and a second barrier system downgradient of the highly contaminant plume beyond the landfill (Area B). Monitored natural attenuation remains the remedy for the area downgradient of the second barrier system (Area C).

1.3 Purpose and Objectives

Because groundwater VOC concentrations continue to exceed ICLs downgradient of the compliance boundary, the 2011 ROD Amendment was issued by EPA that requires the supplemental groundwater remedy to be implemented to address this VOC groundwater plume. In accordance with the ROD Amendment, a PDI is to be performed that has the goal of collecting sufficient field and testing data to:

1. Evaluate and select the appropriate remedial approach for the Landfill Compliance Boundary Barrier System, consisting of either a PRB or a groundwater collection trench, that will achieve groundwater ICLs, and

2. Design the appropriate barrier system at the downgradient edge of the high concentration VOC plume (Area B) that will address VOC contaminated groundwater that has migrated beyond the Landfill Compliance Boundary.

In accordance with the SOW, bench scale testing was performed as part of this PDI to determine if zero valent iron (ZVI) can effectively remediate VOC groundwater concentrations to below ICLs at both PRB

locations. The PDI field and bench testing data will be used to develop the design characteristics of the Landfill Compliance Boundary and Downgradient Barrier Systems, including the appropriate ratio of ZVI and sand, the dimensions of the treatment zone, and the total depth of both barrier systems. In addition, geotechnical data was collected to develop the construction requirements for installation of the barrier systems and accompanying monitoring points.

Sufficient data was also collected as part of the PDI to evaluate the viability and design parameters for a groundwater collection trench, should this approach be selected as the preferred approach. An evaluation and recommendation for the Landfill Compliance Boundary Barrier System is presented in Section 4.0 of this PDI Report.

2.0 METHODOLOGY

2.1 Detailed Site Conditions Data

2.1.1 Site Survey

Environmental Partners contracted MSK Engineering and Design, Inc. (MSK) of Shaftsbury, Vermont to perform a detailed site conditions survey in the vicinity of and downgradient of the Landfill Compliance Boundary, including:

- Existing wells and piezometers along both the Landfill Compliance Boundary and Downgradient Barrier area were re-surveyed so that accurate groundwater elevation data could be collected at these locations,
- The topography along the Unnamed stream between the Landfill Compliance Boundary and Downgradient Barrier area was re-surveyed to provide detailed topography in this area,
- The location, ground surface elevation, and top-of-casing elevation for all piezometers installed under the PDI were surveyed, and
- The location of flagging of a wetland within Area B.

Table 2-1 is a summary table showing the survey coordinates, ground surface elevation and top of casing elevation of the new and existing wells and piezometers in the vicinity of the two barrier systems. Figure 2-1 is in updated site plan that incorporates this new survey data.

2.1.2 Wetland Mapping

Wetlands mapping performed as part of the Remedial Investigation (RI) in 1992 was used to determine the extent of wetlands impacts during the landfill capping and closure activities in 1999. The survey of this wetland included the area between the Landfill Compliance Boundary southward to where the Toe of Slope Swale discharges to the Unnamed Stream, and eastward to include the wetland area to in the vicinity of the landfill access road around the toe of the landfill.

Additional wetlands delineation was performed under the PDI in the vicinity of the Downgradient Barrier area. The delineation encompassed a low-lying area between the W-09 well cluster and the Toe of Slope Swale, as well as the wetlands along the Unnamed Stream between the intersection of the Toe of Slope swale and the Unnamed stream to the P-20 piezometer.

The wetland evaluation was performed by Guntlow and Associates, Inc. (Guntlow) of Williamstown, Massachusetts. The wetland survey was performed in accordance with the techniques and standards described in the Wetland Research Program Technical Report Y-87-1 Corps of Engineers Wetland Delineation Manual and the regional supplement to the Corps Of Engineers Wetland Delineation Manual: Northcentral and Northeast Region. Figure 2-2 is an updated plan showing the limit of mapped wetlands at the site. The wetland survey report is included in Appendix A.

The wetland delineation was reviewed in the field by a representative of the U.S. Fish and Wildlife Service (Mr. Kenneth Munney) on May 14, 2012 and again on July 23, 2012.

2.2 Soil Boring and Piezometer Locations

Soil borings were advanced along the alignments of the Landfill Compliance Boundary and Downgradient Barrier Systems to collect lithologic and geotechnical data, and to install piezometers for evaluating hydraulic and groundwater chemical data for designing the barrier systems. The water-bearing zone targeted for treatment by the barrier systems is comprised of the Kame Sand and Ablation Till zones. The dense, low permeability Lodgment Till underlies the Ablation Till and will serve as the key-in material for the barrier systems. Continuous soil cores were collected along the alignment of the compliance boundary and the down gradient barrier systems with the following objectives:

- to obtain detailed lithologic and geotechnical data of the Kame Sand, Ablation Till, and Lodgment Till;
- to perform vertical profiling of VOCs in groundwater;
- and to install piezometers for evaluating hydraulic and groundwater chemical concentrations.

The locations of all soil boring and vertical profiling locations were reviewed with EPA and VtDEC at a site meeting held with representatives of these agencies on May 14, 2012.

The soil borings were installed between July 16, 2012 and August 22, 2012 and consist of the following: at the Landfill Compliance Boundary area, six soil borings for piezometer installations (PZ-1 through PZ-6) and three additional borings for vertical profiling (ML-1 through ML-3); along the alignment of the Downgradient Barrier area, eight soil borings for piezometers (PZ-7 through PZ-10, PZ-12 through PZ-14, and P-24) and two borings for vertical profiling (ML-4 and ML-5). The soil boring and vertical profiling locations are shown on Figure 2-1.

2.3 Soil Boring Installation

Aquifer Drilling & Testing, Inc. (ADT) of Hartford, Connecticut, under subcontract to Environmental Partners Group, performed the drilling of the soil borings, vertical profiling and piezometer installations. The borings were drilled using the Geoprobe® Model 8140 LC Rotary Sonic drilling rig. The source of water for drilling and installing the piezometers was from the Town of Bennington at a hydrant located on Burgess Road near the entrance to the former Burgess Brothers Construction office.

In general, most soil boring locations were completed in accordance with the described methodologies outlined in the POP, including the FSP and QAPP. Some of the boring locations were adjusted from their proposed location during the field activities due to access restraints, spacing requirements, or difficult subsurface drilling conditions. Two of the vertical profiling locations (ML-2 and ML-5) were combined with nearby piezometer locations (PZ-3 and PZ-9) because they are immediately adjacent to each other and less than approximately 10 feet apart.

2.3.1 Drilling and Soil Coring Methods

The borings were drilled using 6-inch casing and a 4-inch drill bit. A 5-foot core barrel was advanced ahead of the outer drill casing, without the addition of drilling fluids or water. The outer drill casing was then advanced to the same depth, which sometimes required the addition of water to drill through harder materials (cobbles, boulders, dense till).

The material within the core barrel was extruded into a plastic liner to be measured, logged and analyzed. Continuous cores were collected at each location from the ground surface to a depth of approximately five feet into the basal Lodgment Till, which ranged in depth from 20 to 35 feet bgs across the Site.

2.3.2 Lithologic Characterization

Samples were laid out sequentially onto plastic sheeting and initially cut open at 1-foot intervals for screening for total VOCs with a PID. If the initial VOC screening concentrations exceeded 5 ppb, then a soil sample was collected for jar-headspace analysis in accordance with the FSP. VOC readings were recorded in the field book. Once the PID screenings and jar-headspace sampling activities were completed the sample within the plastic liner was split open, photographed and described. Each core was described for lithology in accordance with the FSP and detailed lithologic logs prepared. The boring logs and lithologic descriptions are included in Appendix B. Sampling of the soils is described in further detail in Section 2.4.

Following is a summary of the subsurface stratigraphy encountered at the site and criteria used to classify each unit.

1. As part of the landfill closure activities, clean fill was use to cap the former Marshy Area soils downgradient of the landfill cap. The fill material consisted of sand and gravel. The lower limit of the fill was delineated by the presence of marshy material.
2. Marshy Area sediments were identified in borings along the Landfill Compliance Boundary and contained layers of dark gray or black organic material, with pieces of wood.
3. The Kame Sand consisted of very fine to fine sands with silt, and was generally loosely consolidated and friable.
4. The Ablation Till consisted of poorly sorted sand and gravel with some silt. At some locations the Kame Sand and Ablation Till contact was gradational.
5. Lodgement Till was similar in composition to the Ablation Till and consisted of poorly sorted sand and gravel with some silt. The top of the Lodgement Till was identified by the material being more dense, difficult to break open, and dry in the middle of the cores.

2.3.3 Geotechnical Characterization

Bulk soil samples were collected for geotechnical analyses and were tested at Geotesting Express in Acton, MA, the laboratory identified in the QAPP for the project and that was approved by EPA. The samples were collected from each distinct soil type within the Kame Sand, Ablation Till, and Lodgment Till and analyzed for the following geotechnical parameters.

- Grain Size Distribution (ASTM D422-63) and Soil Classification, Unified Soil Classification System (ASTM D-2487)
- Atterberg Plasticity Indices (ASTM D4318-00)
- Moisture Content (ASTM D2216-98)
- Compaction Characteristics (ASTM 698-07e1) (Kame Sand only, to evaluate suitability as a work platform material)
- In Situ Density (ASTM D2937-04)
- Direct Shear Test (ASTM D3080) (One sample from each lithologic unit at each barrier location)

Table 2-2 summarizes the geotechnical samples that were collected.

All of the geotechnical samples were collected from the sonic cores. In general, most of the geotechnical samples were collected in accordance with the PDI WP and were discreet samples from the sonic cores.

Some of the samples were composited from multiple borings within each stratigraphic unit (i.e., Kame Sand, Ablation Till or Lodgement Till) to achieve the minimum sample volume required of the analytical method. Because the bulk core samples could be re-formed for analysis at the laboratory the use of split spoon samplers fitted with brass liner tubes were not required, as was anticipated in the PDI. The field sample collection program is summarized in Table 2-2.

2.3.4 VOC Pre-Characterization Samples

Groundwater and saturated soil samples were collected from locations along the alignment of both barrier systems to establish pre-treatment concentrations for VOCs, metals, and natural attenuation parameters. The pre-characterization data was also collected to support the development of soil management alternatives to be evaluated during the Remedial Design phase, including consolidation of these materials under the existing landfill capping system or capping them on top of the existing landfill area.

Soil samples collected from soil borings were screened in the field for total VOCs using a PID. Soil samples were collected for laboratory analysis of VOCs from the intervals with the highest total VOC PID readings. The soil samples were collected using an EnCore® soil sampler, in accordance with the procedures described in the FSP and QAPP. Two discrete samples were collected from each interval and placed in laboratory supplied containers. One was preserved in methanol for high level VOC analysis, and the second put in a container with de-ionized water for low level VOC analysis. Both samples were placed immediately on ice and shipped to the laboratory for delivery within 48 hours of collection.

A total of 13 soil samples from were submitted to Test America Laboratories (Test America) in Burlington, Vermont, the QAPP approved laboratory, for laboratory analysis of VOCs by EPA SW-846 Method 8260B. Ten samples along the alignment of the Landfill Compliance Boundary Barrier System were collected and three were collected along the alignment of the Downgradient PRB. The samples with the highest jar headspace measurements were selected for laboratory analysis. The quality assurance (QA)/quality control (QC) samples that were collected are discussed in Appendix G.

Collection of groundwater samples for VOC characterization is discussed in Section 2.8.

2.4 Piezometer Installation

One single piezometer and 12 piezometer couplets were installed as part of the PDI field activities. The single piezometer was installed near where the Toe of Slope Swale discharges to the Unnamed Stream and was screened in the Kame Sand to confirm shallow hydrology in this area. Also installed were six

piezometer couplets along the Landfill Compliance Boundary and six piezometer couplets in the Downgradient Barrier area. These nested piezometer couplets consisted of one piezometer screened in the Kame Sand and one in the Ablation Till. The screen zones were selected based on the following criteria:

1. Within the Kame Sand and Ablation Till, the well screens were located in the interval with the highest PID headspace screening levels to evaluate the maximum VOC concentrations at that location.
2. In the absence of elevated PID readings, the Kame Sand and Ablation Till piezometers were screened across the intervals with higher permeability based on the field lithologic characterization.

The piezometers were constructed using 1.5-inch Schedule 40 PVC riser and 0.010-inch slotted screen. All screen lengths were 5 feet, except vertical profiling location ML-2/PZ-3 where the screens were 2 or 3 feet in length. No. 2 sand was placed around the screen, and #00 choker sand was placed 0.75 feet above and below the screen interval to prevent expansion of bentonite into the screen interval. A minimum of 2 feet of bentonite was placed between the sand packs to isolate the well screens. Piezometer construction logs are included in Appendix B.

After installation, Environmental Partners developed each of the piezometers by surging, injecting with air and over-pumping, by purging at least three to five well volumes of water.

2.5 Discrete-Zone Sampling/Vertical Profiling

Five soil borings were targeted for collection of vertical profiling samples for VOCs, three along the Landfill Compliance Boundary Barrier System and two along the Downgradient Barrier System. Discrete-zone sampling was performed at ML-1, ML-3, ML-4 and ML-5. Vertical profiling location ML-2 was combined with PZ-3 and ML-5 was combined with PZ-9. Discrete-zone sampling was used for vertical profiling of groundwater at all proposed ML locations except ML-2, located near the W-04 well cluster. Difficult drilling at this location made vertical profiling infeasible. Four nested piezometers were installed at this location, with two screened in the Kame Sand and two in the Ablation Till.

The preferred approach for vertical profiling of VOC concentrations in groundwater was to use a discrete-zone sampling device. This was performed using a direct-push sampling probe (Geoprobe SP-16) that was driven into the formation ahead of the drill bit, starting at the top of the water table. The closed sampler was pushed ahead 5 feet into the formation, and then the outer casing retracted 2 feet to expose

the sampling screen and allow the formation water to flow into the probe. At a few locations, the screen was retracted 3 feet, because of insufficient recharge within the 2 foot section. A peristaltic pump was used to collect the discrete zone samples. Prior to collecting the discrete zone samples, the interval was purged to ensure that a representative sample is collected. At most locations the sampler was purged dry one to three times and allowed to recharge before collecting laboratory samples. If the sampler did not go dry then three to five well volumes was purged prior to sample collection.

After the groundwater samples were collected, the sonic core barrel was advanced 5 feet and soil samples were cored to the top of the next groundwater sampling interval. Continuous vertical profiling groundwater samples were collected beginning at the approximate seasonal low water table level and extending to the top of the Lodgment Till.

Due to difficult drilling conditions at ML-2, one discrete zone sample was collected from 8-10 feet bgs and piezometers were used to sample the remaining intervals. At ML-5/PZ-9 discrete zone groundwater samples for analysis of VOCs were collected from three zones; and a piezometer couplet was installed in the boring. Piezometers installed for vertical profiling of groundwater were 1.5-inch diameter and constructed with 2 or 3 feet of 0.010-inch slotted screen and schedule 40 PVC riser to the ground surface.

2.6 Hydraulic Monitoring at Barrier System Locations

2.6.1 Groundwater Elevation Monitoring

Data logging pressure transducers were installed in 29 piezometers and 11 wells around the landfill to monitor groundwater levels in the Kame Sand and Ablation Till. Onset HOBO water level loggers were used to record total pressure in the wells (i.e., the head of water above the sensor plus atmospheric/barometric pressure). Two barometric data loggers (one primary and one backup) were installed in the W-31S1 and W-31T wells above the water table, at a depth of approximately 15 to 20 feet bgs. This was done to provide a stable temperature environment for the barometric loggers and thereby increase their accuracy. All water-level measurements were adjusted for barometric pressure using one of these two barometric pressure recording data loggers. The Onset data logger software (HOBOware Pro version 3.1.1, 2010) was used for the barometric pressure compensation of the water levels. The water level loggers and barometric loggers were programmed to collect measurements at six-hour intervals.
The following table summarizes the locations and dates that water level loggers were installed. All of these water level loggers are still in operation.

Date Installed	*Location*
1/31/2006	W-31S1, W-32S1, W-32T, W-04D, W-04T, W-09S1, W-09TD
5/14/2012	W-06D, W-03, W-05, W-25S1
7/30/12	PZ-2S, PZ-2D, PZ-3S2, PZ-3D
9/5/2012	PZ-4S, PZ-4D, PZ-5S, PZ-5D, PZ-6S, PZ-6D, PZ-9S, PZ-9D, PZ-7S
9/13/2012	PZ-1S, PZ-1D, PZ-3S, PZ-3D2, PZ-7D, PZ-8S*, PZ-8D, PZ-10S, PZ-10D, PZ-12S, PZ-12D, PZ-13S, PZ-13D, PZ-14S, PZ-14D, P-24

* The data logger installed in PZ-8S failed and the data was invalid; therefore, data from this data logger was not usable.

Manual depth-to-water measurements were collected on September 5, 12, and 21, 2012, and October 3 and 27, 2012, to confirm the accuracy of the data loggers and to correct the pressure data to water level elevation. An electronic water level meter with markings every 0.01 feet was used for the manual readings. The top of casing and/or top of PVC at each well and piezometer was surveyed to determine elevation. The manual readings, combined with elevations of the top of each casing, were used to convert the data logger pressure readings to groundwater elevations.

The PDI Work Plan says groundwater elevation data will be collected continuously throughout the PDI field activities. The field activities are completed; however, the water level loggers have been left in place and will continue to measure water levels.

2.6.2 Precipitation Monitoring

A HOBO data logging rain gauge was installed at the site on September 15, 2012 to measure precipitation during groundwater elevation data logging activities. The rain gauge has a resolution of 0.01 inches. The rain gauge was installed on a wooden post at the north end of the SVE/Air Sparge System, which provides an open space for accurate collection of rainfall data.

Historic rainfall data was downloaded from the Weather Underground website (www.wunderground.com) KDDH Station located at the William H. Morse State Airport. This long term rainfall record was used to compare with the water level loggers data collected prior to installing the site rain gauge on September 15, 2012.

2.7 Geochemical Data at Barrier Locations

Groundwater geochemical data included collection of the following data along the Landfill Compliance Boundary and Downgradient Barrier area:

1. Detailed characterization of VOC concentrations vertically and laterally along the alignment of the barrier systems to obtain high resolution characterization of the nature, extent, distribution, and concentrations of VOCs in groundwater along the alignment of each of the barrier systems.
2. Geochemical data including inorganic constituent concentrations that may influence PRB performance through mineral precipitation and can lead to passivation of the zero-valent iron.
3. Collection of baseline metals data, prior to installation of the barrier systems.

2.7.1 Vertical VOC Profiling at Barrier System Locations

Vertical VOC profiling was performed at the five locations identified in Figure 2-1, including three locations along the Landfill Compliance Barrier System alignment (ML-1, ML-2/PZ-3, and ML-3), and two locations along the Downgradient Barrier System alignment (ML-4 and ML-5/PZ-9). These vertical profiling locations target the inferred areas of highest VOC concentrations that intersect each barrier system alignment. Groundwater samples for vertical VOC profiling were collected in accordance with the PDI WP and POP and all proposed samples were collected.

Vertical profiling was performed using a Geoprobe SP-16 direct-push groundwater sampling system or by installing multi-level piezometers, as described in Section 2.6. At locations ML-2/PZ-3 vertical profiling was performed with multi-level piezometers. All groundwater samples were collected using a peristaltic pump, in accordance with methodologies in the FSP. Approximately 3 to 5 well volumes were purged or until the well purged dry, prior to collection of groundwater samples. All vertical profile VOC samples were submitted to Test America for analysis of VOCs by EPA SW846 Method 8260B with a method detection limit of 1 part per billion (ppb). A summary of vertical profiling groundwater samples collected is shown in Tables 2-3 and 2-4. Quality assurance (QA)/quality control (QC) samples collected for vertical profiling samples are discussed in the data validation reports in Appendix G.

2.7.2 VOC and Geochemical Parameter Sampling

Samples were collected from existing monitoring wells and PDI piezometers for analysis of VOC, metals and inorganic constituents. Groundwater samples for VOCs, metals and inorganic constituents were collected in accordance with the PDI WP and POP and all proposed samples were collected. VOC samples were collected from one additional piezometer couplet (PZ-1S and PZ-1D), in order to delineate

the western limit of the VOC plume along the Landfill Compliance Boundary. Groundwater sampling and analysis details are summarized in Tables 2-3 and 2-4. Sampling locations, sampling methods and field screening analytical results are summarized in Table 2-3. The sampling locations and laboratory analyses performed are summarized in Table 2-4. Samples were collected for laboratory analysis of the following parameters:

VOCs *(EPA SW-846 Method 8260B)*:

Major Anions *(EPA SW-846 Method 9056A)*:

Chloride, Sulfate, Nitrate, Nitrite, Phosphate

Major Cations *(EPA SW-846 Method 6010C)*:

Calcium, Potassium, Magnesium, Silica, Iron, Manganese, Sodium

Other parameters:

Alkalinity by method SM 2320B
Total Dissolved Solids (TDS) by method SM 2540C
Total Organic Carbon (TOC) and Dissolved Organic Carbon (DOC) by EPA SW-846 Method 9060A.

Specific conductance, pH, oxidation-reduction potential (ORP), temperature and dissolved oxygen (DO) were measured in the field during sampling at each location following the sampling procedures described in the FSP and QAPP. A YSI 600 Series meter was used for the field measurements and was equipped with a 6560 Conductivity/Temperature Sensor, 6561 Combo pH/ORP Sensor, and ROX™ Optical DO Sensor. Calibration logs were completed in the field. The field measurements were collected using an in-line flow through cell.

Groundwater samples were collected for the above parameters at the following locations (except as noted):

Landfill Compliance Barrier:

- PZ-1 (VOCs only), PZ-2, PZ-3 (VOCs only), PZ-4, PZ-5, PZ-6

Downgradient Barrier:

- PZ-7, PZ-9, PZ-10, PZ-12 (VOCs only), PZ-13 (VOCs only), PZ-14 (VOCs only), P-24 (VOCs only)

Existing Wells:

- W-25S1, W-04D, W-04T, W-03, P-13 (VOCs only), P-14 (VOCs only), W-09S1, W-09TD, P-19 (VOCs only)

Groundwater samples were collected for analysis of Priority Pollutant 13 Metals (Antimony, Arsenic, Beryllium, Cadmium, Chromium (total and hexavalent), Copper, Lead, Mercury, Nickel, Selenium, Silver, Thallium, and Zinc) by EPA SW-846 Methods 6020A, 7470 (mercury), and 7196A (Hexavalent chromium) at the following locations:

Landfill Compliance Barrier:

- W-04D, W-04T, PZ-4

Downgradient Barrier:

- PZ-10, W-09S1, W-09TD, P-19

Hexavalent chromium and orthophosphate have 24-hour holding times. A few of the field samples and PES were not analyzed within holding times. These exceptions are discussed in detail in Appendix G.

Water quality samples were collected using either low flow or conventional purge and sampling techniques, as presented in Table 2-3. Low flow sampling was performed with either a peristaltic pump or bladder pump in accordance with the low flow sampling procedures in the FSP. At some locations a non-dedicated bladder pump was used, in which case an equipment blank was collected and analyzed in accordance with the requirements of the QAPP (one per 20 samples). Groundwater samples collected using conventional sampling procedures were collected either with a peristaltic pump or bladder pump.

2.8 Bench Scale Testing of PRB Zero Valent Iron Material

This section summarizes the procedures for ZVI bench testing. The goal of the bench scale testing was to determine if a ZVI PRB at the Landfill Compliance Boundary can effectively treat VOCs to attain groundwater ICLs, and to select the appropriate reactive medium for the Landfill Compliance Boundary and Downgradient PRBs by assessing the effectiveness of ZVI under site-specific geochemical conditions in a laboratory setting.

2.8.1 Selection and Collection of Groundwater Samples for Bench Scale Testing

Bench scale testing was performed on groundwater samples collected from the Burgess Site. Groundwater sampling locations were selected for the bench testing based on location within the contaminant plume and the results of geochemical sampling.

Bench scale testing was performed only for the Landfill Compliance Boundary Barrier System. The data obtained from the Landfill Compliance Boundary bench test samples may be used to design the Downgradient PRB because concentrations of groundwater VOCs and inorganic constituents are higher

near the Landfill Compliance Boundary, but the composition is similar in both areas. Therefore, the bench scale test results for the Landfill Compliance Boundary Barrier System provide conservative results for design of the Downgradient PRB.

Groundwater was collected on August 27 to 30, 2012, from four Landfill Compliance Boundary wells for the bench scale testing (W-04D, W-04T, PZ-4D and W-03). These four locations were selected because they have the highest measured inorganic concentrations near the Landfill Compliance Boundary, which may influence the long term performance of the ZVI material. Groundwater samples were collected using low flow purge and sampling techniques in order to obtain samples with representative concentrations of mobile inorganic constituents. Minimal drawdown was maintained at wells W-04T, PZ-4D, and W-03 during sampling; however, drawdown at well W-04D continued to increase at purging at rates below 10 ml per minute. In order to collect the bench test samples in a reasonable time, well W-04D was sampled at a flow rate of 15 to 35 ml per minute and the well was purged dry. The sample turbidity at W-04D remained below 5 NTU.

A total of 24 liters of water were collected for the bench test sample. The water samples were pumped into laboratory-supplied 1-liter polyethylene bottles, then composited into 4-gallon polyethylene bottles for shipment to the laboratory. Because the flow rates during sampling were very low (10 to 40 ml per minute), the 1-liter polyethylene sample bottles were placed in an ice bath and the bottle opening was covered with foil to preserve the sample. The August 2012 bench test sample was composited as follows:

- W-04D 5 liters
- W-04T 8 liters
- W-03 5 liters
- PZ-4D 6 liters

Additional bench scale testing (two column tests) was performed in early 2013 to evaluate and confirm the first bench test results. Groundwater was collected on January 2 to 4, 2013, from the same four Landfill Compliance Boundary wells used to supply groundwater for the first bench test. Low flow sampling was not practical because of freezing temperatures, so samples were collected using a modified conventional approach, which involved purging a minimum of three well volumes using a bladder or peristaltic pump and purging at flow rates that maintained low turbidity levels. Previous analytical results indicate that if turbidity levels are below 20 NTU, this modified conventional sampling approach does not cause a significant change in TDS concentration, and does not result in increased calcium or magnesium concentrations compared to low-flow sampling results. Therefore, specific conductivity and turbidity were monitored during sample collection to obtain samples of similar composition to the first bench test.

A total of 48 liters of water were collected for the two column tests performed in early 2013, composited as follows:

- W-04D 2.65 liters
- W-04T 21.25 liters
- W-03 11.35 liters
- PZ-4D 12.75 liters

2.8.2 Bench Scale Test Methods

The bench-scale studies were used to determine site specific reaction kinetics and degradation rates for chlorinated VOCs in site groundwater in the presence of ZVI. Bench testing provides a direct measurement of parent and daughter compound treatment by ZVI, and the behavior of certain site-specific geochemical parameters (pH, inorganic constituents) during ZVI treatment. Bench scale testing was performed by SiREM, in Guelph, Ontario.

The following summarizes the bench-scale testing procedures. Detailed procedures are provided in the SiREM's Treatability Study Report (Appendix C)

Site groundwater was carefully transferred into an influent reservoir to minimize volatile losses. Groundwater in the influent reservoir water was amended with additional PCE, TCE, cis-1,2-DCE, and vinyl chloride to achieve the following target concentrations for the test which emulate the maximums measured during the PDI:

cVOC	Initial Bench Test Sample Concentration (µg/L)	Maximum PDI Concentration (µg/L)	Bench Test Concentration (µg/L)
PCE	1,700	33,000	25,000
TCE	1,130	5,000	6,000
Cis-1,2-DCE	1,960	5,000	6,000
Vinyl Chloride	310	1,800	2,000
Total CVOCs	5,100	37,700	39,000

Literature ZVI reaction rates for cis-1,2-DCE and vinyl chloride are typically slower than for PCE (Stroo et al, 2010; Andrzej Przepiora, Geosyntec Consultants, Inc., personal communication). Therefore, concentrations of cis-1,2-DCE, vinyl chloride, and total cVOCs selected for the bench test are closer to the respective PDI maximum concentrations than PCE.

Based on literature sources and personal communication with PRB experts and environmental professionals, ZVI produced by Connelly-GPM in Chicago was selected for bench testing. Two vendors

commonly used for supplying ZVI for PRB treatment of VOCs are Connelly-GPM and Peerless Metal Powders (PMP) in Detroit (Dr. Jeff Bain, University of Waterloo, and Andrzej Przepiora, SiREM, personal communication). Each of these suppliers produces granular ZVI using grey-iron filings from automotive part manufacturing (e.g., engine blocks, pump housings, etc.). The filings are ground and sieved to various gradations, and then annealed to homogenize the grains. Results from CVOC bench tests in the literature (VanStone, et al, 2004) indicate Connelly-GPM iron exhibits performance comparable to PMP iron for treating PCE and TCE, but better performance than PMP in degrading cis-1,2-DCE and vinyl chloride.

A study at the University of Waterloo (O, 2006) comparing ZVI from four suppliers determined that the Connelly-GPM's faster degradation of cis-1,2-DCE and vinyl chloride may be related to its overall lower corrosion rate. Iron with high corrosion rates rapidly break down VOCs, but faster corrosion can cause faster accumulation of precipitates that passivate the iron and reduce its ability to break down CVOCs.

A single ZVI bench test was set up in September 2012 using 100 percent (%) granular ZVI (CC-1004) from Connelly-GPM. SiREM began feeding spiked groundwater from the reservoir into the ZVI column on September 13, 2012, at a velocity of 1.64 feet/day. This flow rate has been used in numerous ZVI column tests to assure a sufficient volume of groundwater passes through the column within the test period (approximately 45 pore volumes) in order to assess potential long-term changes to CVOC treatment efficacy.

Approximately once per week during the 7-week bench test, water samples were collected at the column influent, at pore-water sampling ports at discrete points along the column length, and at the column effluent to measure changes in groundwater constituents over time. Samples were analyzed weekly for concentrations of CVOCs, dissolved hydrocarbon gases (methane, ethene, and ethane), pH, and redox potential. Samples were also collected during weeks 1, 4, and 7 for analysis of anions (chloride, nitrate, nitrite, sulfate, phosphate).

SiREM performed analyses of VOCs, dissolved hydrocarbon gases, anions, pH and ORP at their laboratory in Guelph, Ontario. VOC analyses were performed by gas chromatography. To confirm SiREM's lab results for VOCs, influent and effluent samples were collected during weeks 0 (baseline influent only), 1, 4, and 7 for analysis of VOCs using EPA Method 8260B at Test America in Burlington, Vermont, the QAPP-approved laboratory.

In addition, samples were submitted to Test America for analysis of the following inorganic constituents to evaluate potential precipitation products in the column, which can passivate the iron and reduce reactivity with CVOCs:

- Cations (iron, magnesium, calcium, potassium, manganese, and silica) and alkalinity in influent and effluent samples during weeks 1 and 7.
- Total dissolved solids, total sulfide, and Priority Pollutant Metals (antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc) in influent and effluent samples during weeks 1, 4, and 7.

Table 2-5 summarizes the samples that were analyzed during the 2012 bench test, and the analytical methods.

The second set of bench tests conducted in early 2013 was performed using the same methods and materials as the first test, with the following exceptions:

- Two bench tests were performed using ZVI from Connelly-GPM (CC-1004) in one column, and from Peerless Metal Powders and Abrasive (Aggregate size 8/50) in a second column.
- Test columns were run side-by-side, sharing a single influent reservoir.
- The Peerless ZVI bench test was tested for 8 weeks, and the Connelly ZVI test was run for 10 weeks.
- Week-1 influent sampling for external lab analyses was omitted because baseline samples were collected 1 week earlier.
- Analyses of total sulfide were not performed because concentrations in the first bench test were very low or below detection limits.

3.0 RESULTS

This section summarizes geologic, hydraulic, and chemical data collected during the PDI. Results of bench scale testing of zero-valent iron for treatment of groundwater VOCs are also summarized.

The goal of collecting these data is to supplement existing site data to further characterize hydrogeologic conditions, as well as the type and distribution of contaminants and other parameters that influence the barrier system design. Supplemental hydrogeologic and geotechnical data were collected to evaluate hydraulic boundaries, vertical and horizontal hydraulic gradients, the direction of groundwater flow, and hydrogeologic properties. The hydrogeologic conditions and distribution of geologic materials was evaluated to determine heterogeneity and spatial and temporal variability of the groundwater flow field. Geotechnical data are used to design the appropriate approach for installing the barrier systems and accompanying monitoring points. Characteristics of the earth materials, including shear strength and cohesion properties of the earth materials, sieve/grain size analysis, moisture content, consolidation, and density were determined.

Supplemental chemical data were collected to evaluate the vertical and lateral extent of VOCs in the area of each barrier. Groundwater and saturated zone soil samples were collected along the alignment of both barrier systems to establish pre-treatment concentrations for VOCs, metals, and geochemical parameters that may affect the performance of the barrier systems.

Bench scale testing was performed to evaluate zero valent iron as a reactive medium for PRB(s) by assessing field information (including site-specific geochemical data) in a laboratory setting. Site-specific geochemical data were collected during the PDI to evaluate potential precipitates and dissolved constituents, including: calcium, magnesium, iron, manganese, bicarbonate/carbonate alkalinity, silicon, chromium, sulfate, sulfide, nitrate, total dissolved solids, and dissolved organic carbon. Field parameters including pH, dissolved oxygen, oxidation-reduction potential, temperature, and conductivity were also evaluated.

3.1 Geologic and Geotechnical Conditions

Subsurface geologic and geotechnical conditions were evaluated near the Landfill Compliance Boundary and Downgradient Barrier alignments using the procedures described in Section 2. Geologic conditions observed at the site are generally consistent with the conceptual site model described in Section 1 of the PDI Work Plan, and provide details on the geologic conditions that influence the barrier designs. Dense

soils and the presence of cobbles at the site had limited the recoverability of soil cores during previous investigations using split-spoon sampling devices and conventional hollow-stem auger drilling methods. The sonic drilling method used during the PDI provided high-quality soil cores that allowed more precise definition of the stratigraphy than was possible during previous investigations. Lithologic descriptions below are based on physical observations, (see Boring Logs in Appendix B), and geotechnical testing results summarized in Table 2-2 and included in Appendix D.

The site geology consists of unconsolidated overburden comprised of loam and fill material of varying thickness, underlain by Kame Sand and Ablation Till that is underlain by a dense Lodgement Till. Bedrock is encountered below the Lodgement Till. This geologic sequence is presented on a series of cross sections following the alignments shown on the site map in Figure 3-1. A north-south cross-section depicting the site geology is shown in Figure 3-2. Cross sections along the approximate alignments of the Landfill Compliance Boundary and Downgradient Barrier System locations are provided in Figures 3-3 and 3-4, respectively.

Loam and fill material consist of varying amounts of gravel, sand, silt, clay, and organic matter. The base of this unit along the Compliance Boundary is identified by be presence of a black, organic rich layer that was deposited as part of the former Marshy Area at the toe of the landfill, pre-capping and closure. The Kame Sand is a well-sorted mixture of non-plastic, fine to very fine sand and silt, with a trace of coarse sand or gravel and typically less than 1 percent clay. The Ablation Till is also primarily fine to very fine sand and silt, but contains some coarse sand and gravel and approximately 3 to 5 percent clay (slight plasticity). The boundary between the Kame Sand and Ablation Till is defined by the appearance of gravel and increased plasticity.

The Kame Sand and Ablation Till are relatively homogeneous, with infrequent lithologic changes within each unit. One or two thin layers of medium to coarse sand were observed within the Kame Sand and Ablation Till at several borings, but the layers are intermittent and do not appear to be connected based on the depths.

The Lodgement Till is similar to the Ablation Till in composition, but contains more clay (approximately 5 to 15 percent) and is very dense (nearly consolidated) and dry. The boundary between the Ablation Till and Lodgement Till is most easily defined by its greater consolidation and dry appearance. The Lodgement Till is the confining layer into which the barrier systems will be keyed; therefore, the borings were drilled at least 5 feet into the Lodgement Till or until refusal to confirm the depth to this confining layer.

Results of geotechnical analyses on samples of Kame Sand, Ablation Till, and Lodgement Till collected along the alignment of each barrier are provided in Appendix D.

Lithologic conditions near each barrier location are described further in the following sections.

3.1.1 Lithology at Landfill Compliance Boundary Barrier System

Cross section B-B' in Figure 3-3 depicts the subsurface lithology near the Landfill Compliance Boundary. Combined, the fill, Kame Sand and Ablation Till are approximately 25 to 30 feet thick west of the Toe of Slope swale, and approximately 20 feet thick east of the Toe of Slope swale. On the west end of section B-B' lithology is dominated by the Ablation Till, which is approximately 20 feet thick. Fill thickness increases from west to east because of re-grading during construction of the landfill cover and filling in of the low-lying former Marshy Area. Kame Sand underlies the fill, but appears to pinch out near the thickest fill area at the W-04 well cluster, which covers a thin layer of the original marsh material (organic-rich silty material) south of the landfill. West of the Toe of Slope swale, the Kame Sand becomes the dominant unit, increasing to approximately 15 feet thick, and the Ablation Till thickness decreases to approximately 5 feet.

3.1.2 Lithology at Downgradient Barrier Area

Cross section C-C' in Figure 3-4 depicts the subsurface lithology in the Downgradient Barrier area. The combined fill, Kame Sand and Ablation Till thickness is between approximately 20 and 25 feet along section C-C'. Loam/fill thickness is typically less than 2 feet. The Kame Sand thickness generally ranges from approximately 5 to 10 feet thick, but appears to pinch out near piezometer PZ-12. The thickest section of Kame Sand is observed near the W-09 well cluster.

3.1.3 Lithology Upgradient to Downgradient

Figure 3-2 is a north-south geologic cross-section extending from the Landfill southward to the downgradient end of the VOC plume. This cross-section follows the groundwater flow direction at the Site. Proceeding from north to south, the Kame Sand thins and then pinches out, leaving only the Ablation Till overlying the Lodgement Till in the vicinity of P-01 and P-02. The saturated thickness of the overburden above the Lodgement Till also thins towards the south. The saturated overburden thickness is approximately 25 feet thick near the Landfill Compliance Boundary, approximately 20 feet thick in the vicinity of the Downgradient Barrier area, near the W-09 well cluster, and decreases to approximately 10 feet near well P-01.

3.2 Hydrogeologic Conditions

Previous investigations indicate that the Site contains two groundwater systems. Shallow overburden groundwater is found within the Kame Sand and Ablation Till and flows generally from the Landfill Area to the south and then southwest toward the W-09 well cluster and P-01. The Lodgement Till separates the overburden groundwater within the Kame Sand and Ablation Till from groundwater within the underlying fractured bedrock. The Lodgement Till is a confining layer separating these two groundwater zones and is a barrier to vertical contaminant migration at the Site. Groundwater within the bedrock flows towards the west-southwest, generally following the hill slope topography.

Surface water and drainage near and downgradient of the Landfill Compliance Boundary are defined by a series of swales and the Unnamed Stream. The landfill cap lines the northern portion of the Toe of Slope swale (Figure 3-1). The lined portion receives surface water drainage from the landfill via series of swales lined with HDPE and rip rap along the steeper eastern slope. South of the liner, the Toe of Slope swale conveys runoff from the Landfill and receives groundwater discharge from the shallow overburden groundwater. The Toe of Slope swale and a small wetland swale downgradient of the landfill area discharge to the Unnamed Stream near the Downgradient Barrier area.

North of the landfill, a swale was created to divert surface water around the upgradient area of the landfill cap. To the east of the Landfill and Toe of Slope swale, a second swale (Clyde's Swale) was excavated along Harmon Hill to divert surface water flow and runoff from Harmon Hill away from the landfill and toward the Unnamed Stream. The Unnamed Stream to the east and south of the Landfill receives runoff and groundwater discharge primarily from the eastern slope of Harmon Hill. The Unnamed Stream to the east of the Toe of Slope swale is located in a low-lying marsh with a relatively flat hydraulic gradient.

Data collected during the PDI focused on overburden groundwater in the Kame Sand and Ablation Till. The following sections summarize the hydrogeologic data collected during the PDI, and include a summary of hydraulic conductivity testing performed in the early 1990's during the Remedial Investigation (RI) (O'Brien and Gere, 1992). These data are evaluated to determine the hydraulic design criteria along the alignment of each of the barrier systems, including groundwater elevations and flow directions, hydraulic gradients, hydraulic conductivities, and groundwater velocities.

3.2.1 Groundwater Elevations, Gradients and Flow Directions

Figure 3-5 depicts shallow water table elevations measured on September 12, 2012. Water table elevation data from the piezometers installed during the PDI confirm that the general hydraulic conditions at the site are consistent with the conceptual site model. The September 12, 2012, contours are generally consistent with contours from previous monitoring events using a smaller set of wells.

Figure 3-6 presents hydrographs of groundwater elevations recorded since spring 2009 at select site monitoring wells near the Landfill Compliance Boundary and the Downgradient Barrier area using data logging pressure transducers. Precipitation events are also plotted in Figure 3-6. The data logged wells are along a central groundwater flow axis extending from the Landfill (W-31S1) to the Downgradient Barrier area (W-09 cluster).

The hydrographs show seasonal changes in water table elevations of approximately 2 to 3 feet during the last 3 years. The parallel nature of the hydrographs indicate that (a) seasonal changes in groundwater elevations occur relatively uniformly at the site, and (b) hydraulic gradient and flow direction are not highly variable along the central groundwater flow axis.

<u>Landfill Compliance Boundary Hydrographs and Vertical Gradients</u>

Groundwater elevation hydrographs for shallow and deep piezometers monitored during the PDI near the Landfill Compliance Boundary are shown in Figures 3-7 and 3-8, respectively. Figures 3-7 and 3-8 also show precipitation data. Piezometers monitored during the PDI extend along an approximate 220-foot transect along the Compliance Boundary. As shown in Figure 3-5, the PDI piezometers near the Landfill Compliance Boundary are aligned closely with the 1,082-foot groundwater equipotential line, as reflected in the water level logger results plotted in Figures 3-7 and 3-8. Along the Landfill Compliance Boundary, piezometer groundwater elevations are within a range of approximately 1 foot, indicating that the piezometers are aligned approximately perpendicular to groundwater flow.

The hydrograph lines in Figures 3-7 and 3-8 remain nearly parallel during the monitoring period, and water level changes at the shallow and deep piezometers are relatively uniform in response to precipitation events of 0.5 to 1.5 inches per day. These observations suggest that hydraulic gradients and groundwater flow directions near the Landfill Compliance Boundary have limited variability during normal periods of rainfall.

Vertical gradients calculated from data logger results at shallow and deep piezometer couplets near the Landfill Compliance Boundary are plotted in Figure 3-9. Slight upward gradients are observed at PZ-5

and PZ-6, near the Toe of Slope swale, and at PZ-2. Downward gradients are observed at PZ-1 and PZ-3. Vertical gradient at PZ-4 is near zero. The vertical hydraulic gradients near the Landfill Compliance Boundary are relatively small, ranging from -0.05 to 0.03 feet/foot. Corresponding hydraulic head differences measured between shallow and deep piezometers were up to approximately 3 inches at piezometers with upward gradients, and up to approximately 6 inches at piezometers with downward gradients.

Downgradient Barrier Area Hydrographs and Vertical Gradient

Groundwater elevation hydrographs for shallow and deep piezometers monitored during the PDI in the Downgradient Barrier area are shown in Figures 3-10 and 3-11, respectively, along with precipitation data. Downgradient Barrier area PDI piezometers were installed over a larger area than at the Landfill Compliance Boundary to collect hydraulic data for determining an appropriate barrier location and alignment. Accordingly, the range of groundwater elevations at the Downgradient Barrier piezometers is approximately 4 feet. The area covered by the piezometers allows detailed evaluation of horizontal gradient directions in the Downgradient Barrier area by interpolation between three wells.

Consistent with water level changes near the Landfill Compliance Boundary, the hydrograph lines in Figures 3-10 and 3-11 remained nearly parallel during the monitoring period, and water level changes at the shallow and deep piezometers are relatively uniform in response to precipitation events of 0.5 to 1.5 inches per day. Hydraulic gradients and groundwater flow directions in the Downgradient Barrier area do not appear to vary greatly during normal periods of rainfall.

Vertical gradients calculated from data logger results at shallow and deep piezometer couplets in the Downgradient Barrier area are plotted in Figure 3-12. Upward gradients are larger and more widespread in the Downgradient Barrier area than near the Landfill Compliance Boundary. Predictably, upward gradients are greatest near the swales and the Unnamed Stream (0.08 to 0.15) where groundwater discharge occurs. Downward gradients are observed at piezometers farthest from the swales and Unnamed Stream (PZ-7 and PZ-13).

Gradient and Azimuth Calculations

Pressure transducer measurements recorded every 6 hours during the PDI, and corrected for elevation, are used to calculate hydraulic gradient magnitude and gradient direction (azimuth), and to evaluate changes in response to precipitation events. For each 6-hour measurement, gradient and azimuth are calculated from the slope of a plane intersecting groundwater elevations at three well locations that form a triangle.

Table 3-1 summarizes the calculation results, including statistical analyses, for four sets of wells near the Landfill Compliance Boundary, and 12 sets of wells in the Downgradient Barrier area. The distribution of wells in the Downgradient Barrier area provides a larger number of possible triangulations for calculating gradients and azimuths. Time-series plots of gradient and azimuth calculation results for each set of triangulation wells are provided in Appendix E.

Overall, the monitoring results show that azimuths and gradients during the monitoring period are relatively stable. Small and brief fluctuations in direction (typically less than approximately 25 degrees) are closely associated with precipitation events. Standard deviation in azimuth is typically less than 5 degrees, with a maximum of approximately 11 degrees. The relative standard deviation in gradient is less than approximately 11 percent.

Average azimuths calculated from groundwater elevation monitoring results are plotted as vectors on Figure 3-13. The vectors only indicate gradient direction, not magnitude, and are placed at the center of each triangulation area. Shallow (Kame Sand) vectors are represented by green arrows, and deep (Ablation Till) vectors are represented by purple arrows.

Kame Sand vectors along the Landfill Compliance Boundary are generally consistent with groundwater flow directions inferred from the water table contours. Ablation till vectors near the Landfill Compliance Boundary are similar to the Kame Sand vectors, likely because vertical gradients in this area are relatively small, indicating similar flow directions in the shallow and deep zones.

Variability in the Kame Sand vectors in the Downgradient Barrier area is likely associated with hydraulic influence from the swales and Unnamed Stream. Shallow zone vectors near PZ-14 and PZ-9 generally point toward the confluence of the swales and the Unnamed Stream. Ablation till vectors in the Downgradient Barrier area are more uniform, likely because the surface drainage features have less influence on groundwater flow direction in the Ablation Till.

3.2.2 Hydraulic Conductivity and Groundwater Velocity

Hydraulic testing performed throughout the Site in the early 1990s during the RI showed that the Kame Sand and Ablation Till are of low permeability, low yield, and are relatively thin units with limited saturated thickness. Table 3-2 summarizes hydraulic conductivity data for tested wells near the Landfill Compliance Boundary and the Downgradient Barrier area. Hydraulic conductivities are calculated from slug testing performed during the RI.

Kame Sand hydraulic conductivity measured at wells near the Landfill Compliance Boundary ranges from 0.040 feet/day (W-03) to 0.105 feet/day (W-04D). Kame Sand hydraulic conductivity measured in the Downgradient Barrier area at well W-09S1 is 0.29 feet/day. Hydraulic conductivities measured at W-04D and W-09S1 are the highest values for the Kame Sand.

Ablation till hydraulic conductivity measured at wells near the Landfill Compliance Boundary range from 0.034 feet/day (W-06D) to 0.08 feet/day (W-04T). Ablation till hydraulic conductivity was not measured in the Downgradient Barrier area, but is likely in a similar range as the Landfill Compliance Boundary because the soil type is similar.

Observed yields during PDI groundwater sampling at the new piezometer locations indicated hydraulic conductivities that are comparable to the range of values measured during the RI.

Estimated maximum groundwater velocities are calculated for each hydraulic conductivity measurement in Table 3-2 using the following equation:

$$\upsilon = ki/n$$

where,
υ = average groundwater velocity (feet/day),
k = hydraulic conductivity (feet/day),
i = maximum measured hydraulic gradient in each lithologic zone in each area (Table 3-1), and
n = maximum porosity calculated from measurements of dry bulk density in soil samples from each lithologic zone in each area (bulk densities are reported in Appendix D).

Porosity is calculated from dry bulk density as follows:

$$n = 1-(\rho_b/\rho_s)$$

where,
n = porosity,
ρ_b = dry bulk density (grams per cubic centimeter), and
ρ_s = soil particle density (assumed to be 2.65 grams per cubic centimeter).

Velocity calculations for the Landfill Compliance Boundary are divided into north and south areas because the maximum hydraulic gradient in the north area (0.09 to 0.1 between W-32, W-04, and W-25S1) is significantly greater than in the south area (0.015 to 0.02 between PZ-4, PZ-5, and PZ-6).

The maximum estimated groundwater velocities are calculated at the following wells:

Well	*Area, Lithology*	*Maximum Velocity (feet/day)*
W-09S1	Downgradient, Kame Sand	28.2
W-04T	Landfill Compliance Boundary, Ablation Till	17.2
W-04D	Landfill Compliance Boundary, Kame Sand	11.5

Based on these calculations, the estimated maximum groundwater velocities in each area are as follows:

Landfill Compliance Boundary Groundwater Velocity: 17.2 feet/day (maximum)

Downgradient Barrier: 28.2 feet/day (maximum)

3.3 Geochemical Conditions

Groundwater analytical results for VOCs are summarized in Table 3-3. Table 3-4 summarizes inorganic/wet chemistry analytical results, and Table 3-5 summarizes Priority Pollutant 13 (PP13) Metals analytical results. Results for each parameter type are discussed in the following sections.

3.3.1 Groundwater VOCs

Groundwater VOC concentrations measured during the PDI are summarized in Table 3-3. The lateral and vertical distribution of groundwater PCE, TCE, cis-1,2-DCE, and vinyl chloride concentrations are depicted on cross sections A-A', B-B', and C-C' in Appendix F. Updated groundwater VOC plume maps for PCE, TCE, cis-1,2-DCE, and vinyl chloride are presented in Figures 3-14, 3-15, 3-16, and 3-17, respectively.

Consistent with historical data, groundwater concentrations of PCE, TCE, cis-1,2-DCE, and vinyl chloride near the Landfill Compliance Boundary are approximately one order of magnitude greater than in the Downgradient Barrier area. Maximum concentrations in each area are listed below, along with the typical range for each constituent.

	Landfill Compliance Boundary		Downgradient Area	
Analyte	***Maximum***	***Typical Range***	***Maximum***	***Typical Range***
PCE	33,000 µg/L	500-5,000 µg/L	1,000 µg/L	10 – 600 µg/L
TCE	5,000 µg/L	500-2,500 µg/L	910 µg/L	10 – 300 µg/L
cis-DCE	5,000 µg/L	500-1,500 µg/L	630 µg/L	5 – 250 µg/L
VC	1,800 µg/L	100-500 µg/L	110 µg/L	1 – 10 µg/L

Landfill Compliance Boundary Area

As indicated in cross section B-B' (Appendix F), the highest concentration VOC along the Compliance Boundary is PCE, with concentrations of 10,000 µg/L or greater at five locations. The highest PCE concentrations are located near the center of the Landfill Compliance Boundary area, between and including PZ-2 and W-04T. Lateral to these locations, PCE concentrations decrease by approximately one to two orders of magnitude (Figure 3-14). Elevated PCE concentrations are detected in both the Kame Sand and Ablation Till.

Maximum concentrations of TCE and daughter products cis-1,2-DCE and vinyl chloride are generally lower than PCE concentrations. Unlike PCE, the highest concentrations of these constituents are found primarily in the lower Ablation Till, presumably because reductive dehalogenation (which generates TCE, cis-1,2-DCE, and vinyl chloride) is greater in the deeper groundwater which is older and is less effected by recharge of aerated groundwater.

Downgradient Barrier Area

VOC concentrations in the Downgradient Barrier area are approximately one order of magnitude lower than in the Landfill Compliance Boundary area. As indicated in cross section C-C' (Appendix F), the highest concentrations of PCE are found in the Kame Sand at PZ-12, and in the Ablation Till near the W-09 well cluster. This is consistent with the analysis of hydraulic gradients (Figure 3-13), which shows that shallow groundwater in the Downgradient Barrier area follows a slightly more southerly flow direction than in the deeper Ablation Till because of influence from the drainage swales and the Unnamed Stream south of the W-09 well cluster.

Elevated concentrations of daughter products cis-1,2-DCE and vinyl chloride are observed only in the lower Ablation Till near W-09TD, indicating a lower degree of reductive dehalogenation of PCE and TCE than near the Landfill Compliance Boundary.

3.3.2 Groundwater Inorganic and Wet Chemistry Parameters

Groundwater concentrations of inorganic and wet chemistry parameters measured during the PDI are summarized in Table 3-4. Maximum concentrations and typical ranges are listed below for key constituents that can precipitate under high pH conditions in the presence of zero valent iron (which can passivate the iron and influence the long-term performance of PRBs) or in groundwater treatment equipment.

Nitrate concentrations are very low or below detection. The highest calcium, magnesium, alkalinity, and TDS concentrations in the Landfill Compliance Boundary area are detected at the W-04 well cluster, PZ-4, and W-03. Concentrations of these constituents in the Downgradient Barrier area are consistently lower than near the Landfill Compliance Boundary. The influence of these constituents on zero valent iron was evaluated during bench testing and is discussed in Section 3.4.

	Landfill Compliance Boundary		**Downgradient Barrier**	
Analyte	***Maximum***	***Typical Range***	***Maximum***	***Typical Range***
Nitrate	2.1 mg/L	<1 mg/L	0.8 mg/L	<0.58 mg/L
Calcium	126 mg/L	20 -100 mg/L	43 mg/L	18 – 30 mg/L
Magnesium	47.6 mg/L	8-43 mg/L	27.8 mg/L	6-10 mg/L
Silica	9.49 mg/L	3-7.5 mg/L	2.6 mg/L	1.86-2.6 mg/L
TDS	586 mg/L	100-400 mg/L	205 mg/L	100-150 mg/L
Alkalinity	475 mg/L	200-400 mg/L	176 mg/L	60-100 mg/L

Maximum concentrations and typical ranges are listed below for key constituents that indicate geochemical and redox conditions in each area. Higher iron and manganese concentrations and depleted sulfate concentrations is consistent with reducing conditions and correlate with areas in which PCE and TCE dehalogenation is occurring. Iron and manganese concentrations near the Downgradient Barrier area indicate oxidizing to mildly reducing conditions, which is consistent with the limited amount of reductive dehalogenation occurring in this area.

	Landfill Compliance Boundary		Downgradient Barrier	
Analyte	***Maximum***	***Typical Range***	***Maximum***	***Typical Range***
Iron	2.35 mg/L	0.2-2 m g/L	0.55 mg/L	<0.1 mg/L
Manganese	9.95 mg/L	0.5-7 mg/L	0.98 mg/L	<0.5 mg/L
Sulfate	35.6 mg/L	5-10 mg/L	20.1 mg/L	6-20 mg/L
DOC	14.9 mg/L	2-10 mg/L	12.9 mg/L	1.3-3.6 mg/L

3.3.3 Priority Pollutant Metals

Concentrations of Priority Pollutant (PP13) Metals are summarized in Table 3-5. PP13 metals analyses were performed to establish pre-treatment conditions in each barrier area. All PP13 metals were below existing Interim Cleanup Levels (ICLs) as established in the ROD Amendment SOW and Federal Maximum Contaminant Levels (MCLs).

3.3.4 Soil VOC Concentrations

PDI soil sample VOC concentrations are summarized in Table 3-6. The purpose of soil sampling is to evaluate pre-treatment, adsorbed VOC concentrations relative to dissolved VOC concentrations in each barrier area.

The highest soil PCE concentrations were detected in the Landfill Compliance Boundary area in both the Kame Sand (5,800 µg/Kg at ML-1, 9.5-10 feet) and Ablation Till (7,200 µg/Kg at PZ-3/ML-2, 17-18 feet). These detections are in the same area where elevated groundwater PCE concentrations were detected (PZ-2S and PZ-3D2). Concentrations of TCE and cis-1,2-DCE in the Landfill Compliance Boundary area are below 1,000 µg/Kg, and vinyl chloride was detected in two samples at 100 µg/Kg.

The highest soil PCE concentration detected in the Downgradient Barrier area was in the Kame Sand at PZ-12 (1,100 µg/Kg), which is consistent with elevated PCE concentrations in shallow groundwater at PZ-12. Maximum concentrations of TCE and cis-1,2-DCE in the Downgradient Barrier area were 630 µg/Kg at W-09TD and 200 µg/Kg at ML-4, 18-20 feet, respectively. These detections are in the Ablation Till in the area where elevated VOCs in groundwater were also detected in the Ablation Till. Vinyl chloride was not detected.

Overall, soil VOC concentrations are generally consistent with adsorbed phase VOCs in equilibrium with groundwater and soil organic carbon.

3.4 ZVI Bench Testing Results

ZVI bench testing results are presented in two parts:

1. Results from the 7-week Connelly ZVI bench test initiated in September 2012; and
2. Results from the 10-week Connelly and Peerless ZVI tests initiated in January 2013.

3.4.1 September 2012 Bench Test Results

Bench testing was performed to evaluate the reactivity of ZVI manufactured by Connelly-GPM, and to calculate the estimated half-life values for the CVOCs at the Site (PCE, TCE, cis DCE and VC). The CVOC half-life values are then used to determine the ZVI barrier thickness needed to achieve treatment goals (ICLs). CVOC degradation kinetics are evaluated by plotting CVOC concentrations versus distance along the bench scale column containing 100% ZVI. Concentrations decrease exponentially along the column length, so a first-order reaction equation is used to calculate the decay degradation rate, as follows:

$$C = C_o e^{-kt}$$

where C is the CVOC concentration along the column, C_o is the column influent concentration, t is the groundwater residence time in the column, and k is the first-order rate constant. The rate constant is determined from a least-squares best fit of the first-order reaction equation to the experimental data.

The half-life ($t_{1/2}$) is the time required for CVOC concentrations to decrease by half ($C/C_0 = 0.5$), and is calculated as follows:

$$t_{\frac{1}{2}} = \frac{\ln(2)}{k} = \frac{0.639}{k}$$

Site-specific CVOC half-lives determined from the bench test data were used to calculate the required CVOC residence time in the ZVI reactive material using the following equation:

$$Residence\ time\ (hrs) = t_{\frac{1}{2}}(hrs) * \frac{ln\frac{C}{C_o}}{-\ln(2)}$$

where C_o is the PRB influent concentration, and C is the target treatment concentrations (ICL).

The corresponding ZVI thickness needed to achieve ICLs is determined using this residence time and site-specific groundwater velocity, as follows:

$$ZVI\ Thickness\ (inches) = Residence\ time\ (hrs) * Groundwater\ velocity\ (\frac{in.}{hr.})$$

CVOC half-life data from the first 4 weeks of the bench test appeared to be consistent with the results from previous tests (Stroo, et al, 2010, and Andrzej Przepiora, Geosyntec Consultants, Inc., personal communication). However, the last 3 weeks of the bench test produced results that showed significantly higher-than-expected CVOC half-life values, particularly for PCE. In addition, degradation half-lives for appeared to increase at the end of the bench test at rates greater than expected. Calculated CVOC half-lives are summarized in Table 3-7. Changes in CVOC half-lives over time during the September 2012 bench test are plotted in Figure 3-18.

SiREM's results report for the September 2012 bench test is provided in Appendix C. Half-lives and ZVI residence time calculated by SiREM are based on half-lives from the final round of column samples (week-7), and do not incorporate long-term projected increases in CVOC half-lives.

Long-term bench tests simulating decades of PRB operation have been performed to evaluate changes in half-life over time (U.S. Department of Defense, 2003). Based on those results, ZVI treatment half-life under geochemical and hydraulic conditions similar to the Burgess site would be expected to increase by a factor of approximately 2 over a 25 year period. The long term change in half-life extrapolated from the bench test results indicates an increase by a factor of approximately 4 to 10 over a 25-year period. Based on these results, a PRB design for the Site would need to incorporate a significantly larger amount of ZVI (approximately 810 tons) than was anticipated in the FFS (390 tons).

The initial test using Connelly ZVI iron resulted in anomalously high calculated half-live values. Comparable elevated half-lives have been measured before, but are typically attributed to elevated concentrations of inorganic constituents that adversely affect ZVI reactivity (i.e., nitrate, chromium, calcium, magnesium, alkalinity, and silica). However, based on SiREM's experience, concentrations of these constituents at the Burgess site are not at levels that are considered to be elevated.

3.4.2 January 2013 Bench Test Results

Based on the initial bench test results, additional testing was performed to confirm the results for Connelly ZVI from the initial test, and to evaluate a potential alternate ZVI material manufactured by Peerless. Bench test data were analyzed using the procedures described above in Section 3.4.1.

The second Connelly ZVI bench test indicated lower PCE and TCE half-lives that did not increase over time as much as in the initial test. However, half-lives for cis-1.2-DCE and vinyl chloride were higher in the second test and increased at a greater rate. CVOC half-lives for the Peerless ZVI material were significantly greater than in either of the Connelly ZVI tests. CVOC half-lives from the second round of bench tests are summarized in Table 3-7. Changes in CVOC half-lives over time during the January 2013 Connelly ZVI bench test are plotted in Figure 3-19.

The long term changes in CVOC half-lives extrapolated from second Connelly ZVI bench test indicates an increase by a factor of approximately 2 to 11 over a 25-year period, which is similar to the projections from the first Connelly ZVI test. Based on the second Connelly test, the calculated amount of ZVI needed to achieve ICLs over a 25-year period is approximately 1,000 tons, driven primarily by longer half-lives for cis-1,2-DCE and vinyl chloride. These results confirm the initial Connelly ZVI test results.

SiREM's results report for the January 2013 bench test is provided in Appendix C. Half-lives and ZVI residence time calculated by SiREM for the second Connelly ZVI test are based on half-lives from the final round of column samples (week-10), and do not incorporate long-term projected increases in CVOC half-lives.

4.0 CONCLUSIONS AND RECOMMENDATIONS

A pre-design investigation was completed at the Site and included the collection of data and completion of testing necessary to proceed with the Remedial Design of contaminant barrier systems at the Landfill Compliance Boundary and near the downgradient edge of the high-concentration CVOC plume (Downgradient Barrier). The evaluation of the PDI data has concluded that the most appropriate barrier system for the Landfill Compliance Boundary Barrier is a groundwater collection trench. While not the specific focus of this Report, the same data and testing leads to the conclusion that a groundwater collection trench should be reconsidered as the appropriate downgradient barrier protection system.

The following PDI data were collected to further characterize hydrogeologic and geochemical conditions that guide the selection of the barrier system technology, and for completing the barrier system remedial design:

1. Vertical and lateral distribution of groundwater CVOCs and inorganic parameters at the barrier locations were evaluated using a series of soil borings, discrete-interval groundwater samples, piezometers, and monitoring wells;
2. Soil cores in the area of each barrier system were collected to confirm lithology and heterogeneity and to characterize CVOC concentrations in soils.
3. Groundwater elevations and precipitation events were monitored to determine hydraulic gradients and groundwater flow directions in each barrier location
4. Soil geotechnical data were collected to support barrier design and construction, including shear strength, cohesion, grain size, moisture content, density, and compaction properties
5. ZVI bench scale testing was performed to evaluate Site-specific CVOC degradation rates in the presence of ZVI, and design criteria for PRBs at the Landfill Compliance Boundary and Downgradient Barrier locations

The following summarizes the findings from the PDI:

1. Geologic conditions observed at the Site continue to confirm the accuracy of the Conceptual Site Model (CSM) as described in Section 1 of the PDI Work Plan, and the collected data provide details on the geologic conditions that influence the barrier designs. The Kame Sand and Ablation Till are relatively homogeneous, with infrequent lithologic changes within each unit. The underlying Lodgement Till is the confining layer into which any barrier system would be

keyed. The boundary between the Ablation Till and Lodgement Till is easily defined by its greater density and consolidation, and relatively dry appearance.

2. Water table elevation data from the piezometers installed during the PDI continue to confirm the accuracy of the CSM, as described in the PDI Work Plan. The parallel nature of groundwater hydrographs in Site wells indicate that (a) seasonal changes in groundwater elevations occur relatively uniformly at the Site, and (b) hydraulic gradient and flow direction are not highly variable along the central groundwater flow axis. Pressure transducer and precipitation monitoring data suggest that hydraulic gradients and groundwater flow directions have limited variability during normal periods of rainfall. The vertical hydraulic gradients near the Landfill Compliance Boundary are relatively small, ranging from -0.05 to 0.03 feet/foot. Upward gradients are greatest near the swales and the Unnamed Stream where groundwater discharge occurs, and downward gradients are observed at piezometers farthest from the swales and Unnamed Stream. The monitoring results also show that hydraulic gradients and directions monitored during the PDI are relatively stable. Small and transient fluctuations in direction are closely associated with precipitation events.
3. The estimated maximum groundwater velocities in each of the two barrier areas are as follows:
    a. Landfill Compliance Boundary Groundwater Velocity: 17.2 feet/day (maximum)
    b. Downgradient Barrier: 28.2 feet/day (maximum)
4. PDI groundwater sampling results from vertical profiling and nested piezometer data provide detailed resolution data on the vertical and lateral distribution of CVOCs and inorganic parameters. This detailed data was then used to develop the specific parameters and design for the ZVI bench testing.
5. The detailed groundwater sampling data indicate that the lateral extent of CVOCs is generally consistent with previous data presented in the CSM.
6. Groundwater concentrations of several inorganic and wet chemistry parameters that can precipitate under high pH conditions in the presence of ZVI were measured during the PDI; concentrations of these constituents at the Site are not considered to be at elevated levels that would significantly impact long-term ZVI PRB performance.
7. Priority pollutant metals concentrations in groundwater are below ICLs and MCLs.
8. Soil CVOC concentrations are generally consistent with adsorbed phase VOCs in equilibrium with groundwater and soil organic carbon, which is consistent with the CSM.
9. Bench testing demonstrated that ZVI effectively degraded Site CVOCs, and the tests yielded CVOC degradation data that could be used to develop design criteria for a PRB at the

Compliance Boundary that would achieve groundwater remedial action objectives. However, duplicate ZVI bench tests of Connelly-GPM iron produced results that showed significantly higher-than-expected CVOC half-life values, and degradation half-lives appeared to increase at the end of the bench tests at rates greater than expected. The resulting estimates of the volume of ZVI material needed for treatment of CVOCs at the barrier locations is significantly greater than anticipated in the FFS, which were based on other sites where ZVI has been utilized.

Although Site conditions are amenable to ZVI PRB technology, the amount of ZVI needed for the initial construction and long-term maintenance of a Compliance Boundary PRB is significantly greater than originally estimated in the FFS. Therefore, the use of groundwater collection trench technology is recommended at the Landfill Compliance Boundary.

5.0 REFERENCES

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TABLES

TABLE 2-1
PDI Summary of Survey and Well Construction Data
Burgess Brothers Superfund Site, Bennington, VT

Location	Well ID	Ground Eleveation (feet)	Screen Intervals					
			Top Screen (ft bgs)	Top Screen (elevation ft)	Bottom Screen (ft bgs)	Bottom Screen (elevation ft)	Vertical Profiling Water Samples (ft bgs)	Vertical Profiling Water Samples (elevation ft)
Landfill Compliance Barrier System	PZ-1S	1086.84	5	1081.84	10	1076.84		
	PZ-1D	1086.78	16	1070.78	21	1065.78		
	PZ-2S	1085.63	5	1080.63	10	1075.63		
	PZ-2D[2]	1085.67	17	1068.67	22	1063.67		
	PZ-4S	1081.48	10	1071.48	15	1066.48		
	PZ-4D	1081.61	19	1062.61	24	1057.61		
	PZ-5S	1082.37	3	1079.37	8	1074.37		
	PZ-5D	1082.38	15	1067.38	20	1062.38		
	PZ-6S	1080.96	4	1076.96	9	1071.96		
	PZ-6D	1081.14	13	1068.14	18	1063.14		
	ML-1	1085.63					8-10 13-15 18-20 23-25	1077.63-1075.63 1072.63-1070.63 1067.63-1065.63 1062.63-1060.63
	PZ-3S1	1083.41	4	1079.41	6	1077.41	8-10	1075.60-1073.60
	PZ-3S2	1083.53	10	1073.53	12	1071.53		
	PZ-3D1	1083.60	17	1066.6	19	1064.60		
	PZ-3D2	1083.44	25	1058.44	28	1055.44		
	ML-3						8-10 13-15 18-20 23-25	
Downgradient Barrier System	PZ-7S	1074.98	4	1070.98	9	1065.98		
	PZ-7D	1075.31	17	1058.31	22	1053.31		
	PZ-8S	1074.37	4	1070.37	9	1065.37		
	PZ-8D	1074.31	15	1059.31	20	1054.31		
	PZ-9S	1073.13	4	1069.13	9	1064.13		
	PZ-9D	1073.1	15	1058.10	20	1053.10		
	PZ-10S	1072.18	3	1069.18	8	1064.18		
	PZ-10D	1072.17	21	1051.17	26	1046.17		
	PZ-12S	1074.96	5	1069.96	10	1064.96		
	PZ-12D	1074.96	15	1059.96	20	1054.96		
	PZ-13S	1077.88	2	1075.88	7	1070.88		
	PZ-13D	1077.59	17	1060.59	22	1055.59		
	ML-4						13-15 18-20	
	ML-5 (PZ-9)	1073.13					8-10 13-15 18-20	1065.13-1063.13 1060.13-1058.13 1055.13-1053.13
Toe-of-slope Swale	PZ-14S	1075.5	2	1073.5	7	1068.5		
	PZ-14D	1075.57	11	1064.57	16	1059.57		
Unnamed Stream	P-24	1075.49	2	1073.49	7	1068.49		
Existing Wells	W-03	1083.36						
	W-04D	1084.22						
	W-04T	1084.84						
	W-09S1	1075.95						
	W-09TD	1075.58						
	W-25S1	1086.76						
	W-25S1	1086.76						
	P-13	1083.89						
	P-14	1081.49						
	P-19	1072.79						

Notes:
"P" wells will be single piezometers.
"PZ" wells will be nested pair piezometers, samples will be collected from both the shallow and deep piezometers at each designated location.
"ML" locations will consist of up to 6 discrete-interval samples collected using GeoProbe Screen Point sampler or similar device.
[1] When calculating bgs elevation, the higher elevation value was used between piezometers in each couplet
[2] Ranges are noted when no soil core was recovered from the bore hole
(1) Does not include cell volume, which is 250-350 mL, depending on set-up

TABLE 2-2
PDI Soil Sampling and Analysis Summary
Burgess Brothers Superfund Site, Bennington, VT

Boring ID	Location	Ground Surface Elevation (ft NAD 1983[1])	Bottom Elevation (ft NAD 1983)	Total Boring Depth (ft)	Laboratory Analysis - VOCs	Geotechnical Samples							Geotechnical Laboratory Sample IDs
						Grain size	Shear Strength[2]	Atterberg Limits	Soil Classification	Compaction[3]	Density[2]	Moisture Content	
						ASTM D422-63	ASTM D3080	ASTM D4318	ASTM D-2487	ASTM D 1557	ASTM D2937-04	ASTM D2216-98	
PZ-1	Landfill Compliance Barrier System	1086.8	1051.8	35	N/A	X		X	X	X	X	X	PZ1- PD-GT1
PZ-2		1085.6	1050.6	35	N/A	X	X	X	X	X	X	X	PZ2-PD-GT1 (4'-10'), PZ2-PD-GT2 (15'-23'), PZ2-PD-GT3 (30'-35')
PZ-3/ML-2		1083.5	1053.5	30	PZ3-PD-S1 (12'-13'), PZ3-PD-S2 (17'-18'), PZ150-PD-S1 (DUP), PZ3-PD-S3 (26')	X		X	X		X	X	PZ3-PD-GT1 (9'-18')
ML-3		1086	1056	30	ML3-PD-S1 (20'), ML152-PD-S1 (DUP), ML3-PD-S2 (23'), ML3-PD-S3 (29')	X		X	X		X	X	ML3-PD-GT1 (27'-30')
PZ-5		1082.3	1057.3	25	N/A	X		X	X	X	X	X	PZ5-PD-GT1 (3.5'-11.5'), PZ5/6-PD-GT2 (21'-25'), PZ5/6-PD-GT2 (17'-18')
PZ-6		1081	1060	21	N/A	Combined with Above		Combined with Above	Combined with Above		Combined with Above	Combined with Above	*PZ5/6-PD-GT2 (17'-18'), PZ5/6-PD-GT2 (21'-25')*
PZ-7	Downgradient Barrier System	1075.3	1040.3	35	N/A	X	X	X	X	X	X	X	PZ7-PD-GT1 (2'-4'), PZ7-PD-GT2 (4'-10'), PZ7D-PD-GT1 (30'-35')
PZ-9/ML-5		1073.1	1048.1	25	N/A	X	X	X	X	X	X	X	PZ9-PD-GT1 (5'-20'), PZ9-PD-GT2 (23'-25')
PZ-10		1072.1	1042.1	30	N/A	X		X	X		X	X	PZ10-PD-GT1 (5'-7'), PZ10-PD-GT2 (13'-18'), PZ10-PD-GT3 (27'-30')
ML-1	Landfill Compliance Barrier System	1085.6	1055.6	30	ML1-PD-S1 (5'), ML1-PD-S2 (9.5'-10'), ML1-PD-S3 (27'), MS, MSD	NONE							N/A
PZ-4		1081.6	1051.6	30	PZ4-PD-S1 (30')	NONE							N/A
PZ-8	Downgradient Barrier System	1074.3	1049.3	25	N/A	NONE							N/A
PZ-12		1074.9	1044.9	30	PZ12-PD-S1 (2'), PZ12-PD-S2 (9'), PZ160-PD-S1 (9', DUP)	NONE							N/A
PZ-13		1077.6	1047.6	30	N/A	NONE							N/A
ML-4		1076	1051	25	N/A	NONE							N/A
PZ-14	Toe-of-slope Swale	1075.5	1050.5	25	PZ14-PD-S1 (2'), MS, MSD	NONE							N/A
P-24	Unnamed Stream	1075.5	1060.5	15	N/A	NONE							N/A
			Total # of Samples:		**13**	**17**	**6**	**17**	**17**	**6**	**17**	**17**	

Notes:

= Estimated Elevation

1. NAD 1983 = North American Vertical Datum of 1983
2. Density and shear strength samples will only be collected from relatively undisturbed samples, if possible. Up to 3 samples per barrier location (one sample from each of the three lithologic units - Kame Sand, Ablation Till, and Lodgememnt Till).
3. Compaction tests will only be performed for the Kame Sand soils

TABLE 2-3
PDI Groundwater Sampling Methods and Field Analyses Summary
Burgess Brothers Superfund Site, Bennington, VT

Location	Well ID	Groundwater Sampling Summary												
		Date Purged/ Sampled	Purging Method	Sampling Device	Time Required to Stabilize/Purge (hours:min)	Total Volume Purged (1) (L)	Pump Rate (mL/min)	Does Well Go Dry Y/N	Temp (°C)	SC)	DO (mg/L)	pH	ORP (mV)	Turbidity (NTU)
Landfill Compliance Barrier System	PZ-1S	8/4	LF	Peristaltic										
	PZ-1D	8/4	LF	Peristaltic										
	PZ-2S	8/7	Conv.	Peristaltic	1:00	3 gal.	177.9	NO	15.25	525	2.22	6.52	-85.0	8.13
	PZ-2D[2]	8/6	Conv.	Peristaltic	1:30	6 gal.	454.3	NO	11.62	695	0.04	7.33	-194.7	4.83
	PZ-4S	8/1 - 8/2	LF	Bladder	7:00	3.5	10.8	NO	19.1	912	1.14	7.3	-132	16.6
	PZ-4D	7/31	LF	Bladder	5:00	0.8	4.7	NO	28.7	801	4.12	7.39	-67.3	19.7
	PZ-5S	8/6	Conv.	Peristaltic	0:35	2.5 gal.	302.8	NO	16.94	220	3.22	6.89	84.9	14.5
	PZ-5D	8/2	Conv.	Peristaltic	1:30	5.5 gal.	340.7	NO	11.44	257	2.84	7.48	-123.4	8.38
	PZ-6S	8/3	Conv.	Bladder	3:00	3 gal.	94.6	NO	25.87	217	1.04	6.97	-128.2	8.92
	PZ-6D	8/7	Conv.	Peristaltic	2:30	6 gal.	212.0	NO	14.46	193	0.37	7.75	-167.6	16.5
	ML-1 (8-10)	7/25	Conv.	Peristaltic					15.2	638	2.14	7.61	-53.2	
	ML-1 (13-15)	7/25	Conv.	Peristaltic										
	ML-1 (18-20)	7/25	Conv.	Peristaltic					14.5	643	2.34	7.76	-86.2	
	ML-1 (23-25)	7/25	Conv.	Peristaltic					22.8	645	1.42	8.02	-86.0	
	PZ-3S1	8/30	Conv.	Peristaltic	0:10	0.5 gal - DRY	289.2	YES	20.15	1015	0.01	6.18	-82.10	86.90
	PZ-3S2	8/9	Conv.	Peristaltic	0:50	3.1 gal.	257.4	NO	15.70	688	0.76	6.87	-173.8	5.99
	PZ-3D1	8/8	Conv.	Peristaltic	2:00	5 gal.	121.1	NO	15.51	705	0.04	7.16	-208.2	5.90
	PZ-3D2	8/29	Conv.	Peristaltic	2:00	6.5 gal.	198.4	NO	13.02	669	0.29	6.15	-185.1	17.80
	ML-3	7/24	Conv.	Peristaltic					23.30	760	1.84	7.76	-164.0	
		7/24	Conv.	Peristaltic					16.00	781	3.06	7.59	-152.0	
		7/24	Conv.	Peristaltic					17.3	888	2.15	7.76	-131.2	
Downgradient Barrier System	PZ-7S	8/8	Conv.	Bladder	1:30	3 gal.	99.9	NO	14.21	220	0.52	7.09	-160.2	16.9
	PZ-7D	8/29 - 8/31	LF	Bladder			10.0		21.3	219	1.56	8.21	48.1	7.21
	PZ-8S													
	PZ-8D													
	PZ-9S	8/9	Conv.	Peristaltic	0:15	1.5 gal. - DRY	352.0	YES*	16.78	326	1.81	7.51	-223	40.5
	PZ-9D	8/8	Conv.	Peristaltic	3:00	3.7 gal. - DRY	174.1	YES	12.33	257	0.06	7.95	-106.7	15
	PZ-10S	8/30	LF	Peristaltic	5+	0.6	10.0	NO	21.91	297	3.01	7.74	-109.4	11.7
	PZ-10D	8/29	LF	Bladder	13:00	1.0	6.0	NO	20.57	252	3.19	7.8	-114.2	6.2
	PZ-12S	8/31	Conv.	Peristaltic	0:45	2 gal.	181.7	NO	14.27	323	3.79	7.61	81.6	91.2
	PZ-12D	8/28	Conv.	Peristalitic	1:30	5 gal.	251.4	NO	11.92	231	1.51	7.91	53.1	4.97
	PZ-13S	8/29	Conv.	Peristaltic	0:45	4 gal. - DRY	94.6	YES	13.77	297	1.56	7.83	61.7	51
	PZ-13D	8/28	Conv.	Peristaltic	2.5 ?	5.5 gal.	213.1	NO	11.46	252	1.94	8.37	-72.9	6.13
	ML-4	8/14							16.8	419.3	2.62	8.54	-193.1	
	ML-5 (PZ-9)	7/26							16.4	185.5	3.9	7.96	-93.2	
		7/26							19.4	216.4	4.63	8.44	-60.2	
		7/26							17.4	174.5	5.42	8.58	18.5	
Toe-of-slope Swale	PZ-14S	8/30	Conv.	Peristaltic	1:00	5 gal.	162.8	NO	18.41	507	1.66	7.08	50.9	OVER
	PZ-14D	8/30	Conv.	Peristaltic	1:25	4.5 gal	242.3	NO	13.08	186	1.05	7.87	-91.5	20.8
Unnamed Stream	P-24	8/31	Conv.	Peristaltic	0:35	1.5 gal	189.3	NO	15.71	206	5.13	7.31	487	33.9
Existing Wells	W-03	8/8	LF	Peristaltic	3:00	1.2	7.7	NO	30.91	1080	0.08	6.8	-178.8	16.3
	W-04D	8/6	LF	Bladder	5:05	2.0	10.0	NO	27.09	933	0.78	7.11	-112.9	14.6
	W-04T	8/6	LF	Bladder	5:16	1.4	8.0	NO	27.12	871	1.63	6.87	-62.1	4.97
	W-09S1	7/31 - 8/1	LF	Bladder	9.74	1.9	9.7		26.1	162	6.46	6.86	341.5	1.27
	W-09TD	7/37 - 8/3	LF	Bladder	5:10	4.8	15.5	NO	23.21	3.92	1.46	8.11	-63.3	0.97
	W-25S1	8/8	LF	Peristaltic	3:45	0.2	3.3	NO	26.4	330	2.86	5.94	246	51.6
	W-25S1	8/8	Conv.	Peristaltic	5:00	3 gal - DRY	261.2	YES	14.85	307	3.2	5.5	282	22
	P-13	8/9	Conv.	Peristaltic	0:30	1.2 gal.	199.9	NO	16.41	145	1.77	6.89	145	2.98
	P-14	8/9	Conv.	Peristaltic	0:15	1.2 gal	350.0	NO*	17.19	196	1.07	7.85	-133.2	6.71
	P-19	8/6	Conv.	Peristaltic	2:00	0.36 gal. - DRY		YES	17.2	722	3.35	8.0	-44.9	25.7

Notes:
"P" wells will be single piezometers.
"PZ" wells will be nested pair piezometers, samples will be collected from both the shallow and deep piezometers at each designated location.
"ML" locations will consist of up to 6 discrete-interval samples collected using GeoProbe Screen Point sampler or similar device.
[1] When calculating bgs elevation, the higher elevation value was used between piezometers in each couplet
[2] Ranges are noted when no soil core was recovered from the bore hole
(1) Does not include cell volume, which is 250-350 mL, depending on set-up

TABLE 2-4
PDI Groundwater Sampling and Analysis Summary
Burgess Brothers Superfund Site, Bennington, VT

Well ID	Location	Top of Screen Elevation (ft NAD 1983[1])	Bottom of Screen Elevation (ft NAD 1983)	Screen Length (ft)	Laboratory Analyses										Sample IDs
					VOCs	Priority Pollutant Metals		Anions	Cations		Alkalinity	Total Dissolved Solids	Total & Dissolved Organic Carbon		
					EPA SW-846 Method 8260B	EPA SW-846 Methods 6020A, 7470, and 7196A		EPA SW-846 Method 9056A	EPA SW-846 Method 6010C		SM 2320B	SM 2540C	EPA SW-846 Method 9060A		
						TOTAL	DISSOLVED		TOTAL	DISSOLVED			TOTAL	DISSOLVED	
PZ-1S	Landfill Compliance Barrier System	1081.84	1076.84	5	X										PZ1S-PD-1
PZ-1D		1070.78	1065.78	5	X										PZ1D-PD-1
W-25S1			-10	10	X			X	X	X	X	X	X	X	W25S1-PD-1, W152-PD-1 (DUP)
ML-1		1077.63	1075.63	2	X										ML1-PD-W1 (8'-10')
		1072.63	1070.63	2	X										ML1-PD-W2 (13'-15')
		1067.63	1065.63	2	X										ML1-PD-W3 (18'-20')
		1062.63	1060.63	2	X										ML1-PD-W4 (23'-25')
PZ-2S		1080.63	1075.63	5	X			X	X	X	X	X	X	X	PZ2S-PD-1
PZ-2D		1068.67	1063.67	5	X			X	X		X	X	X	X	PZ2D-PD-1
ML-2		1075.6	1073.6	2	X										ML2-PD-W1 (8'-10')
		1060.5	1058.5	2	X										ML2-PD-W4 (23'-25')
		1055.5	1053.5	2	X										ML2-PD-W5 (28'-30')
PZ-3S1		1079.41	1077.41	2	X										ML2-PD-W7 (4'-6')
PZ-3S2		1073.53	1071.53	2	X										ML2-PD-W2 (10'-12')
PZ-3D1		1066.6	1064.6	2	X										ML2-PD-W3 (17'-19')
PZ-3D2		1058.44	1055.44	3	X										ML2-PD-W6 (25'-28')
W-04T			-5	5	X	X	X	X	X	X	X	X	X	X	W04T-PD-1
W-04D			-5	5	X	X		X	X		X	X	X	X	W04D-PD-1
ML-3		1078	1076	2	X										ML3-PD-W1 (8'-10')
		1073	1071	2	X										ML3-PD-W2 (13'-15'), MS, MSD, ML151-PD-W2 (DUP)
		1068	1066	2	X										ML3-PD-W3 (18'-20')
		1063	1061	2	X										ML3-PD-W4 (23'-25')
W-03			-5	5	X			X	X	X	X	X	X	X	W03-PD-1
PZ-4S		1071.48	1066.48	5	X	X		X	X		X	X	X	X	PZ4S-PD-1
PZ-4D		1062.61	1057.61	5	X	X		X	X		X	X	X	X	PZ4D-PD-1
PZ-5S		1079.37	1074.37	5	X			X	X		X	X	X	X	PS5S-PD-1
PZ-5D		1067.38	1062.38	5	X			X	X	X	X	X	X	X	PZ5D-PD-1
P-13			-5	5	X										P13-PD-1
PZ-6S		1076.96	1071.96	5	X			X	X		X	X		X	PZ6S-PD-1
PZ-6D		1068.14	1063.14	5	X			X	X	X	X	X	X	X	PZ6D-PD-1
P-14			-5	5	X										P14-PD-1
PZ-7S	Downgradient Barrier System	1070.98	1065.98	5	X			X		X	X	X	X	X	PZ7S-PD-1
PZ-7D		1058.31	1053.31	5	X			X	X		X	X		X	PZ7D-PD-1, MS, MSD
ML-4		1063	1061	2	X										ML4-PD-W1 (13'-15')
		1058	1056	2	X										ML4-PD-W2 (18'-20')
W-09TD		1056.58	1051.58	5	X	X		X	X		X	X	X	X	W09TD-PD-1, MS, MSD,W150-PD-1 (DUP)
W-09S1		1075.95	1065.95	10	X	X		X	X		X	X	X	X	W09S1-PD-1
PZ-9S		1069.13	1064.13	5	X		X	X		X	X	X	X	X	PZ9S-PD-1
PZ-9D		1058.1	1053.1	5	X		X	X		X	X	X	X	X	PZ9D-PD-1
ML-5		1065.13	1063.13	2	X										
		1060.13	1058.13	2	X										
		1055.13	1053.13	2	X										
PZ-10S		1069.18	1064.18	5	X	X		X	X		X	X	X	X	PZ10S-PD-1
PZ-10D		1051.17	1046.17	5	X	X		X	X		X	X		X	PZ10D-PD-1, PZ170-PD-1 (DUP)
PZ-12S		1069.96	1064.96	5	X										PZ12S-PD-1
PZ-12D		1059.96	1054.96	5	X										PZ12D-PD-1
PZ-13S		1075.88	1070.88	5	X										PZ13S-PD-1
PZ-13D		1060.59	1055.59	5	X										PZ13D-PD-1
PZ-14S	Toe-of-slope Swale	1073.5	1068.5	5	X										PZ14S-PD-1
PZ-14D		1064.57	1059.57	5	X										PZ14D-PD-1
P-19	Unnamed Stream			2	X	X									P19
P-24		1073.49	1068.49	5	X										PZ24-PD-1
				Total # of Samples:	**62**	**13**	**9**	**27**	**24**	**12**	**27**	**27**	**21**	**27**	

Acronyms and Abbreviations:
VOCs - Volatile Organic Compounds
Priority Pollutant Metals - Antimony, Arsenic, Beryllium, Cadmium, Chromium (total and hexavalent), Copper, Lead, Mercury, Nickel, Selenium, Silver, Thallium, and Zinc
Anions - Chloride, Sulfate, Nitrate, Nitrite, and Phosphate
Cations - Calcium, Potassium, Magnesium, Silica, Iron, Manganese, Sodium
Field Geochemical Parameters - Specific conductance, pH, oxidation-reduction potential (ORP), temperature, and dissolved oxygen (DO)
EPA - Environmental Protection Agency
SW-846 - Test Methods for Evaluating Solid Waste, Physical Chemical Methods
SM - Standard Methods for the Examination of Water and Wastewater

Table 2-5
PDI Bench Scale Test Sampling and Analysis Summary
Connelly ZVI, September - October, 2012

Burgess Brothers Superfund Site
Woodford and Bennington, Vermont

				Samples Collected and Analyzed							
Parameter Groups	**Analytical Laboratory**	**Analytical Method**	**Sampling Location**	**Baseline[1]**	**Week 1**	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**	**Week 7**
VOCs	SiREM	SiREM VOC Method[2]	Sampling Ports	--	7	7	7	7	7	7	7
			Influent	2	1	1	1	1	1	1	1
			Effluent	--	1	1	1	1	1	1	1
	TBD	EPA Method 8260B	Influent	2	1	--	--	1	--	--	1
			Effluent	--	1	--	--	1	--	--	1
Dissolved Gases	SiREM	SiREM DHG Method[2]	Sampling Ports	--	7	7	7	7	7	7	7
			Influent	2	1	1	1	1	1	1	1
			Effluent	--	1	1	1	1	1	1	1
Eh/pH	SiREM	SiREM Eh/pH Method[2]	Sampling Ports	--	7	7	7	7	7	7	7
			Influent	2	1	1	1	1	1	1	1
			Effluent	--	1	1	1	1	1	1	1
Anions	SiREM	SiREM Anion Method[2]	Sampling Ports	--	7	--	--	7	--	--	7
			Influent	2	1	--	--	1	--	--	1
			Effluent	--	1	--	--	1	--	--	1
Cations	TBD	EPA Method 6010C	Influent	2	1	--	--	--	--	--	1
			Effluent	--	1	--	--	--	--	--	1
Alkalinity	TBD	SM 2320B	Influent	2	1	--	--	--	--	--	1
			Effluent	--	1	--	--	--	--	--	1
Total Sulfide	TBD	EPA Method 376.2	Sampling Ports	--	1	--	--	1	--	--	1
			Influent	2	1	--	--	1	--	--	1
			Effluent	--	1	--	--	1	--	--	1
TDS	TBD	SM 2450C	Influent	2	1	--	--	1	--	--	1
			Effluent	--	1	--	--	1	--	--	1
Metals (PP13)	TBD	EPA Methods 6020A and 7470A	Influent	2	1	--	--	1	--	--	1
			Effluent	--	1	--	--	1	--	--	1

Acronyms and Abbreviations:

VOCs - Volatile Organic Compounds including tetrachloroethene, trichloroethene, cis-1,2-dichloroethene, and vinyl chloride

EPA - Environmental Protection Agency

Dissolved Gases - ethene, ethane, and methane

Eh - oxidation/reduction potential

Anions - chloride, nitrate, nitrite, sulfate, and phosphate

Cations - total iron, magnesium, calcium, potassium, manganese and silica

Metals (PP13) - Priority pollutant metals including antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc

Notes:

1. Baseline samples were collected in duplicate from the influent reservoir at the start of column testing.
2. SiREM Analytical Methods are detailed in Appendix C of the Project Operations Plan.

Table 2-6
PDI Bench Scale Test Sampling and Analysis Summary
Connelly and Peerless ZVI, January - March, 2013

Burgess Brothers Superfund Site
Woodford and Bennington, Vermont

				Samples Collected and Analyzed for Each Column Test, Except as Noted								
Parameter Groups	**Analytical Laboratory**	**Analytical Method**	**Sampling Location**	**Baseline[1]**	**Week 1**	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**	**Week 8 (2)**	**Week 10 (3)**
VOCs	SiREM	SiREM VOC Method[(4)]	Sampling Ports	--	7	7	7	7	7	7	7	7
			Influent[(5)]	2	1	1	1	1	1	1	1	1
			Effluent	--	1	1	1	1	1	1	1	1
	TBD	EPA Method 8260B	Influent[(5)]	2	--	--	--	1	--	--	1	--
			Effluent	--	1	--	--	1	--	--	1	--
Dissolved Gases	SiREM	SiREM DHG Method[(4)]	Sampling Ports	--	7	7	7	7	7	7	7	7
			Influent[(5)]	2	1	1	1	1	1	1	1	1
			Effluent	--	1	1	1	1	1	1	1	1
Eh/pH	SiREM	SiREM Eh/pH Method[(4)]	Sampling Ports	--	7	7	7	7	7	7	7	7
			Influent[(5)]	2	1	1	1	1	1	1	1	1
			Effluent	--	1	1	1	1	1	1	1	1
Anions	SiREM	SiREM Anion Method[(4)]	Sampling Ports	--	7	--	--	7	--	--	7	7
			Influent[(5)]	2	1	--	--	1	--	--	1	1
			Effluent	--	1	--	--	1	--	--	1	1
Cations	TBD	EPA Method 6010C	Influent[(5)]	2	--	--	--	--	--	--	1	--
			Effluent	--	1	--	--	--	--	--	1	--
Alkalinity	TBD	SM 2320B	Influent[(5)]	2	--	--	--	--	--	--	1	--
			Effluent	--	1	--	--	--	--	--	1	--
TDS	TBD	SM2540C	Influent[(5)]	2	--	--	--	1	--	--	1	--
			Effluent	--	1	--	--	1	--	--	1	--
Metals (PP13)	TBD	EPA Methods 6020A and 7470A	Influent[(5)]	2	--	--	--	1	--	--	1	--
			Effluent	--	1	--	--	1	--	--	1	--

Acronyms and Abbreviations:

VOCs - Volatile Organic Compounds including tetrachloroethene, trichloroethene, cis-1,2-dichloroethene, and vinyl chloride

EPA - Environmental Protection Agency

Dissolved Gases - ethene, ethane, and methane

Eh - oxidation/reduction potential

Anions - chloride, nitrate, nitrite, sulfate, and phosphate

Cations - total iron, magnesium, calcium, potassium, manganese and silica

Metals (PP13) - Priority pollutant metals including antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc

Notes:

1. Baseline samples were collected in duplicate from the influent reservoir at the start of column testing.
2. Only three samples were collected from the Peerless ZVI column at Week 8 for analysis of VOCs, dissolved gases, Eh/pH, and anions.
3. Week 10 sampling was performed only for the Connelly ZVI column. The Peerless ZVI column test stopped after Week 8 sampling.
4. SiREM Analytical Methods are detailed in Appendix C of the Project Operations Plan.
5. Influent sampling was performed at the single influent reservoir shared by both columns.

TABLE 3-1

Hydraulic Conductivity Summary for Selected Kame Sand and Ablation Till Wells Near Compliance Boundary and Downgradient Barriers

Burgess Brothers Superfund Site, Bennington and Wodford, Vermont

Geology	Well	Ground Elevation (RI) (ft MSL)	Screen Depths Top (ft)	Screen Depths Bottom (ft)	Screen Elevation (RI) Top (ft-MSL)	Screen Elevation (RI) Bottom (ft-MSL)	Hydraulic Conductivity (ft/day)	Groundwater Velocity[1] (ft/year)
Ablation Till	W04T	1079.00	18.5	28.5	1060.5	1050.5	7.99E-02	7.00
Ablation Till	W03T	1079.81	17.0	27.0	1062.81	1052.81	4.34E-02	3.80
Ablation Till	W06D	1078.66	11.5	16.5	1067.16	1062.16	3.39E-02	2.97
						Average	**5.241E-02**	**4.59**
						Cv	**0.46**	
Kame Sand	W09-S1	1076.64	0.0	10.0	1076.64	1066.64	2.90E-01	25.39
Kame Sand	W06S	1078.26	1.0	5.0	1077.26	1073.26	2.63E-01	23.03
Kame Sand	W05	1080.77	4.0	14.0	1076.77	1066.77	1.85E-01	16.18
Kame Sand	W04D	1079.00	10.5	15.5	1068.5	1063.5	1.05E-01	9.23
Kame Sand	W25-S1	1086.60	2.0	8.0	1084.6	1078.6	6.84E-02	5.99
Kame Sand	W03	1079.28	7.0	17.0	1072.28	1062.28	4.01E-02	3.51
						Average	**1.586E-01**	**13.89**
						Cv	**0.65**	

Source: Remedial Investigation Report (O'Brien and Gere, August 1994)

[1] Groundwater velocity calculated assuming the following conditions:

Porosity	0.25
Hydraulic Gradient	0.06

Cv - Coefficient of variation

TABLE 3-2

Hydraulic Gradent Analysis Summary

Burgess Brothers Superfund Site, Bennington, Vermont

Triangulation Wells			Gradient Azimuth (degrees from North) Average	Max	Min	Gradient (ft/ft) Average	Max	Min
Compliance Boundary								
Shallow								
PZ-5S	PZ-6S	PZ-4S	198.99	218.14	192.02	0.018	0.019	0.016
W32S1	W04D	W25S1	181.11	186.09	170.88	0.080	0.089	0.067
Deep								
PZ-4D	PZ-5D	PZ-6D	212.59	228.64	205.30	0.015	0.015	0.014
W32T	W04T	PZ-2D	169.53	171.53	167.83	0.091	0.099	0.084
Downgradient								
Shallow								
PZ-09S	PZ-14S	P-24	237.78	256.62	216.95	0.037	0.054	0.032
PZ-09S	PZ-10S	P-24	267.48	296.94	247.87	0.032	0.042	0.029
PZ-7S	PZ-13S	W09S1	234.96	254.03	227.09	0.048	0.052	0.039
PZ-09S	PZ-13S	PZ-12S	207.21	217.57	199.16	0.059	0.078	0.046
PZ-09S	PZ-14S	PZ-12S	190.40	200.45	185.75	0.057	0.074	0.044
Deep								
PZ-09D	PZ-10D	PZ-8D	240.42	250.34	231.64	0.025	0.030	0.021
PZ-09D	PZ-13D	PZ-8D	224.36	227.62	220.19	0.038	0.043	0.034
PZ-09D	PZ-13D	PZ-12D	205.36	219.51	193.69	0.017	0.024	0.014
PZ-7D	PZ-13D	PZ-8D	244.97	248.06	242.56	0.052	0.057	0.048
PZ-09D	PZ-14D	PZ-12D	243.47	249.91	229.93	0.027	0.029	0.025
PZ-09D	PZ-8D	PZ-12D	240.63	248.65	228.21	0.025	0.030	0.022
PZ-13D	PZ-8D	PZ-12D	213.57	219.90	208.81	0.035	0.039	0.032

Gradents and azimuths are calculated from the slope of a plane intersecting groundwater elevations at three well locations (triangulating wells). Groundwater elevations were measured during 2012 using pressure transducers that log data every 6 hours. Time-series plots of azimuth an gradient for each set of triangulating wells are provided in Appendix __.

TABLE 3-3
Groundwater VOC Analytical Results
Pre-Design Investigation 2012
Burgess Brothers Superfund Site, Bennington, VT
Compliance Boundary Results (West - East)

Analyte	Units	ICL	PZ1S-PD-1 10/4/2012	PZ1D-PD-1 10/4/2012	W25S1-PD-1 8/8/2012	PZ2S-PD-1 8/7/2012	PZ2D-PD-1 8/6/2012	ML1-PD-W1 (8-10') 7/25/2012	ML1-PD-W2 (13-15') 7/25/2012	ML1-PD-W3 (18-20') 7/25/2012	ML1-PD-W4 (23-25') 7/25/2012	ML2-PD-W7 (4'-6') 8/30/2012	ML2-PD-W1 (8-10) 7/17/2012	ML2-PD-W2 (10-12) 8/9/2012	ML2-PD-W3 (17-19) 8/8/2012	ML2-PD-W4 (23'-25') 8/13/2012	ML2-PD-W5 (28'-30') 8/13/2012	ML2-PD-W6 (25'-28') 8/29/2012
Volatile Organic Compounds (GC/MS)																		
1,1-Dichloroethene	ug/L	7	-	1.8	-	-	25 J	-	-	16 J	95 J	21	-	-	-	-	17 J	60 J
1,2-Dichloroethene, Total	ug/L		-	52	8.3	2200	1300	1200	1200	1100	5000	1100	1700	2200	2600	2300	1700	3600
trans-1,2-Dichloroethene	ug/L	100	-	-	-	-	-	-	-	-	-	5.6 J	-	-	-	-	-	-
1,2,4-Trichlorobenzene	ug/L	*70*	-	-	-	-	-	-	-	-	-	-	-	58 J	-	-	-	-
1,3-Dichlorobenzene			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	ug/L	75	-	-	-	-	-	-	-	-	-	4.0 J	-	-	-	-	-	-
2-Butanone	ug/L		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	220 J
Acetone	ug/L		-	-	1.2 J	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	ug/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon disulfide			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroform	ug/L	80	-	0.39 J	-	-	-	-	-	-	-	-	-	-	-	370	28 J	26 J
Chloromethane	ug/L		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
cis-1,2-Dichloroethene	ug/L	70	-	52	8.3	2200	1300	1200	1200	1100	5000	1100	1700	2200	2600	2300	1700	3600
Dichlorodifluoromethane	ug/L		-	6.7	0.39 J	-	28 J	-	19 J	23 J	58 J	10 J	-	-	-	39 J	-	34 J
Methyl methacrylate			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylene Chloride	ug/L	5	-	-	-	-	-	-	-	-	-	6.3 J	-	-	-	-	-	-
Tetrachloroethene	ug/L	5	0.91 J	13	1.3	33000	3700	6200	3600	2700	5400	670	5000	12000	24000	9900	3100	10000
Tetrahydrofuran			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	ug/L	*1000*	-	-	-	-	-	71 J	27 J	10 J	21 J	15	-	-	-	16 J	-	-
Trichloroethene	ug/L	5	0.66 J	80	14	2100	1200	820	560	660	5000	440	530	1600	1600	1700	1200	3500
Vinyl chloride	ug/L	2	-	5	2.2	400 J	330	390	390	380	1800	770	230	350	430	670	380	1100
o-Xylene	ug/L		-	0.42 J	-	-	9.7 J	-	-	6.1 J	-	-	-	-	-	-	-	-

Qualifier
ICL = Interim Cleanup Level as referenced in the 2012 Statement of Work;
except values in italic, which are Federal Maximum Contaminant Levels (MCLs)
J Result is less than the RL but greater than or equal to the MDL and the concentration is is an approximate value.
E Result exceeded calibration range. "-" = Concentration not detected
* Recovery or RPD exceeds control limits

TABLE 3-3
Groundwater VOC Analytical Results
Pre-Design Investigation 2012
Burgess Brothers Superfund Site, Bennington, VT
Compliance Boundary Results (West - East)

Analyte	Units	ICL	WO4D-PD-1 8/7/2012	WO4T-PD-1 8/7/2012	ML3-PD-W1 (8-10) 7/24/2012	ML3-PD-W2 (13-15) 7/24/2012	ML3-PD-W3 (18-20) 7/24/2012	ML3-PD-W4 (13-25) 7/24/2012	PZ-4S-PD-1 8/2/2012	PZ-4D-PD-1 8/1/2012	W03-PD-1 8/8/2012	PZ5S-PD-1 8/6/2012	PZ-5D-PD-1 8/2/2012	PZ-6S-PD-1 8/2/2012	PZ6D-PD-1 8/7/2012	P13-PD-1 8/9/2012	P14-PD-1 8/9/2012
Volatile Organic Compounds (GC/MS)																	
1,1-Dichloroethene	ug/L	7	-	-	-	-	6.2 J	-	25 J	34 J	19	-	0.78 J	-	1.5	-	-
1,2-Dichloroethene, Total	ug/L		2200	3200	-	1100	1300	1400	1300	1800	1200	-	36	0.90 J	36	-	-
trans-1,2-Dichloroethene	ug/L	100	-	-	-	6.9 J	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	ug/L	*70*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene			-	-	0.45 J	-	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	ug/L	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Butanone	ug/L		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetone	ug/L		-	-	8.2	-	-	-	-	-	-	2.9 J	5.4 J	3.5 J	3.3 J	-	-
Benzene	ug/L	5	-	-	0.60 J	-	-	-	-	-	-	-	-	-	0.28 J	-	-
Carbon disulfide			-	-	0.45 J	-	-	-	-	-	-	-	-	-	-	-	-
Chloroform	ug/L	80	-	-	7.2	6.1 J	7.3 J	-	-	-	-	0.45 J	10	0.46 J	3.7	-	-
Chloromethane	ug/L		-	-	-	-	-	-	-	-	-	-	-	-	-	0.28 J	-
cis-1,2-Dichloroethene	ug/L	70	2200	3200	-	1100	1300	1400	1300	1800	1200	-	36	0.90 J	36	-	-
Dichlorodifluoromethane	ug/L		-	42 J	-	2.6 J	15 J	17 J	21 J	16 J	-	-	-	-	0.47 J	-	-
Methyl methacrylate			-	-	0.99 J	-	-	-	-	-	-	-	-	-	-	-	-
Methylene Chloride	ug/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethene	ug/L	5	7200	10000	-	230	2300	1800	3200	3200	520	0.41 J	110	1.9	110	1.7	-
Tetrahydrofuran			-	-	18	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	ug/L	*1000*	-	-	39	67	33	45	25 J	-	-	-	0.30 J	0.45 J	-	-	-
Trichloroethene	ug/L	5	840	2700	1.1	300	1100	900	1300	2000	670	-	61	1.6	72	-	-
Vinyl chloride	ug/L	2	190	480	-	230	120	200	320	460	210	-	-	-	0.40 J	-	-
o-Xylene	ug/L		-	-	0.51 J	-	-	-	-	8.1 J	-	-	-	-	-	-	-

Qualifier
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* Recovery or RPD exceeds control limits

TABLE 3-3
Groundwater VOC Analytical Results
Pre-Design Investigation 2012
Burgess Brothers Superfund Site, Bennington, VT
Downgradient Barrier Results (West - East)

Analyte	Units	ICL	PZ7S-PD-1 8/8/2012	PZ7D-PD-W1 8/30/2012	PZ13S-PD-W1 8/29/2012	PZ13D-PD-W1 8/28/2012	W09TD-PD-1 8/2/2012	W09S1-PD-1 8/1/2012	ML4-PD-W1 (13-15) 8/14/2012	ML4-PD-W2 (18'-20') 8/14/2012	PZ12S-PD-W1 8/31/2012	PZ12D-PD-W1 8/28/2012	ML5-PD-W1 (8-10) 8/9/2012	ML5-PD-W2 (13-15) 8/9/2012	ML5-PD-W3 (18'-20') 8/9/2012
Volatile Organic Compounds (GC/MS)															
1,1-Dichloroethene	ug/L	7	-	0.38 J	-	2.5	17	2.6 J	7	20	-	0.80 J	0.36 J	-	-
1,2-Dichloroethene, Total	ug/L		3.9	11	7.6	82	630	120	320	820	240	53	33	2.7	2.3
trans-1,2-Dichloroethene	ug/L	100	-	-	-	-	-	0.79 J	1.8 J	-	-	-	-	-	-
1,2,4-Trichlorobenzene	ug/L	*70*	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene			-	-	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	ug/L	75	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Butanone	ug/L		-	-	-	5.6 J	-	-	-	-	-	-	-	-	-
Acetone	ug/L		-	1.7 J	6.4	2.8 J	-	-	5.1 J *	-	-	-	15	11	60
Benzene	ug/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon disulfide			-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroform	ug/L	80	-	-	-	1.6 J	-	-	7.4	17	-	2.9 J	25	1.9	11
Chloromethane	ug/L		-	0.41 J	-	-	-	-	-	-	-	-	-	-	-
cis-1,2-Dichloroethene	ug/L	70	3.9	11	7.6	82	630	120	320	820	240	53	33	2.7	2.3
Dichlorodifluoromethane	ug/L		-	0.29 J	-	1.6 J	7.4 J	1.9 J	2.5 J	7.6 J	2.0 J	0.79 J	0.23 J	-	-
Methyl methacrylate			-	-	-	-	-	-	-	-	-	-	2.3	1.4	1.1
Methylene Chloride	ug/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethene	ug/L	5	9.8	26	13	160	880	260	370	1000	850	180	33	1.6	3
Tetrahydrofuran			-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	ug/L	*1000*	-	0.84 J	-	-	-	-	120	24	-	-	110 E	75	38
Trichloroethene	ug/L	5	9.5	26	13	150	910	190	430	1100	780	190	30	4.1	7.1
Vinyl chloride	ug/L	2	-	0.49 J	0.38 J	2.3 J	110	7.9	26	150	42	9.2	6	0.35 J	0.27 J
o-Xylene	ug/L		-	-	-	-	-	-	-	-	-	-	0.24 J	-	-

Qualifier
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J Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
E Result exceeded calibration range. "-" = Concentration not detected
* Recovery or RPD exceeds control limits

TABLE 3-3
Groundwater VOC Analytical Results
Pre-Design Investigation 2012
Burgess Brothers Superfund Site, Bennington, VT
Downgradient Barrier Results (West - East)

Analyte	Units	ICL	PZ9S-PD-1 8/9/2012	PZ9D-PD-1 8/9/2012	P19 9/13/2012	PZ10D-PD-W1 8/30/2012	PZ10S-PD-W1 8/30/2012	PZ14S-PD-W1 8/30/2012	PZ14D-PD-W1 8/30/2012	P24-PD-W1 8/31/2012
Volatile Organic Compounds (GC/MS)										
1,1-Dichloroethene	ug/L	7	-	-	0.84 J	-	-	3.7 J	-	-
1,2-Dichloroethene, Total	ug/L		60	0.51 J	45	-	-	610	-	-
trans-1,2-Dichloroethene	ug/L	100	0.39 J	-	-	-	-	4.7 J	-	-
1,2,4-Trichlorobenzene	ug/L	*70*	0.32 J	-	-	-	-	-	-	-
1,3-Dichlorobenzene			-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	ug/L	75	-	-	-	-	-	-	-	-
2-Butanone	ug/L		-	-	-	-	-	-	-	-
Acetone	ug/L		5.3	3.6 J	-	2.8 J	4.5 J	12 J	3.8 J	1.2 J
Benzene	ug/L	5	-	-	-	-	-	-	-	-
Carbon disulfide			-	-	-	-	-	-	-	-
Chloroform	ug/L	80	3.4	1.8	0.56 J B	-	-	8.8	-	-
Chloromethane	ug/L		-	-	-	-	0.38 J	-	0.40 J	0.30 J
cis-1,2-Dichloroethene	ug/L	70	60	0.51 J	45	0.24 J	-	610	-	-
Dichlorodifluoromethane	ug/L		-	-	2.5	-	-	-	-	-
Methyl methacrylate			-	-	8.5 * B	-	-	-	-	-
Methylene Chloride	ug/L	5	-	-	1.1 J B	-	-	-	-	-
Tetrachloroethene	ug/L	5	48	1.2	98	8.1	-	590	-	-
Tetrahydrofuran			-	-	-	-	-	-	-	-
Toluene	ug/L	*1000*	0.28 J	-	-	-	-	-	-	-
Trichloroethene	ug/L	5	42	0.23 J	120	2.2	-	330	-	-
Vinyl chloride	ug/L	2	0.33 J	-	1.4 J	-	-	22	-	-
o-Xylene	ug/L		-	-	-	-	-	-	-	-

Qualifier
ICL = Interim Cleanup Level as referenced in the 2012 Statement of Work;
except values in italic, which are Federal Maximum Contaminant Levels
J Result is less than the RL but greater than or equal to the MDL and the conce
an approximate value.
E Result exceeded calibration range. "-" = Concentration not detect
* Recovery or RPD exceeds control limits

TABLE 3-4
Groundwater Inorganics Analytical Results: Pre-Design Investigation 2012
Burgess Brothers Superfund Site, Bennington, VT
Compliance Boundary Results (West - East)

Analyte	Units	ICLs	W25S1-PD-1 8/8/2012	W25S1-PD-1 8/8/2012 Filtered	PZ2S-PD-1 8/7/2012	PZ2S-PD-1 8/7/2012 Filtered	PZ2D-PD-1 8/6/2012	PZ2D-PD-1 8/6/2012 Filtered	WO4D-PD-1 8/7/2012	WO4D-PD-1 8/7/2012 Filtered	WO4T-PD-1 8/7/2012	WO4T-PD-1 8/7/2012 Filtered	PZ-4S-PD-1 8/2/2012	PZ-4S-PD-1 8/2/2012 Filtered	PZ-4D-PD-1 8/1/2012	PZ-4D-PD-1 8/1/2012 Filtered
Cations (Metals (ICP)																
Calcium	mg/L		**7.68**	**7.62**	**37.6**	**39.9**	**78.4**		**113**		**108**	**101**	**86.7**		**97.4**	
Iron	mg/L		**2.11**	**0.696**	**3.93**	**3.43**	**0.22**		**1.36**		**2.51**	**1.83**	**2.35**		**-**	
Magnesium	mg/L		**8.73**	**8.85**	**14.5**	**15.3**	**47.6**		**18.1**		**41.7**	**42.7**	**42.7**		**45.5**	
Manganese	mg/L	**0.3**	**1.26**	**1.35**	**6.85**	**7.42**	**0.12**		**1.6**		**9.95**	**9.08**	**1.3**		**1.29**	
Potassium	mg/L		**9.8**	**11.4**	**32.2**	**33.8**	**2.87 J**		**34.5**		**16.1**	**13.8**	**8.1**		**5.34**	
Silicon	mg/L		**5.93**	**6.74**	**5.29**	**6.14**	**6.97**		**2.14**		**7.49**	**3.39**	**-**		**-**	
Solids, Total Dissolved (TDS)																
Total Dissolved Solids	mg/L		**195**		**298**		**343**		**442**		**452**		**492**		**428**	
Anions, Ion Chromatography																
Alkalinity	mg/L		**81.8**		**206**		**344**		**338**		**402**		**400**		**373**	
Chloride	mg/L		**1.8 J**		**7.9**		**4.9 J**		**17.7**		**19.5**		**18.4**		**14**	
Nitrate as N	mg/L		**2.1**		**-**		**-**		**1.7**		**-**		**-**		**-**	
Sulfate	mg/L		**35.6**		**6.8**		**9**		**-**		**4.6 J**		**16.9**		**11.4**	
Orthophosphate	mg/L		**-**		**-**		**-**		**-**		**-**		**-**		**0.26**	
Organic Carbon, Total (TOC)/ Organic Carbon, Dissolved (DOC)																
TOC/DOC Result 1	mg/L		**14.3**	**15.3**	**7.3**	**8.4**	**1.3**	**1.8**	**9.1**	**10.1**	**3.2**	**3.6**	**8.8**	**9**	**2.8**	**4.9**
TOC/DOC Result 2	mg/L		**14**	**14.8**	**6.9**	**8.3**	**1.4**	**1.6**	**8.4**	**10.5**	**3.1**	**3.4**	**8.9**	**8.9**	**2.7**	**4.9**
TOC/DOC Result 3	mg/L		**13.9**	**14.7**	**6.9**	**8.3**	**1.3**	**1.5**	**8.3**	**10.3**	**3.1**	**3.6**	**8.8**	**8.9**	**2.8**	**5**
TOC/DOC Result 4	mg/L		**13.9**	**14.8**	**6.9**	**8.2**	**1.4**	**1.5**	**8.4**	**10.1**	**3.2**	**3.6**	**8.8**	**8.9**	**2.7**	**4.8**
TOC/DOC	mg/L		**14**	**14.9**	**7**	**8.3**	**1.4**	**1.6**	**8.6**	**10.2**	**3.2**	**3.5**	**8.8**	**8.9**	**2.8**	**4.9**

Qualifier
J Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

"-" = Concentration not detected
Blank Cell designates not analyzed

TABLE 3-4
Groundwater Inorganics Analytical Results: Pre-Design Invest
Burgess Brothers Superfund Site, Bennington, VT
Compliance Boundary Results (West - East)

Analyte	Units	ICLs	W03-PD-1 8/8/2012	W03-PD-1 8/8/2012 Filtered	PZ5S-PD-1 8/6/2012	PZ5S-PD-1 8/6/2012 Filtered	PZ-5D-PD-1 8/2/2012	PZ-5D-PD-1 8/2/2012 Filtered	PZ-6S-PD-1 8/2/2012	PZ-6S-PD-1 8/2/2012 Filtered	PZ6D-PD-1 8/7/2012	PZ6D-PD-1 8/7/2012 Filtered
Cations (Metals (ICP)												
Calcium	mg/L		**126**	**126**	**28.5**		**29.9**	**31.3**	**26.6**		**21.3**	**21.9**
Iron	mg/L		**1.34**	**0.748**	**0.197 J**		**0.103 J**	**-**	**2.09**		**0.279**	**-**
Magnesium	mg/L		**36.6**	**36.8**	**8.76**		**8.48**	**8.58**	**8.37**		**7.91**	**8**
Manganese	mg/L	**0.3**	**2.26**	**2.19**	**0.242**		**0.55**	**0.59**	**0.856**		**0.125**	**0.129**
Potassium	mg/L		**22.3**	**22.7**	**0.664 J**		**0.72 J**	**0.77 J**	**0.897 J**		**1.10 J**	**1.18 J**
Silicon	mg/L		**9.49**	**9.18**	**2.44**		**-**	**-**	**-**		**3.37**	**2.93**
Solids, Total Dissolved (TDS)												
Total Dissolved Solids	mg/L		**586**		**108**		**150**		**124**		**94**	
Anions, Ion Chromatography												
Alkalinity	mg/L		**475**		**85**		**110**		**90.2**		**80.3**	
Chloride	mg/L		**10.9**		**-**		**2.5 J**		**1.0 J**		**2.9 J**	
Nitrate as N	mg/L		**-**		**0.093 J**		**-**		**-**		**0.088 J**	
Sulfate	mg/L		**6.9**		**5**		**5.2**		**4.5 J**		**5.2**	
Orthophosphate	mg/L		**-**		**-**		**-**		**-**		**-**	
Organic Carbon, Total (TOC)/ Organic Carbon, Dissolved (DOC)												
TOC/DOC Result 1	mg/L		**4.8**	**8.4**	**1.8**	**9.7**	**4.3**	**4.2**	**-**	**12.8**	**1.8**	**1.6**
TOC/DOC Result 2	mg/L		**4.6**	**8.5**	**1.8**	**9.5**	**4.3**	**4.2**	**-**	**15.5**	**1.2**	**1.1**
TOC/DOC Result 3	mg/L		**4.5**	**8.5**	**1.8**	**9.7**	**4.4**	**4.4**	**-**	**12.2**	**1.1**	**1.1**
TOC/DOC Result 4	mg/L		**4.5**	**8.9**	**1.8**	**9.8**	**4.3**	**4.3**	**-**	**12.4**	**1.1**	**1**
TOC/DOC	mg/L		**4.6**	**8.6**	**1.8**	**9.7**	**4.3**	**4.3**	**-**	**13.2**	**1.3**	**1.2**

Qualifier
J Result is less than the RL but greater than or equal to the MDL and the concentration is ar

"-" = Concentration not detected
Blank Cell designates not analyzed

TABLE 3-4
Groundwater Inorganics Analytical Results
Pre-Design Investigation 2012
Burgess Brothers Superfund Site, Bennington, VT
Downgradient Barrier Results (West - East)

Analyte	Units	ICL	PZ7S-PD-1 8/8/2012	PZ7S-PD-1 8/8/2012 Filtered	PZ7D-PD-W1 8/30/2012	PZ7D-PD-W1 8/30/2012 Filtered	W09TD-PD-1 8/2/2012	W09TD-PD-1 8/2/2012 Filtered	W09S1-PD-1 8/1/2012	W09S1-PD-1 8/1/2012 Filtered	PZ9S-PD-1 8/9/2012	PZ9S-PD-1 8/9/2012 Filtered	PZ9D-PD-1 8/9/2012	PZ9D-PD-1 8/9/2012 Filtered	PZ10D-PD-W1 8/30/2012	PZ10D-PD-W1 8/30/2012 Filtered	PZ10S-PD-W1 8/30/2012	PZ10S-PD-W1 8/30/2012 Filtered
Cations (Metals (ICP)																		
Calcium	mg/L			25.8	21.9		43		18.6			32.9		24.8	27.4		29.3	
Iron	mg/L			0.55	0.191 J		-		0.125 J			-		-	0.169 J		0.050 J	
Magnesium	mg/L			6.12	8.72		27.8		6.84			9.54		9.07	10.2		6.92	
Manganese	mg/L	0.3		0.98	0.057		0.005 J		0.021			0.427		0.186	0.036		0.006 J	
Potassium	mg/L			0.67 J	1.02 J		0.997 J		0.547 J			2.85 J		2.34 J	1.31 J		2.13 J	
Silicon	mg/L			2.6	-		-		-			2.19		1.86	-		-	
Solids, Total Dissolved (TDS)																		
Total Dissolved Solids	mg/L		104		111		52		89		205		128		126		154	
Anions, Ion Chromatography																		
Alkalinity	mg/L		98.4		69.8		176		60.3		108		85.7		91.8		106	
Chloride	mg/L		1.1 J		4.9 J		3.4 J		3.1 J		9.7		5.5		2.1 J		5.2	
Nitrate as N	mg/L		0.078 J		0.079 J		0.8		0.58		-		-		-		-	
Sulfate	mg/L		6.8		17.8		16.4		9		20.1		13.9		6.6		14	
Orthophosphate	mg/L		-		-		-		-		-		-		-		-	
Organic Carbon, Total (TOC)/ Organic Carbon, Dissolved (DOC)																		
TOC/DOC Result 1	mg/L		2.2	1.6	-	2.3	2.1	3.6	2	12.3	3.1	3.7	1.4	2.4	-	2.5	1.2	3.6
TOC/DOC Result 2	mg/L		1.8	1.6	-	2.4	1.5	3.5	1.5	13.1	3.1	3.1	1.2	1.7	-	2.3	1.2	3.5
TOC/DOC Result 3	mg/L		1.7	1.5	-	2.2	1.4	3.3	1.3	13.2	3	3.1	1.2	1.7	-	2.4	1.2	3.6
TOC/DOC Result 4	mg/L		1.7	1.5	-	2.2	1.4	3.4	1.3	13.2	3.1	3.1	1.2	1.7	-	2.3	1.1	3.6
TOC/DOC	mg/L		1.9	1.6	-	2.2	1.6	3.5	1.5	12.9	3.1	3.3	1.3	1.9	-	2.4	1.2	3.6

Qualifier
J Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

"-" = Concentration not detected
Blank Cell designates not analyzed

TABLE 3-5
Groundwater PP-13 Analytical Results: Pre-Design Investigation 2012
Burgess Brothers Superfund Site, Bennington, VT
Compliance Boundary Results (West - East)

Analyte	Units	ICL	WO4D-PD-1 8/7/2012	WO4D-PD-1 8/7/2012 Filtered	WO4T-PD-1 8/7/2012	WO4T-PD-1 8/7/2012 Filtered	PZ-4S-PD-1 8/2/2012	PZ-4S-PD-1 8/2/2012 Filtered	PZ-4D-PD-1 8/1/2012	PZ-4D-PD-1 8/1/2012 Filtered
PP13 Metals (ICP/MS)										
Antimony	ug/L	*6*	**0.16 J**		-	-	-		-	
Arsenic	ug/L	10	**0.56 J**		**1.9 J**	**1.7 J**	-		-	
Beryllium	ug/L	*4*	-		-	-	-		-	
Cadmium	ug/L	*5*	**0.086 J**		**0.070 J**	**0.054 J**	-		-	
Chromium (total)	ug/L	*100*	-		**0.20 J**	-	-		**0.26 J**	
Chromium (hexavalent)	ug/L		-		-		-		-	
Copper	ug/L	*1300 TT*	**3.0 J**		**0.92 J**	**0.35 J**	-		-	
Lead	ug/L	15	-		-	-	-		-	
Mercury	ug/L	*2*	-		-	-	-		-	
Nickel	ug/L		**119**		**33.1**	**31.6**	**52.2**		**19.9 J**	
Selenium	ug/L	*50*	-		-	-	-		-	
Silver	ug/L		-		-	-	-		-	
Thallium	ug/L	2	-		-	-	-		-	
Zinc	ug/L		**8.9 J**		**0.73 J**	**0.73 J**	-		-	

Qualifier
ICL = Interim Cleanup Level as referenced in the 2012 Statement of Work;
except values in italic, which are Federal Maximum Contaminant Levels (MCLs)
J Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

"-" = Concentration not detected
Blank Cell designates not analyzed

TABLE 3-5
Groundwater PP-13 Analytical Results: Pre-Design Investigation 2012
Burgess Brothers Superfund Site, Bennington, VT
Downgradient Barrier Results (West - East)

Analyte	Units	ICL	P19-PD-1 8/6/2012	P19-PD-1 8/6/2012 Filtered	W09TD-PD-1 8/2/2012	W09TD-PD-1 8/2/2012 Filtered	W09S1-PD-1 8/1/2012	W09S1-PD-1 8/1/2012 Filtered	PZ10S-PD-1 8/30/2012	PZ10S-PD-1 8/30/2012 Filtered	PZ10D-PD-1 8/30/2012	PZ10D-PD-1 8/30/2012 Filtered
PP13 Metals (ICP/MS)												
Antimony	ug/L	*6*	-		-		-		-		-	
Arsenic	ug/L	10	**1.8 J**		-		-		-		-	
Beryllium	ug/L	*4*	-		-		-		-		-	
Cadmium	ug/L	*5*	**0.082 J**		-		-		-		-	
Chromium (total)	ug/L	*100*	**0.31 J**		**0.53 J**		**0.69 J**		-		-	
Chromium (hexavalent)	ug/L		-		-		-		-		-	
Copper	ug/L	*1300 TT*	**0.89 J**		-		-		**0.67 J**		**0.73 J**	
Lead	ug/L	15	**0.63 J B**		-		-		-		-	
Mercury	ug/L	*2*	-		-		-		-		**0.25**	
Nickel	ug/L		-		-		**2.0 J**		-		-	
Selenium	ug/L	*50*	-		-		-		**0.41 J**		-	
Silver	ug/L		**0.072 J B**		-		**0.16 J**		-		-	
Thallium	ug/L	2	**0.18 J B**		-		-		-		-	
Zinc	ug/L		**3.5 J**		-		-		-		-	

Qualifier
ICL = Interim Cleanup Level as referenced in the 2012 Statement of Work;

except values in italic, which are Federal Maximum Contaminant Levels (MCLs)
J Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

"-" = Concentration not detected
Blank Cell designates not analyzed

TABLE 3-6
Soil VOC Analytical Results: Pre-Design Investigation 2012
Burgess Brothers Superfund Site, Bennington, VT
Compliance Boundary & Downgradient Barrier Results

		Compliance Boundary										Downgradient Barrier		
Analyte	Units	ML1-PD-S1 (5') 7/25/2012	ML1-PD-S2 (9.5'-10') 7/25/2012	ML1-PD-S3 (27') 7/25/2012	PZ3-PD-S1 (12'-13') 7/17/2012	PZ3-PD-S2 (17'-18') 7/18/2012	PZ3-PD-S3 (26') 8/13/2012	ML3-PD-S1 (20') 7/24/2012	ML3-PD-S2 (23') 7/24/2012	ML3-PD-S3 (29') 7/24/2012	PZ4-PD-S1 (30') 7/16/2012	PZ12-PD-S1 (2') 8/20/2012	PZ12-PD-S2 (9') 8/20/2012	PZ14-PD-S1 (2') 8/20/2012
Volatile Organic Compounds (GC/MS)														
1,2-Dichloroethene, Total	ug/Kg	750	460	380	400	600	360	210	180	370	330	130	160	200
Bromomethane	ug/Kg	-	47 J	-	35 J B	-	-	-	-	-	-	110 J B	120 J * B	69 J * B
Chloroform	ug/Kg	-	350 B	51 J B	-	-	310	-	-	-	-	-	-	-
Chloromethane		-	-	-	-	-	-	-	-	-	-	52 J B	55 J B	36 J B
cis-1,2-Dichloroethene	ug/Kg	750	460	380	400	600	360	210	180	370	330	130	160	200
Methyl iodide	ug/Kg	-	40 J	-	-	-	57 J B	-	-	-	-	180 B	-	100 B
Methylene Chloride	ug/Kg	54 J B	55 J B	46 J B	62 J B	40 J B	74 J B	55 J B	42 J B	37 J B	64 J B	57 J B	58 J B	38 J B
Naphthalene	ug/Kg	-	-	58 J B	-	-	-	-	50 J	-	-	-	-	-
Tetrachloroethene	ug/Kg	3600	5800	500	3500	7200	2300	630	750	840	720	550	1100	260
Toluene		-	-	-	-	-	-	-	-	-	-	40 J	48 J	32 J
Trichloroethene	ug/Kg	360	280	560	190	370	280	160	190	270	280	410	630	130
Vinyl chloride	ug/Kg	37 J	100	82 J	71 J	100	93 J	-	-	39 J	32 J	-	-	-
Percent Solids	%	84.4	84.7	91	85.7	80.2	82.2	82.1	91	91.9	89.4	83.8	88.5	84.8

Notes:
B=Compound was found in the Blank and the Sample.
J=Estimated value.
"-" = Concentration not detected

Table 3-7
Summary of CVOC Half-lives (hours) at End of Each ZVI Bench Test, and Typical Ranges

Burgess Brothers Superfund Site
Woodford and Bennington, Vermont

CVOCs	Connelly (2012) Week 7 (44.6 Pore Volumes)		Connelly (2013) Week 10 (63.9 Pore Volumes)		Peerless (2013) Week 8 (53.8 Pore Volumes)		Typical Range[1]
	22°C	10°C	22°C	10°C	22°C	10°C	22°C
PCE	5.1	14	3.4	9.2	6.2	17	2.6 ±1.9 (2) 1.4 - 3.3 (3)
TCE	3.9	11	3.2	8.6	4.1	11	1.3 ± 0.9
cis-1,2DCE	3.8	10	4.8	13	9.6	26	3.4 ± 2.2
Vinyl Chloride	2.7	7.3	4	11	7.2	19	3.2 ± 2.9

NOTES:

(1) Statistical data are from a database of column test results compiled by EnviroMetal Technologies, Inc. PCE statistical data provided by Andrzej Przepiora, Geosyntec Consultants, Inc. (formerly with EnviroMetal Technologies, Inc.). Statistical data for TCE, cis DCE, and VC are published in *In Situ Remediation of Chlorinated Solvent Plumes*, Stroo, H.F., Ward, C.H., eds., SERDP and ESTCP Remediation Technology Monograph Series, Springer Science+Business Media, LLC, 2010.

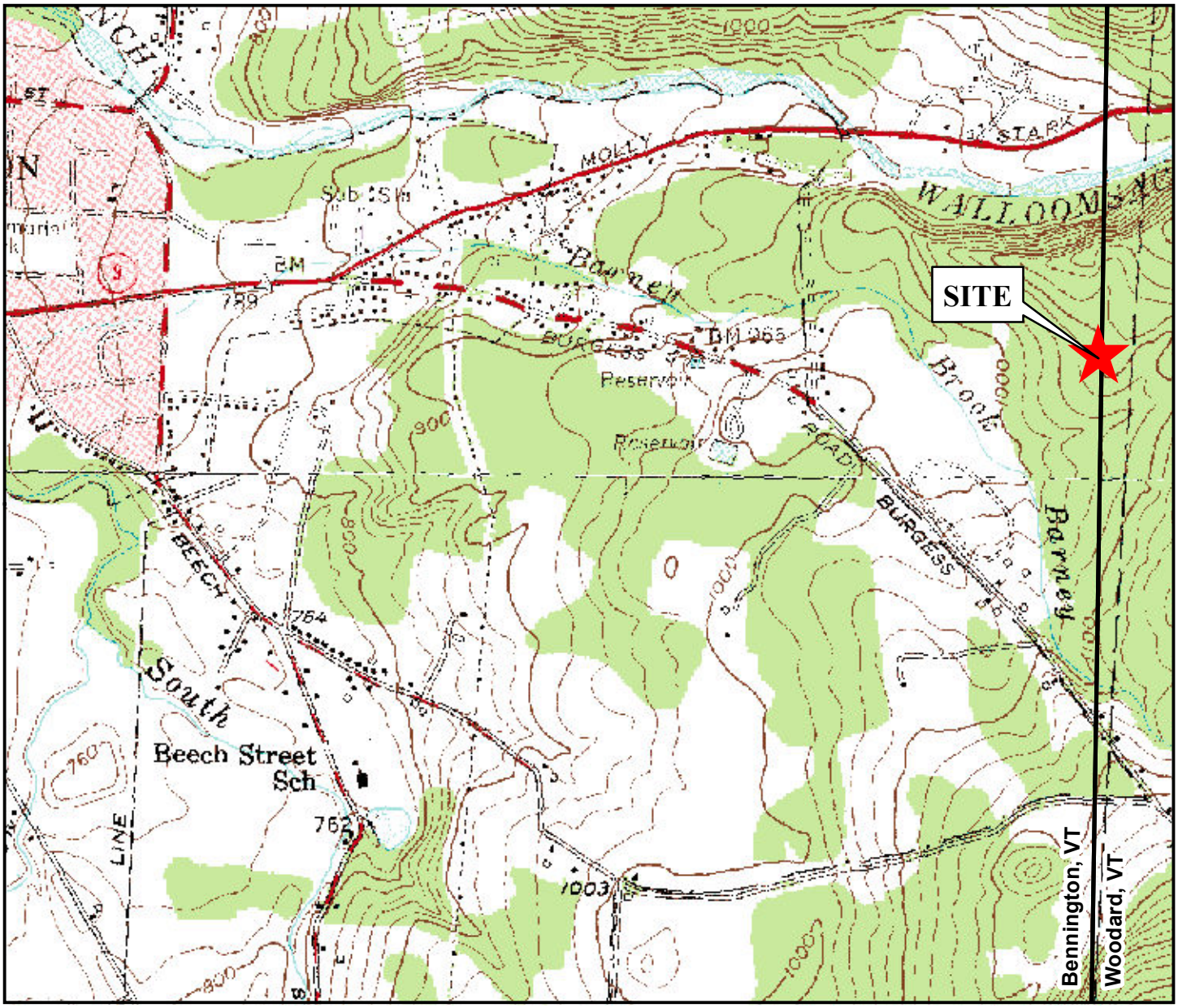
Lab degradation half-lives are reported at laboratory temperature (22°C) and at site groundwater temperature (10°C).

(2) Bench test results with PCE concentrations ranging from 1,000 to 30,000 µg/L.

(3) Bench test results with PCE concentrations ranging from 10,000 to 30,000 µg/L.

FIGURES

Figure 1-1: Site Location Map

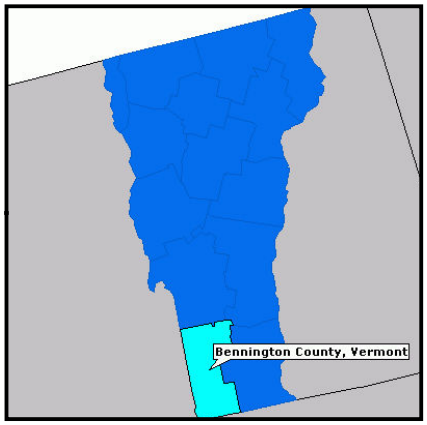


Burgess Brothers Superfund Site
Woodard and Bennington, VT

N
W E
S

0 0.125 0.25 0.5 Miles

1 in = 0.25 miles



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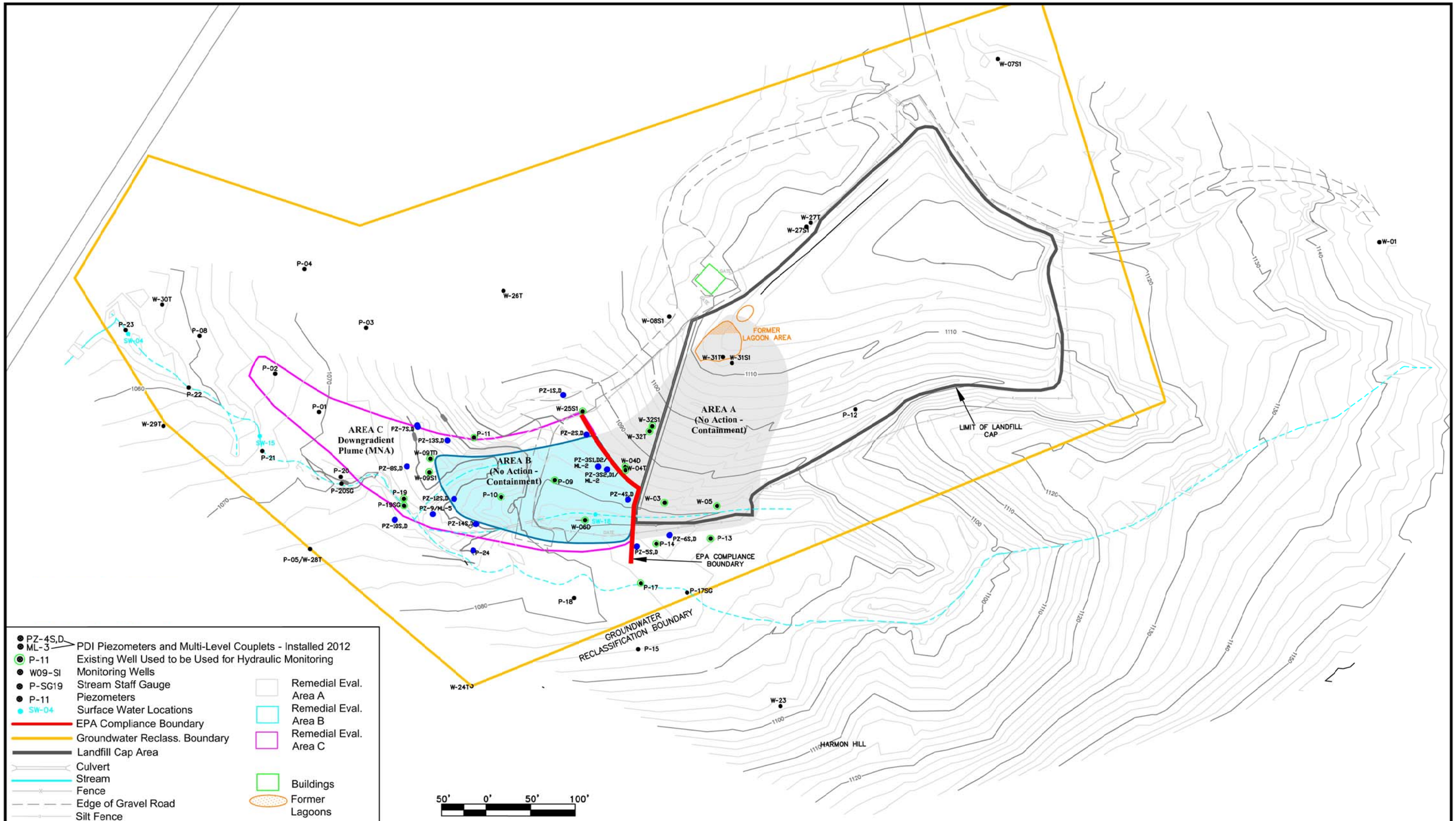

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Scale As Shown

Figure 1-2. Existing Conditions Plan

Burgess Brothers Superfund Site, Bennington, VT

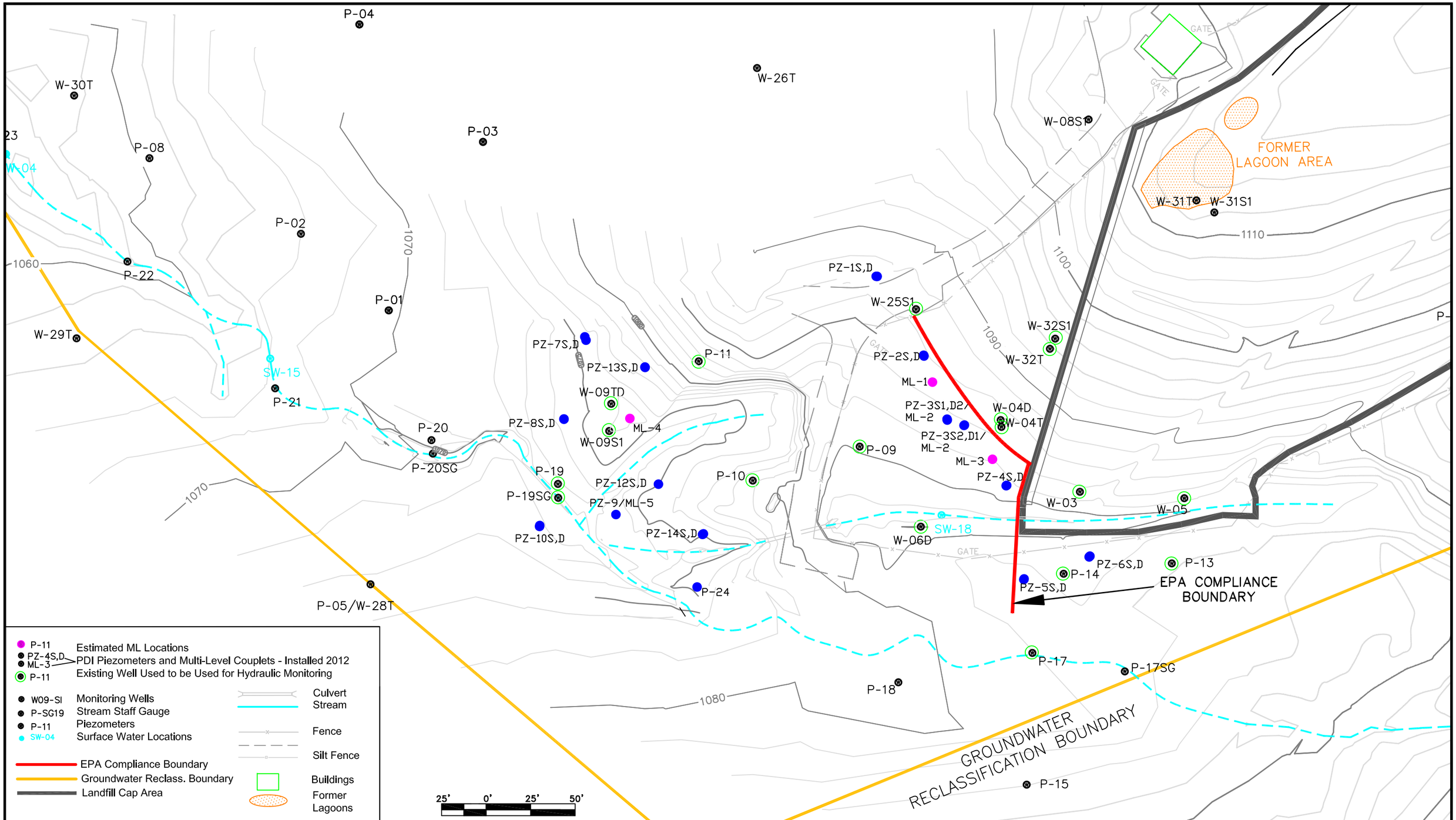

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Figure 2-1. Updated Site Survey Plan

Burgess Brothers Superfund Site, Bennington, VT

NOTE:
2012 Wetland Delineation performed by Guntlow Associates and locations surveyed by MSK Engineers.

Wetland evaluation on the south-southeast side of the Unnamed Stream was only determined in the immediate vicinity of the Unnamed Stream, in the area shaded. The south-southeast limit of wetlands was not delineated.

PZ-4S,D
ML-3 — PDI Piezometers and Multi-Level Couplets - Installed 2012
P-11 — Existing Well Used to be Used for Hydraulic Monitoring
W09-SI — Monitoring Wells
P-SG19 — Stream Staff Gauge
P-11 — Piezometers
SW-04 — Surface Water Locations
Culvert
Stream
2012 Wetland
Fence
EPA Compliance Boundary
Groundwater Reclass. Boundary
Landfill Cap Area
Buildings
Former Lagoons

25' 0' 25' 50'

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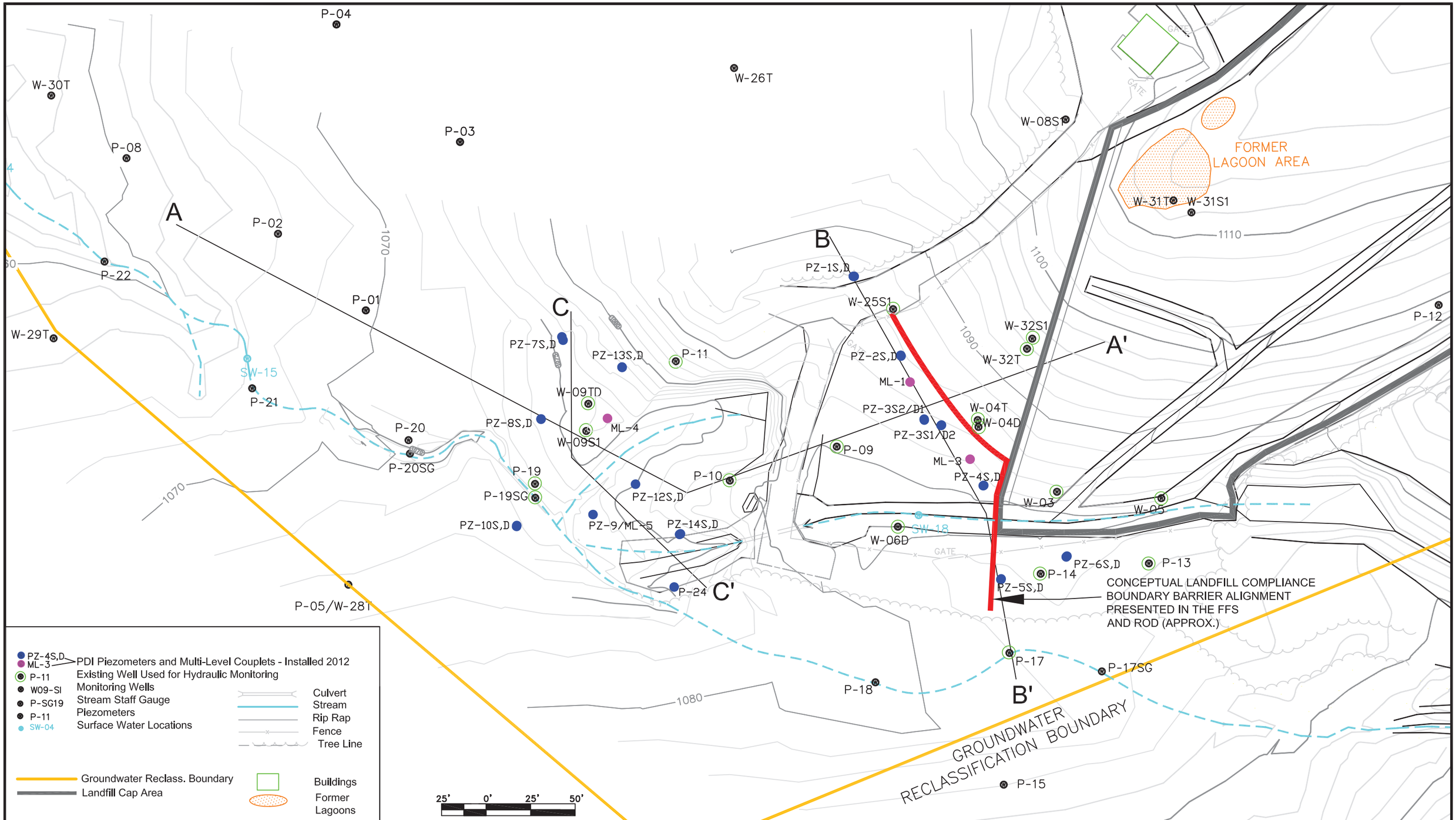
January 14, 2013	Figure 2-2. Updated Wetlands Map
106-1203.00	Burgess Brothers Superfund Site, Bennington, VT
Scale As Shown	



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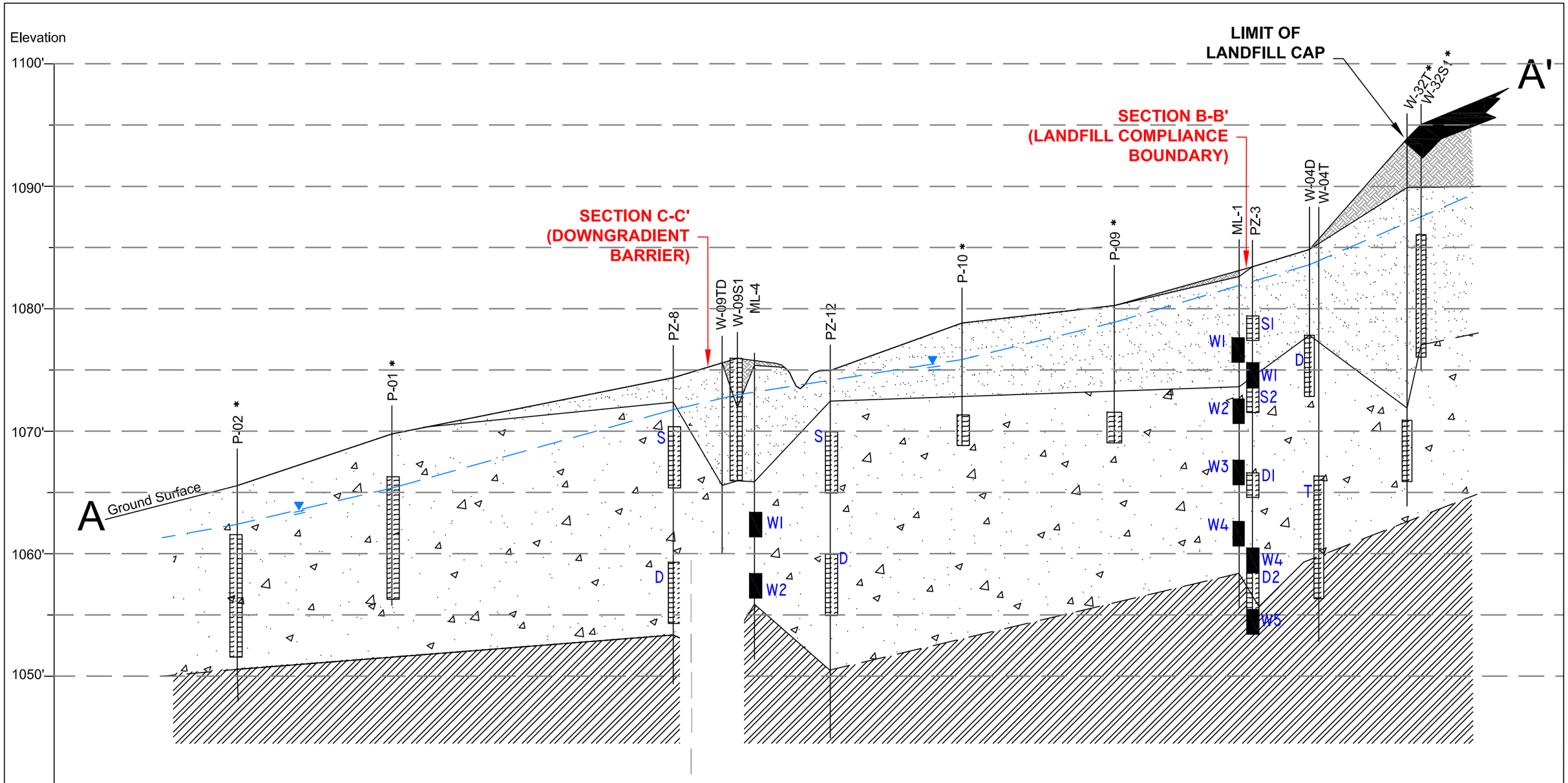
106-1202.00

Scale As Shown

Figure 3-1. Cross Section Location Map

Burgess Brothers Superfund Site, Bennington, VT



LEGEND

FILL
Sand and Silt; trace Gravel, roots, and organic matter

KAME SAND
Non-plastic Fine Sand to Silty Fine Sand, except as noted

ABLATION TILL
Non-plastic Fine Sand, Silty Fine Sand, or Fine Sandy Silt; some Gravel and Cobbles; trace to some Clay

LODGEMENT TILL
Silty Fine Sand, Fine Sandy Silt, or Silt; some Gravel and Cobbles; dry, very dense, slight to low plasticity

WELL SCREEN

VERTICAL PROFILE SAMPLE

GROUNDWATER ELEVATION
SEPTEMBER 12, 2012

VERTICAL EXAGGERATION = 5X
HORIZONTAL SCALE
20' 0' 20' 40'

SCALE: As Shown	TITLE: GEOLOGIC CROSS-SECTION A-A'
DATE: OCTOBER 17, 2012	
PROJECT NO.: 12012	
CLIENT: EPG	
DRAWN BY: DJW	DRAWING NO.: FIGURE 3-2
CHECKED BY: MW	REV: 0
PROJ. MGMT. APPROVAL: MW	

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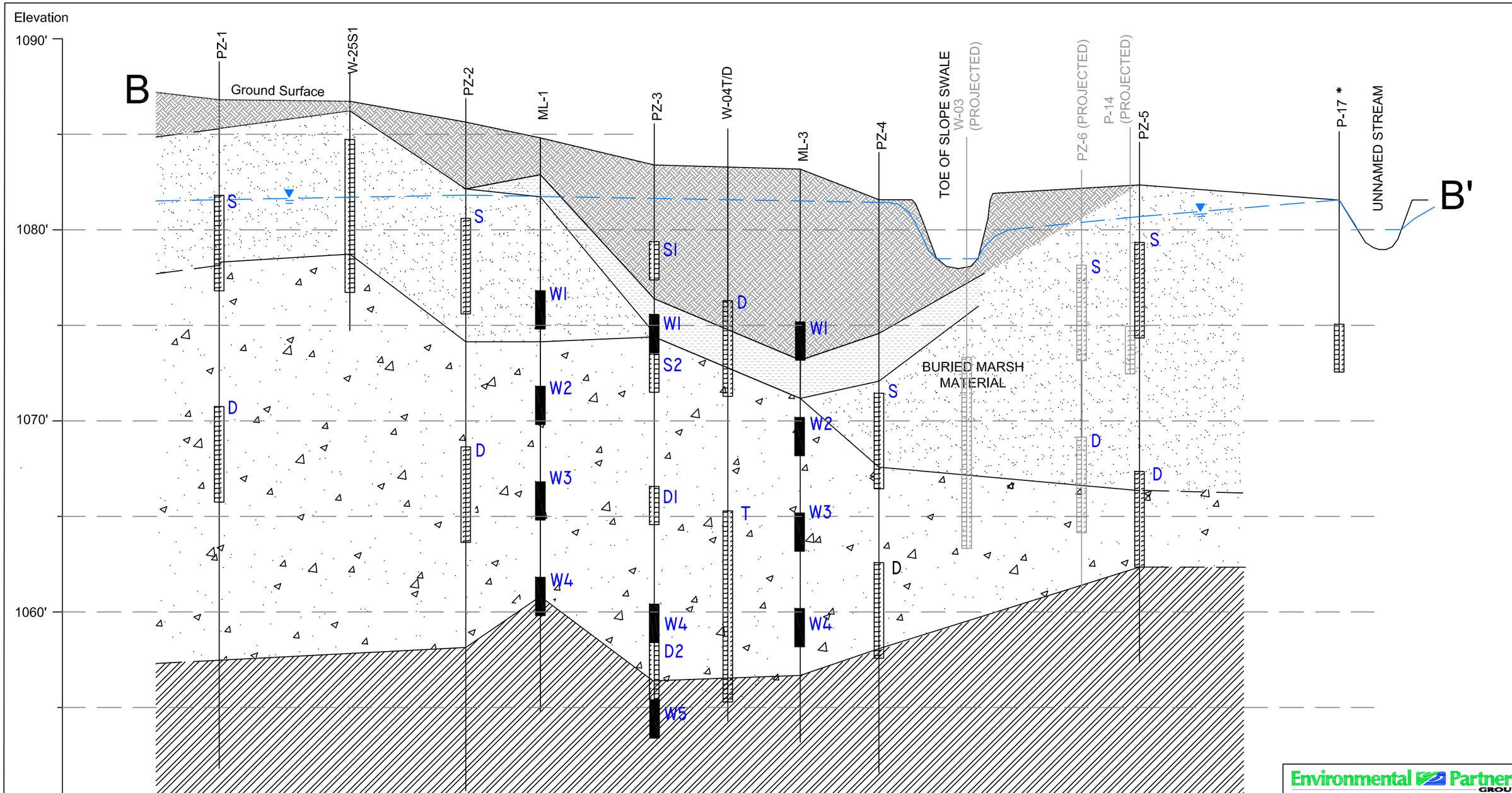

LEGEND

FILL
Sand and Silt; trace Gravel, roots, and organic matter

KAME SAND
Non-plastic Fine Sand to Silty Fine Sand, except as noted

ABLATION TILL
Non-plastic Fine Sand, Silty Fine Sand, or Fine Sandy Silt; some Gravel and Cobbles; trace to some Clay

LODGEMENT TILL
Silty Fine Sand, Fine Sandy Silt, or Silt; some Gravel and Cobbles; dry, very dense, slight to low plasticity

WELL SCREEN

VERTICAL PROFILE SAMPLE

GROUNDWATER ELEVATION
SEPTEMBER 12, 2012

VERTICAL EXAGGERATION = 4X
HORIZONTAL SCALE
10' 0' 10' 20'

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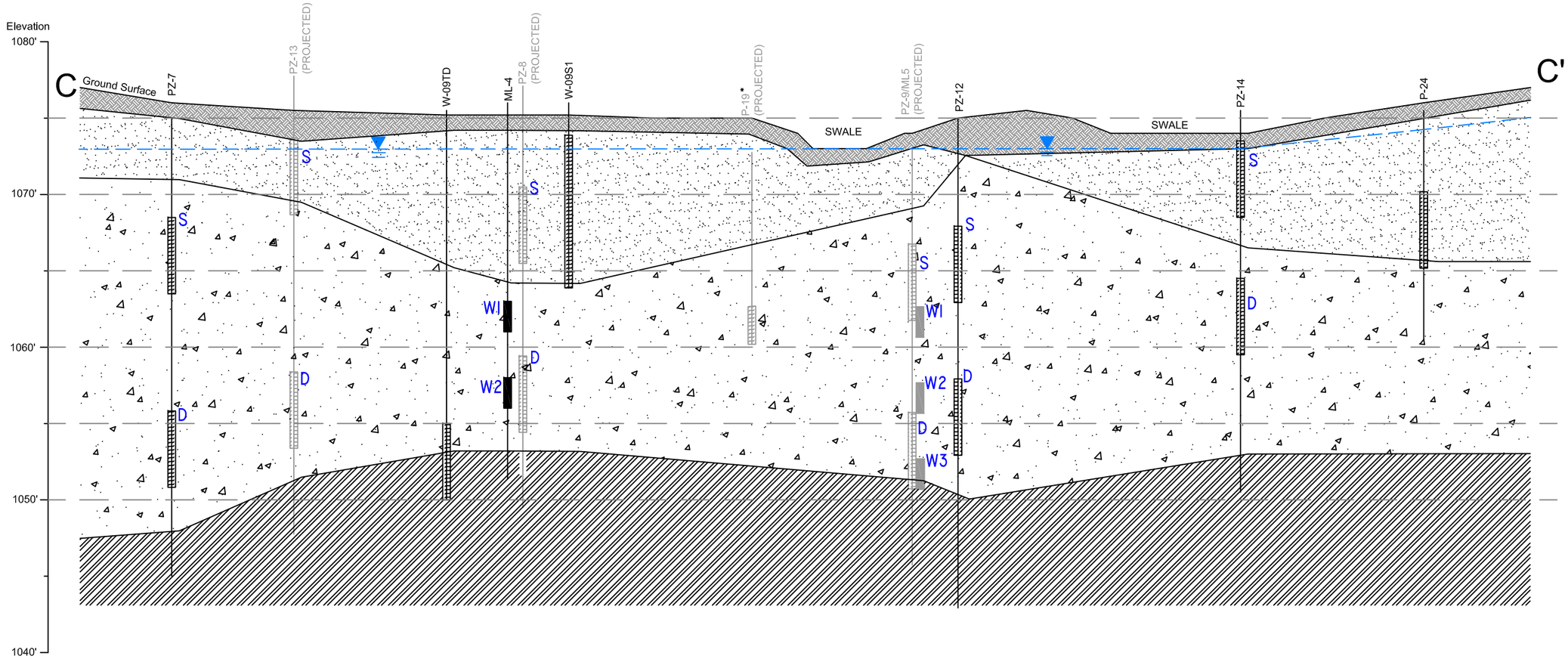
SCALE: As Shown	TITLE: GEOLOGIC CROSS-SECTION B-B'
DATE: OCTOBER 10, 2012	
PROJECT NO.: 12012	
CLIENT: EPG	
DRAWN BY: DJW	DRAWING NO.: FIGURE 3-3
CHECKED BY: MTW	REV: 0
PROJ. MGMT. APPROVAL: MTW	



LEGEND

FILL
Sand and Silt; trace Gravel, roots, and organic matter

KAME SAND
Non-plastic Fine Sand to Silty Fine Sand, except as noted

ABLATION TILL
Non-plastic Fine Sand, Silty Fine Sand, or Fine Sandy Silt; some Gravel and Cobbles; trace to some Clay

LODGEMENT TILL
Silty Fine Sand, Fine Sandy Silt, or Silt; some Gravel and Cobbles; dry, very dense, slight to low plasticity

WELL SCREEN

VERTICAL PROFILE SAMPLE

GROUNDWATER ELEVATION
SEPTEMBER 12, 2012

VERTICAL EXAGGERATION = 2X
HORIZONTAL SCALE

7.5' 0' 7.5' 15'

SCALE: As Shown	
DATE: November 8, 2012	
PROJECT NO.: 12012	
CLIENT: EPG	
DRAWN BY: DJW	
CHECKED BY: MTW	
PROJ. MGMT. APPROVAL: MTW	

GEOLOGIC
CROSS-SECTION C-C'

DRAWING NO.: FIGURE 3-4

REV: 0

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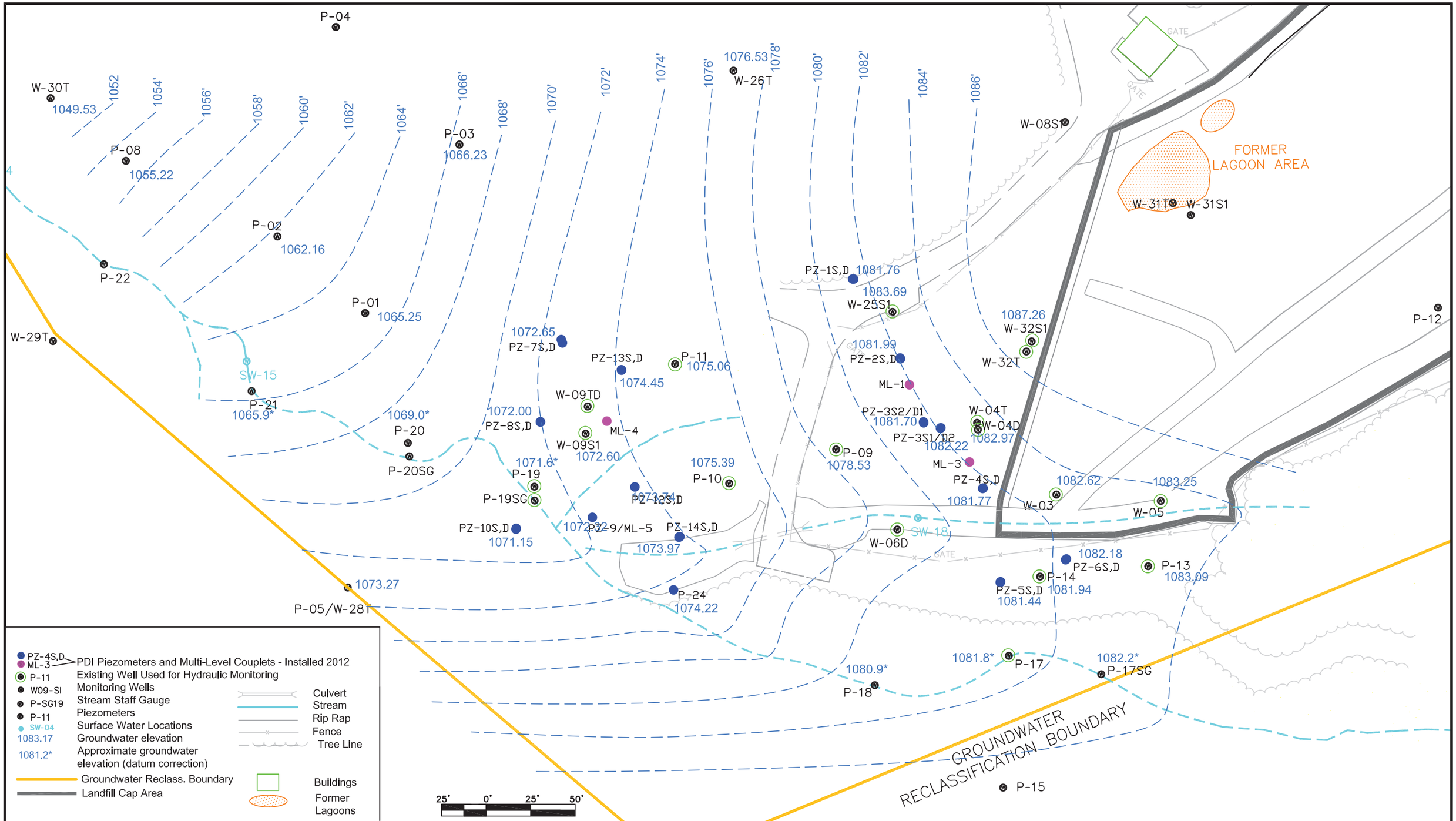

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106-1202.00

Scale As Shown

Figure 3-5. Water Table Elevations on September 12, 2012

Burgess Brothers Superfund Site, Bennington, VT

Figure 3-6
Groundwater Elevations at Existing Monitoring Wells (2009-2012) and Precipitation Events

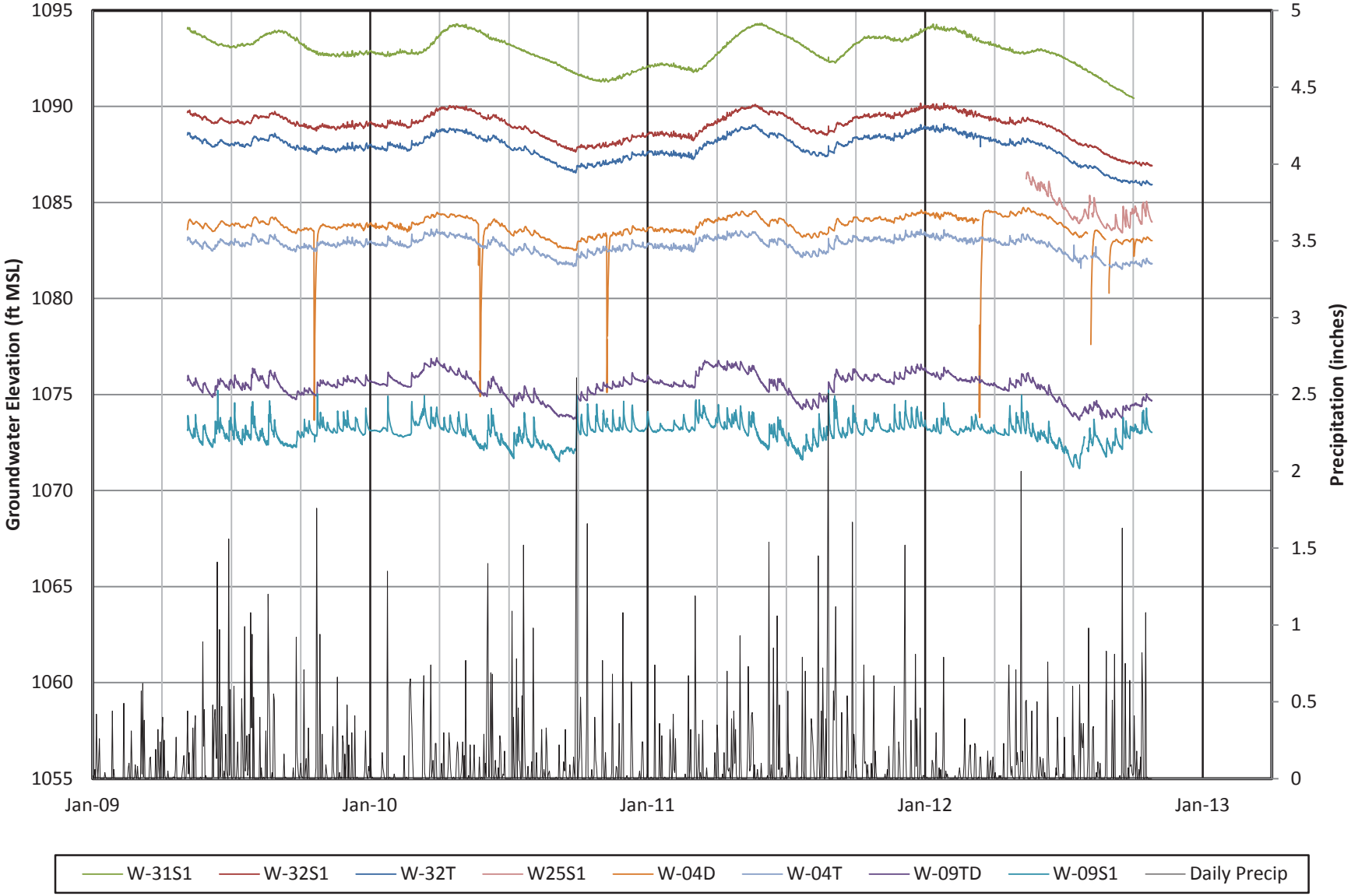


Figure 3-7
Groundwater Elevations at Compliance Boundary Shallow Piezometers and Precipitation Events

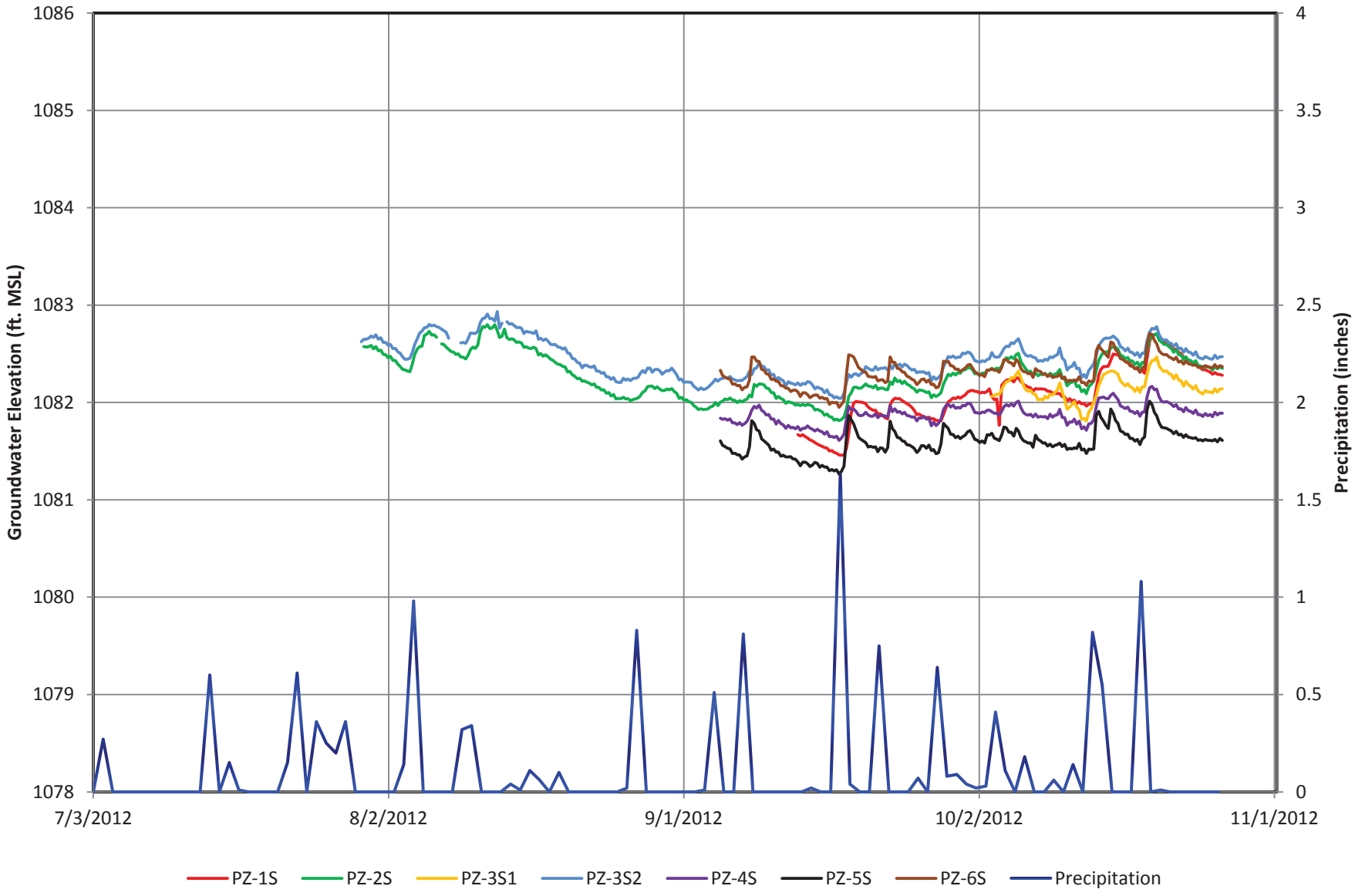


Figure 3-8
Groundwater Elevations at Compliance Boundary Deep Piezometers and Precipitation Events

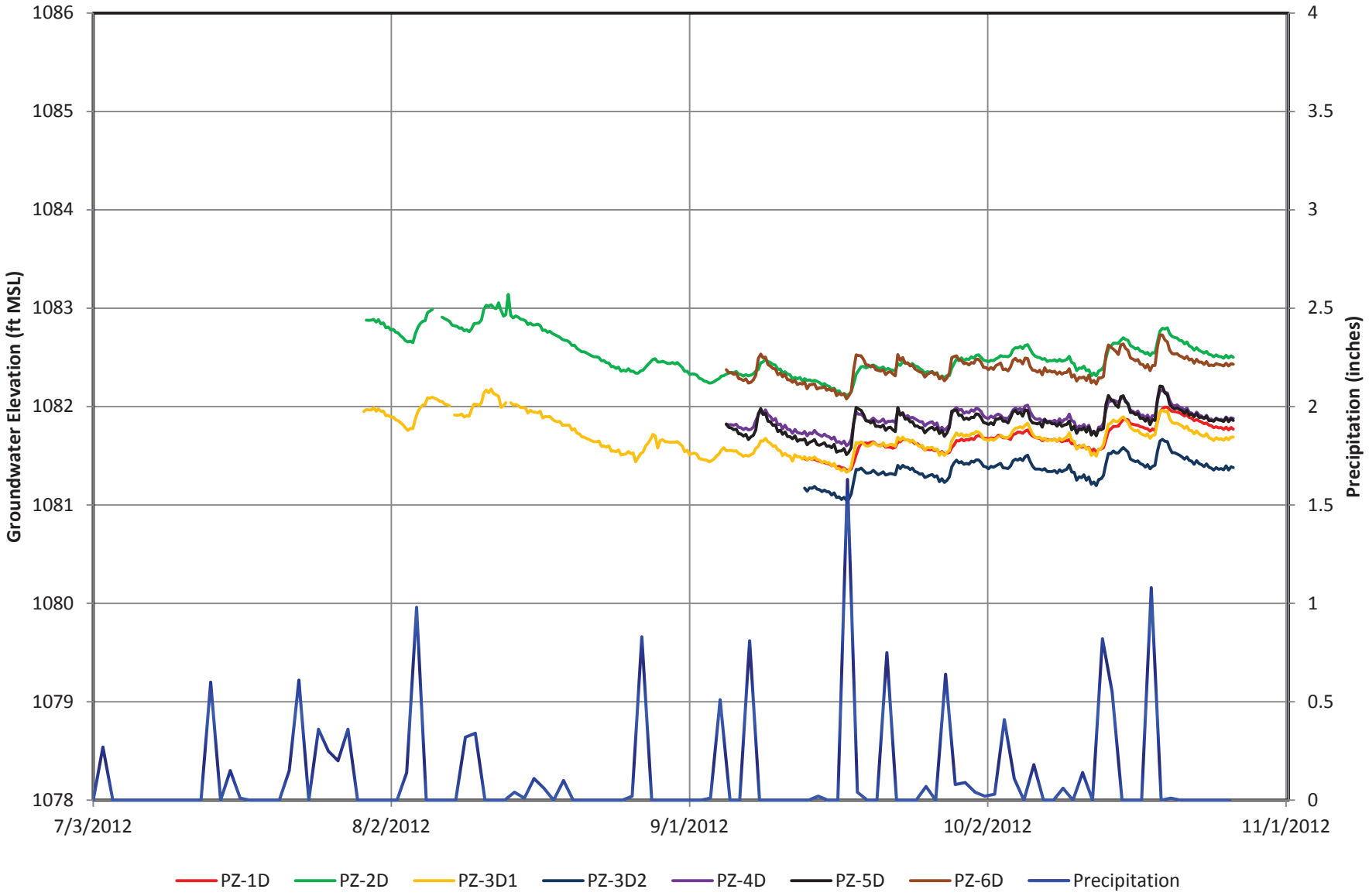


Figure 3-9
Vertical Gradients and Precipitation Events - Compliance Boundary

Burgess Brothers Superfund Site
Bennington, Vermont

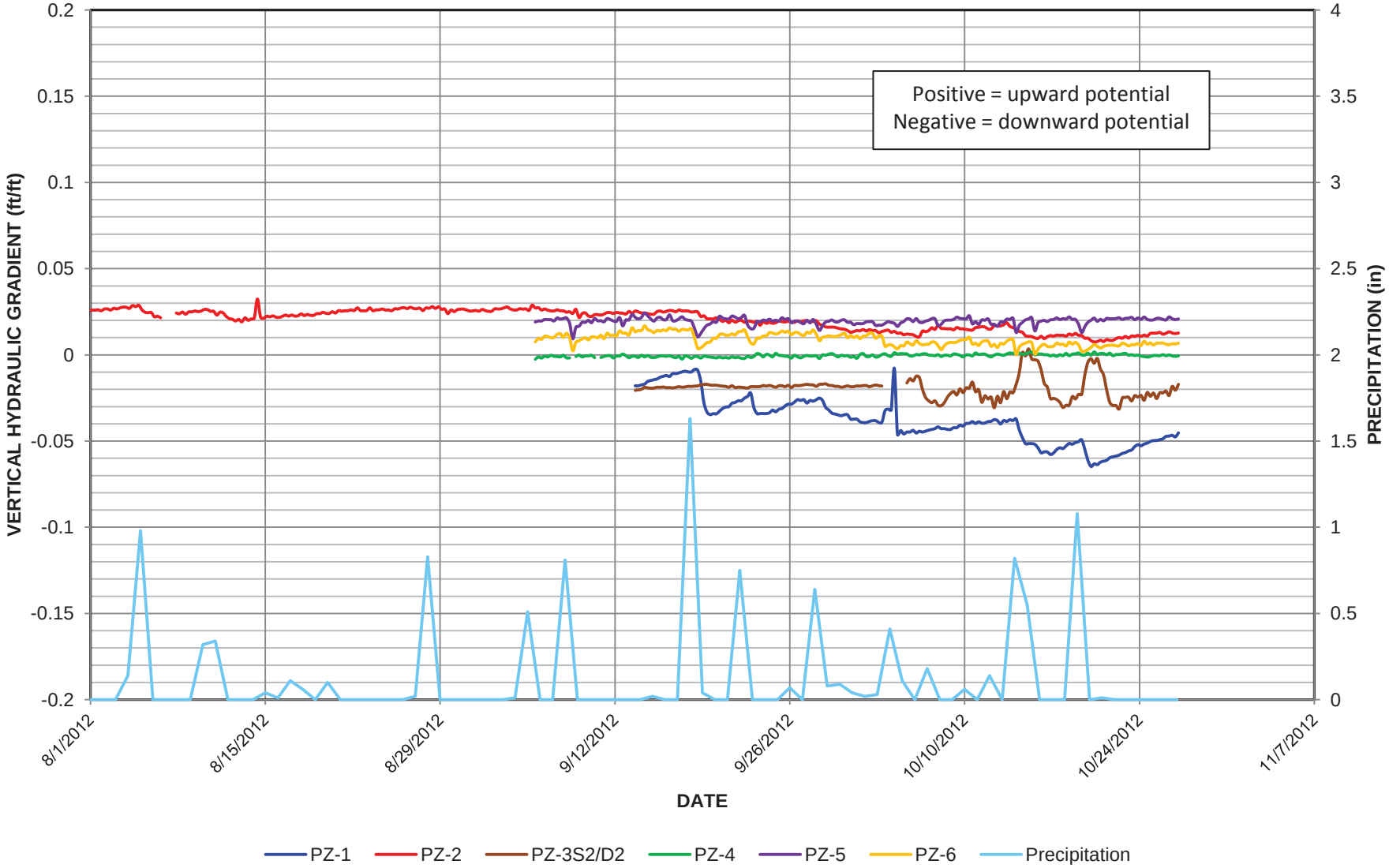


Figure 3-10
Groundwater Elevations at Downgradient Barrier Shallow Piezometers and Precipitation Events

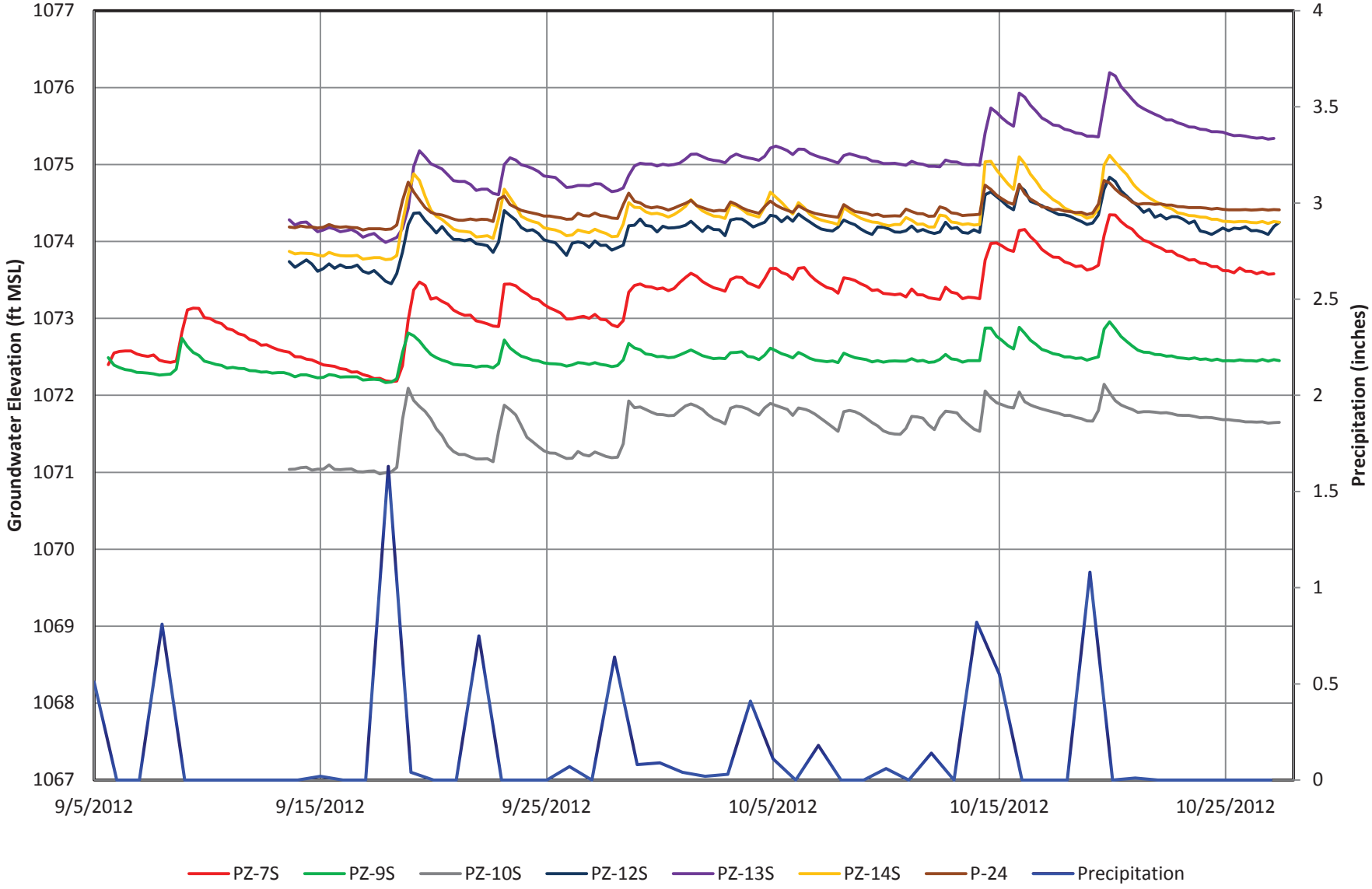


Figure 3-11
Groundwater Elevations at Downgradient Barrier Deep Piezometers and Precipitation Events

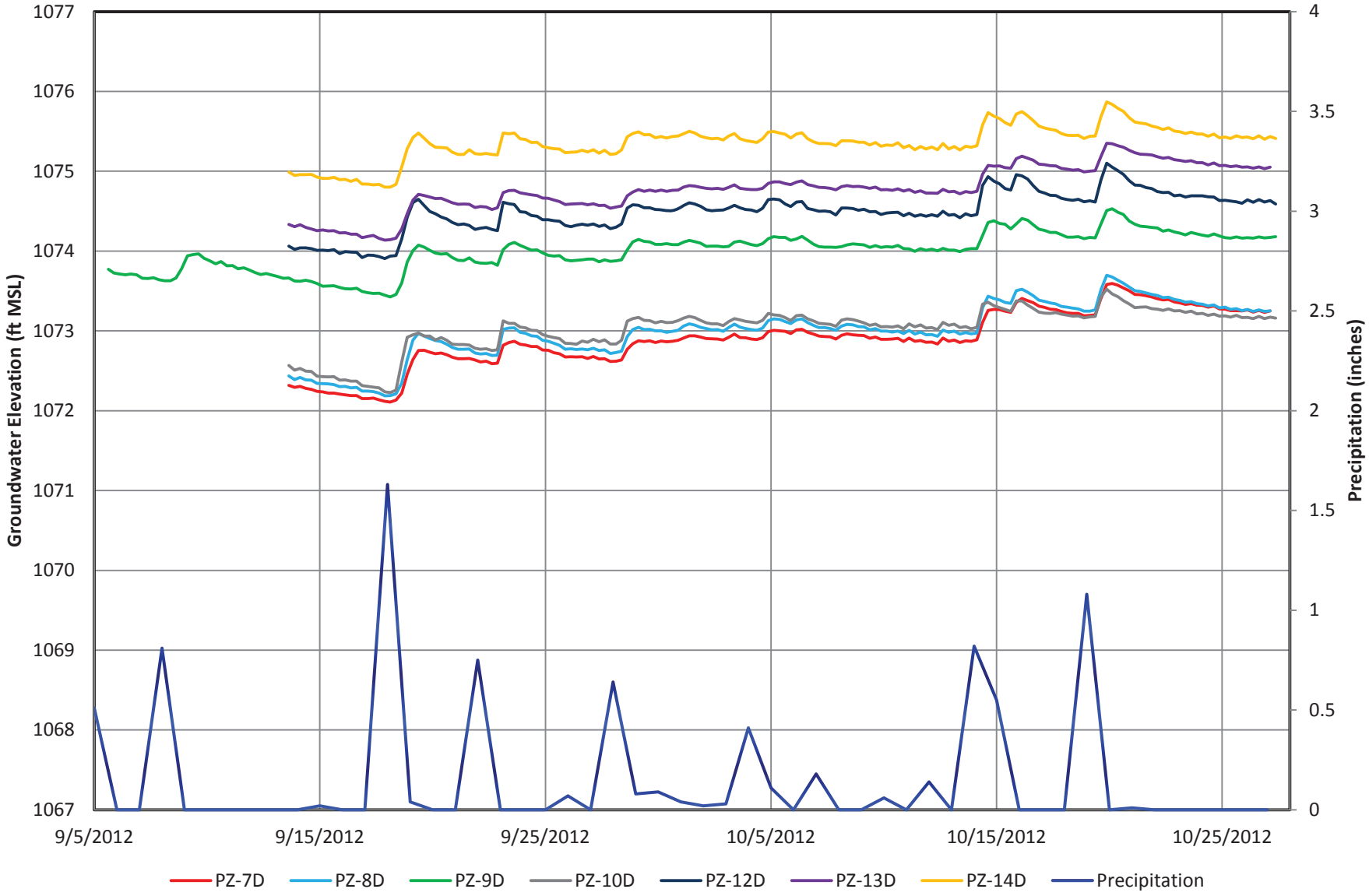
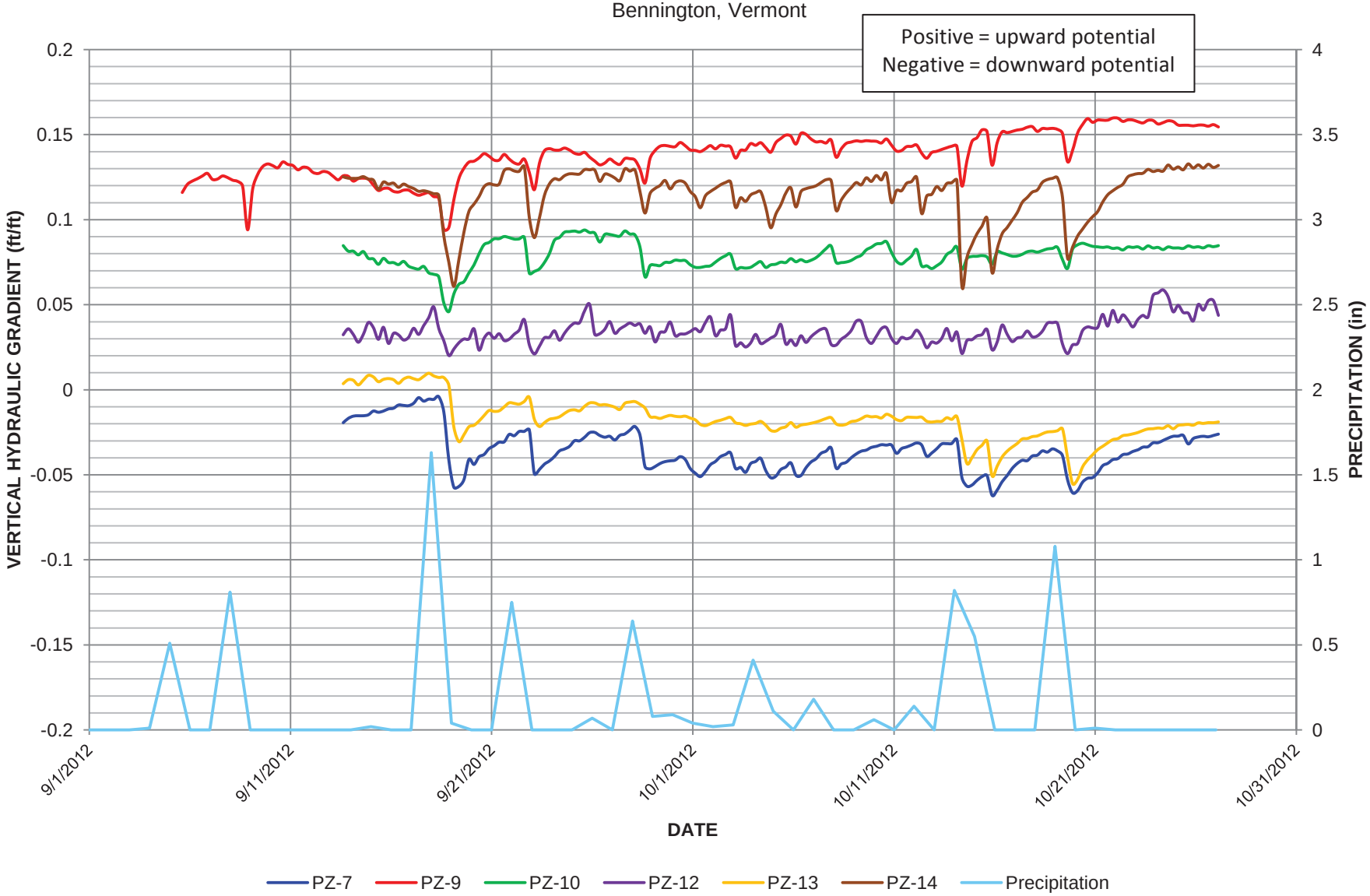
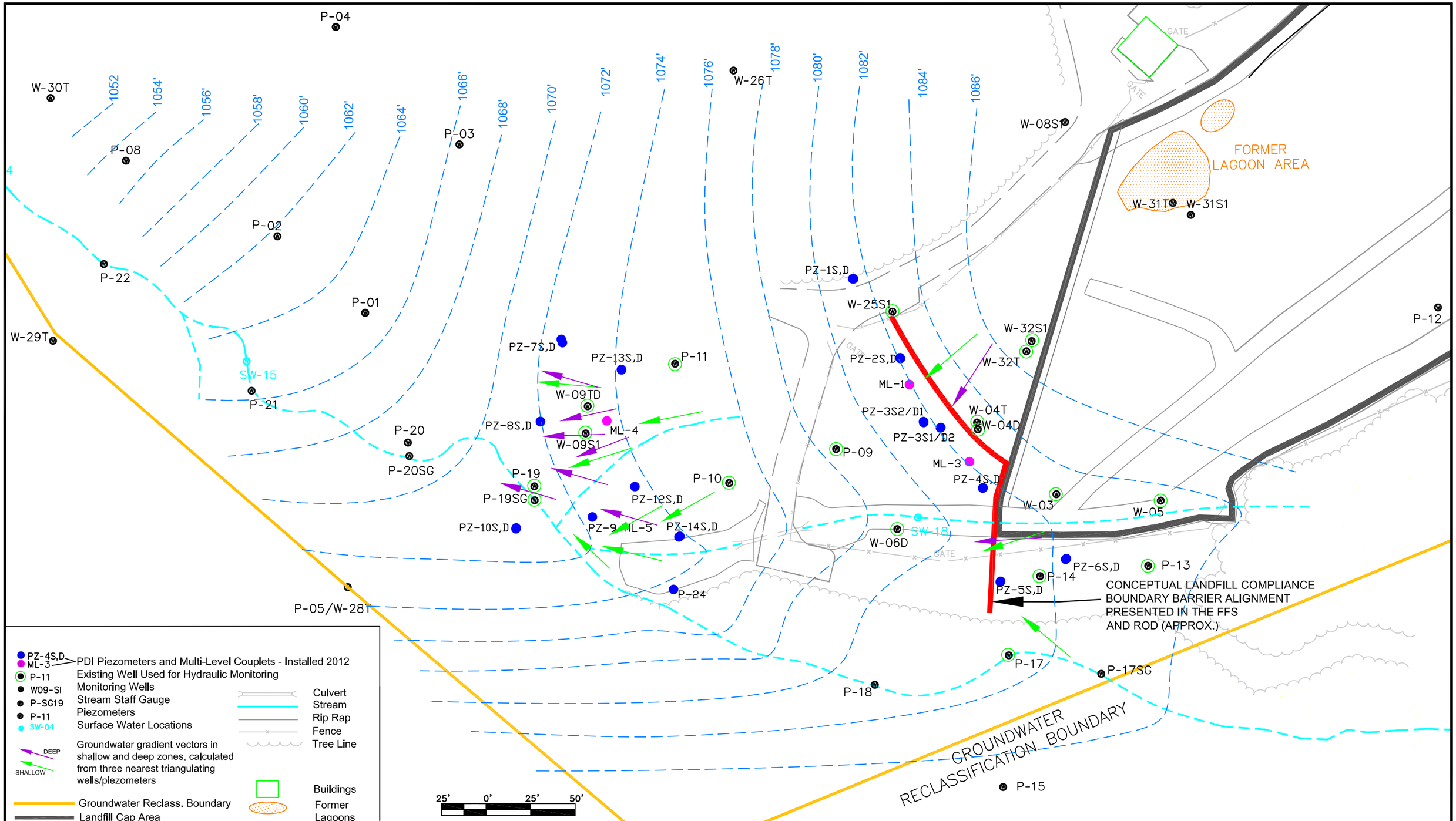


Figure 3-12
Vertical Gradients and Precipitation Events - Downgradient Barrier

Burgess Brothers Superfund Site
Bennington, Vermont





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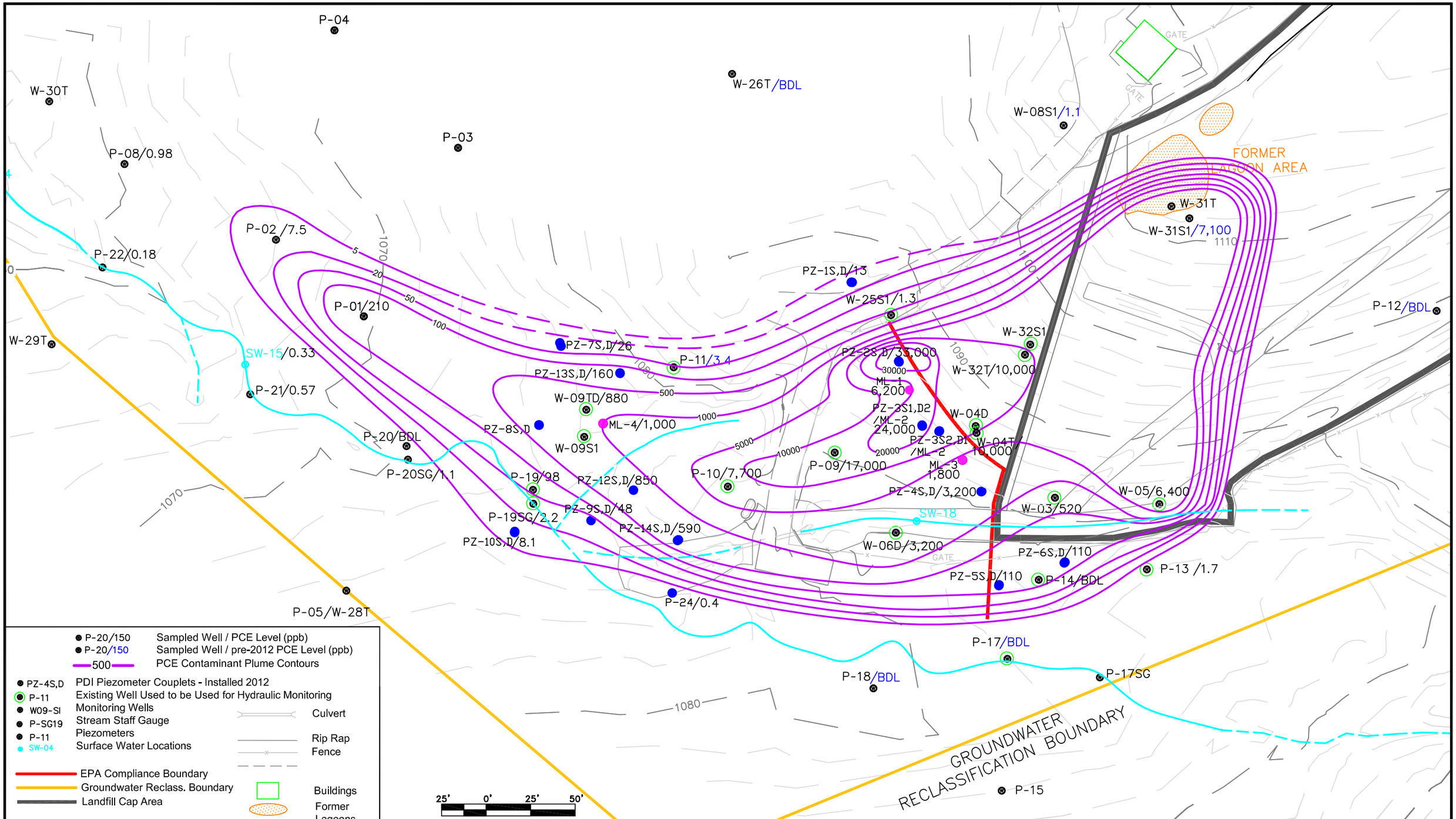
May 7, 2013	Figure 3-13. Groundwater Elevations and Gradient Vectors
106-1202.00	Burgess Brothers Superfund Site, Bennington, VT
Scale As Shown	



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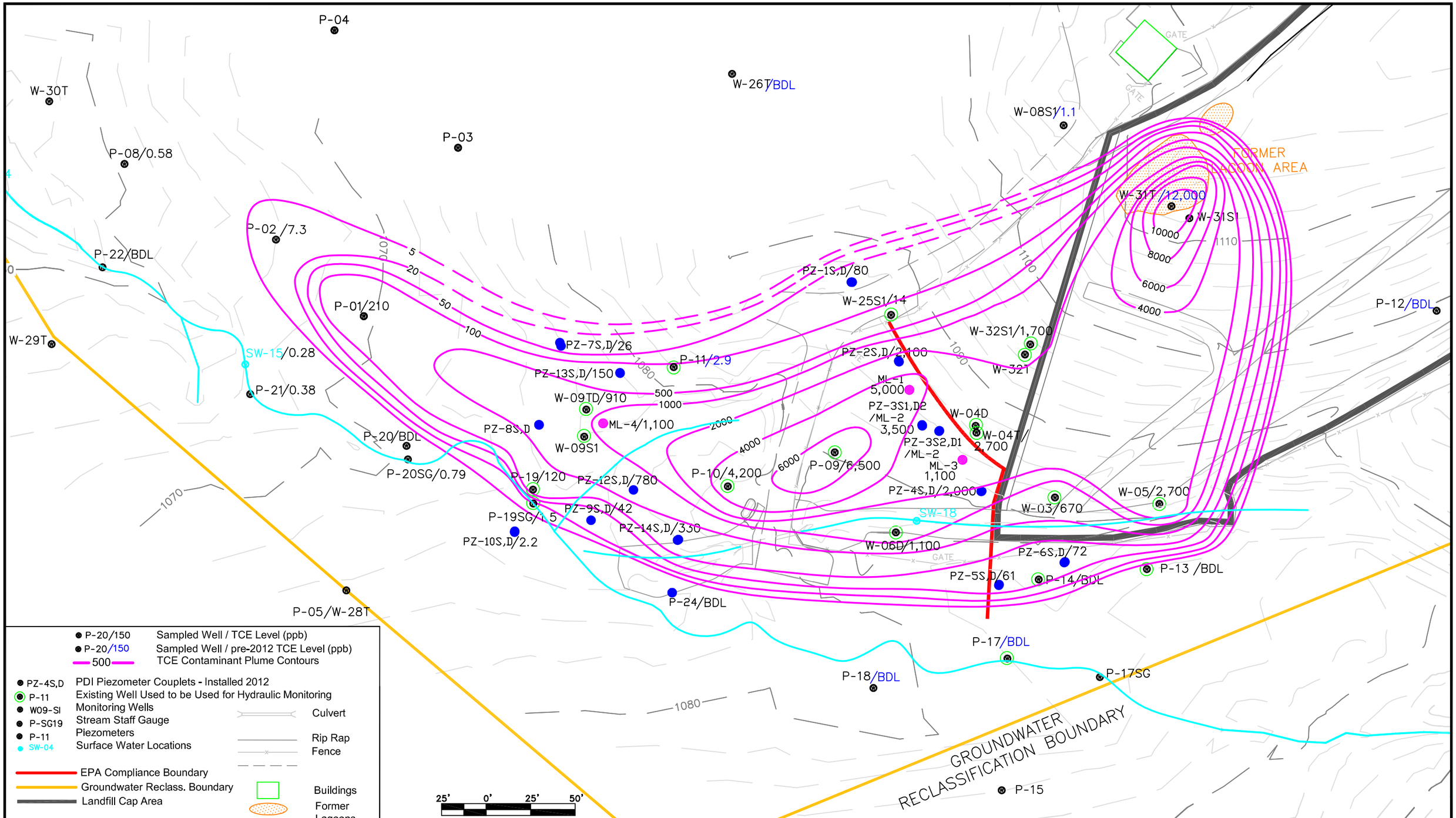
Scale As Shown

Figure 3-14. PCE Contaminant Plume Map (2012)

Burgess Brothers Superfund Site, Bennington, VT



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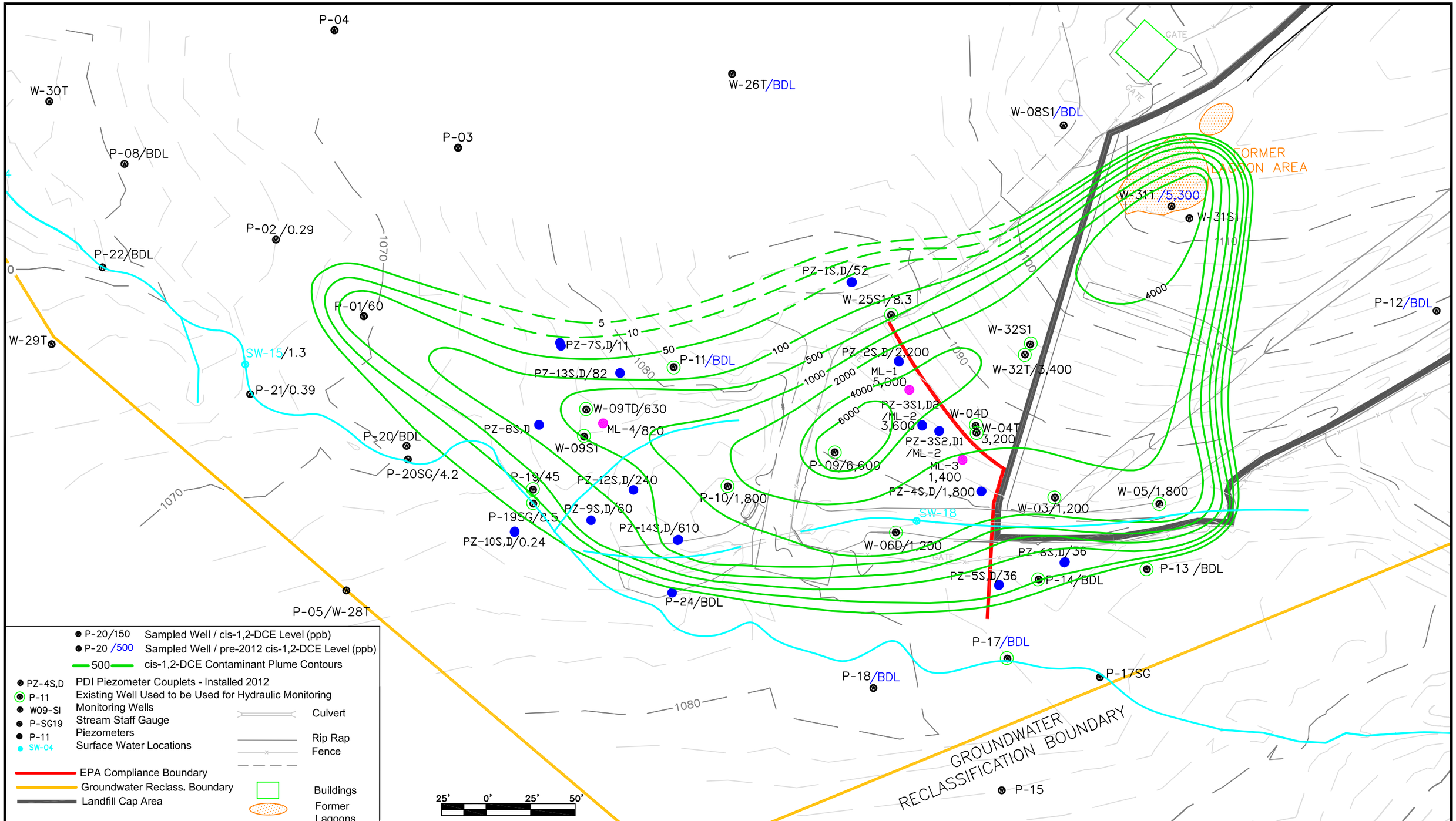
Scale As Shown

Figure 3-15. TCE Contaminant Plume Map (2012)

Burgess Brothers Superfund Site, Bennington, VT



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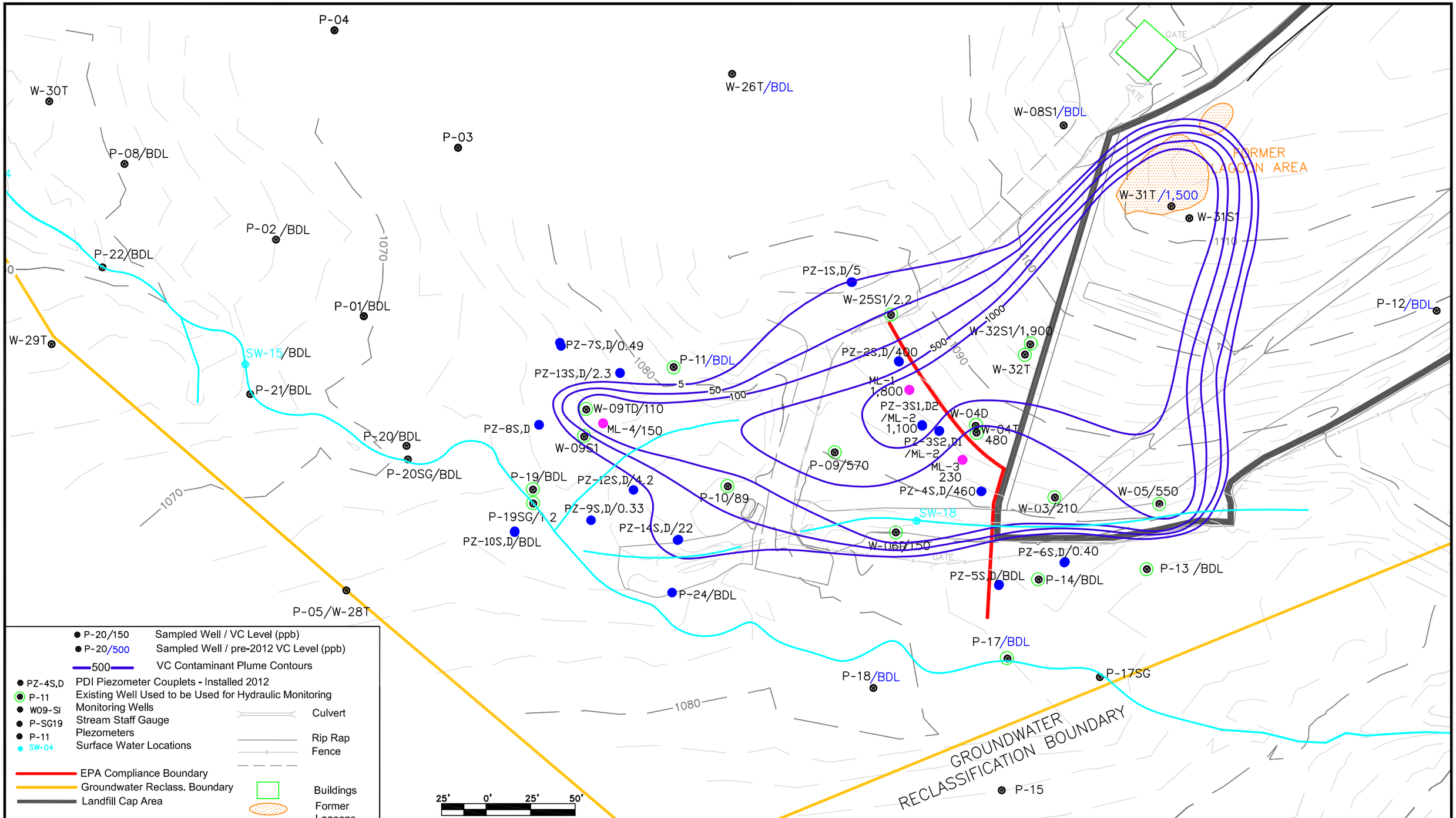
Scale As Shown

Figure 3-16. cis-1,2 DCE Contaminant Plume Map (2012)

Burgess Brothers Superfund Site, Bennington, VT



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106-1203.00

Scale As Shown

Figure 3-17. Vinyl Chloride Contaminant Plume Map (2012)

Burgess Brothers Superfund Site, Bennington, VT

Figure 3-18
Summary of CVOC Half-Lives in September 2012 Connelly ZVI Bench Test

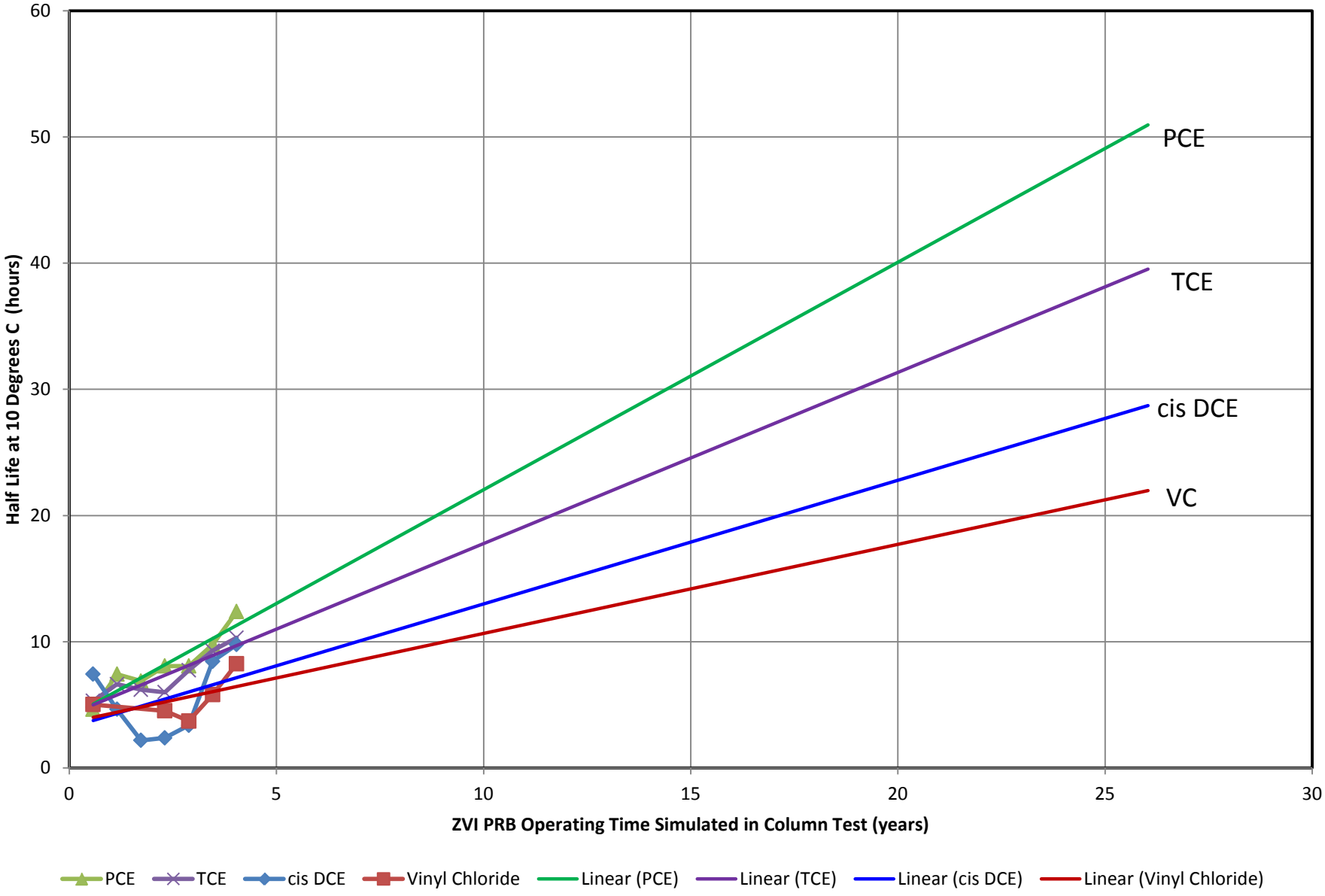
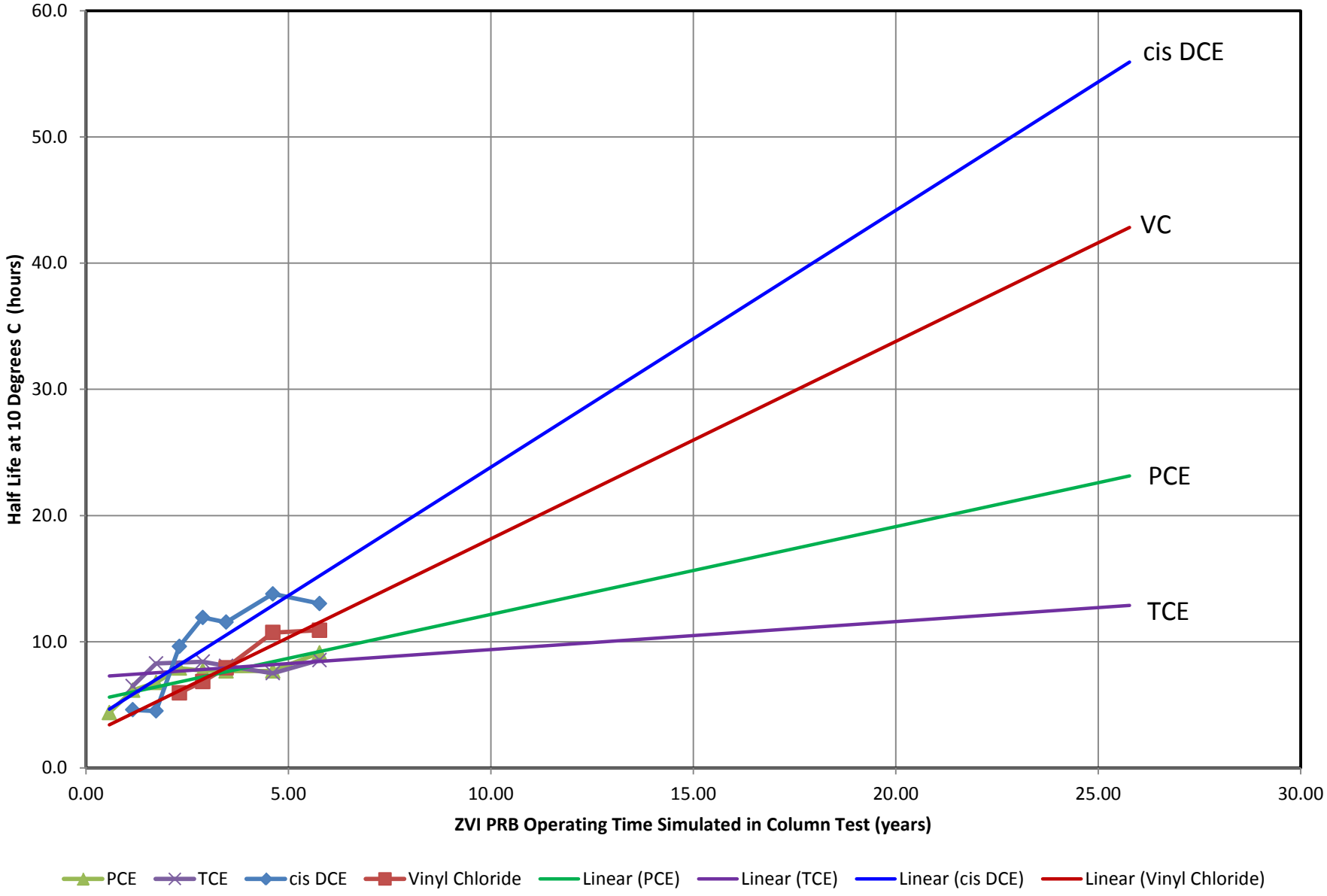


Figure 3-19
Summary of CVOC Half-Lives in January 2013 Connelly ZVI Bench Test



APPENDIX A
Wetlands Evaluation Report

Wetland Delineation Report

Burgess Brothers Superfund Site
EPA ID: VTD003965415

Prepared for:

Environmental Partners Group
1900 Crown Colony Drive, Suite 402
Quincy, MA 02169

September 28, 2012
October 5, 2012 revised

GUNTLOW & ASSOCIATES, INC.
55 North Street
Williamstown
Massachusetts 01267
413.458.2198
413.458.2712 FAX

Wetland Resource Area Delineation Report
Prepared for:
Environmental Partners Group
1900 Crown Colony Drive, Suite 402
Quincy, MA 02169

During the month of August of 2012, Guntlow & Associates, Inc. performed various site visits on property located at the Burgess Brothers Superfund Site (EPA ID: VTD003965415) located north off of Burgess Road in Bennington, Vermont. The objective of the site visit was to field delineate all applicable state/federal jurisdictional wetland resource areas within the projects scope of services. These wetland resource areas can be identified by the pink and black striped ribbon flagging outlining the outer extent of the physical resource areas.

Methodology

Utilizing the techniques and standards outlined in Wetlands Research Program Technical Report Y-87-1 Corps of Engineers Wetlands Delineation Manual, and the" Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region".

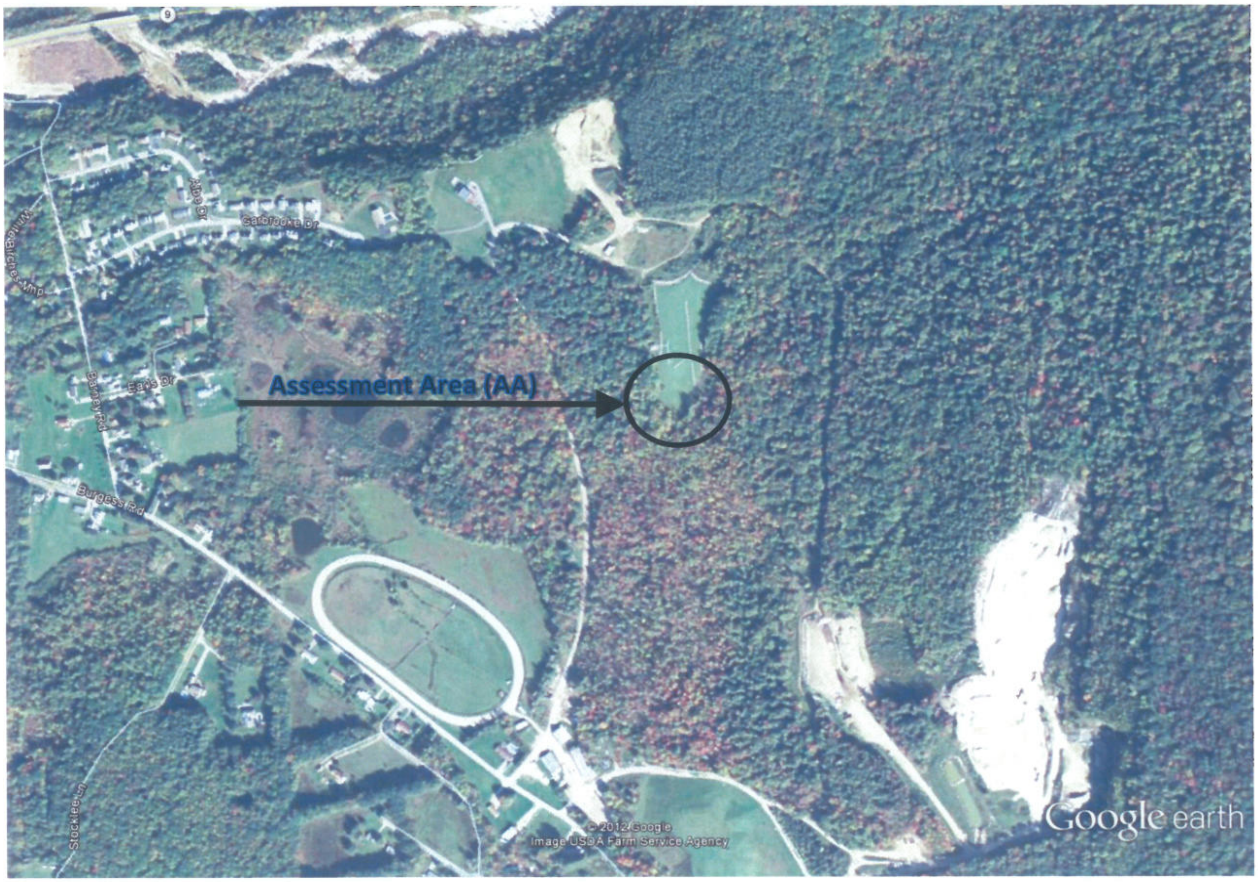
The indicator status of vegetation was identified on the basis of the "1988, U.S. Fish and Wildlife Service's National List of Plant Species that Occur in Wetlands" and supplemented with the State of Massachusetts 2012 National wetland plant list as prepared by the U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory (CRREL). No credence was given to the modifiers of plus (+) or minus (-) during the plant evaluations.

Physical and chemical soil characteristics were evaluated to determine level of soil saturation. Standard Munsell soil color charts were used to evaluate such distinctiveness. Such soil characteristics were coupled with other regional indicators of hydrology as to determine the presence of wetland hydrology. With this, wetlands boundaries were obtained through a three parameter approach including dominating hydrophytes and hydrology, with the hydrology parameter also including the occurrences of hydric soils.

Site Description

The assessment area (AA) is located approximately one mile southeast of the Burgess Road and Main Street (State Route 9) intersection, on Burgess Road. The site is part of an ongoing EPA Superfund Project (EPA ID: VTD003965415), where remediation work abuts the AA (refer to Figure 1.) The AA remains undeveloped and exists primary as upland forest. However, two ephemeral waterways bisect the forested regions and eventually combine to form a single ephemeral stream.

Figure 1. *2011 Aerial image (Google Earth. 2012) showing the subject site and immediately surrounding areas*



These ephemeral water courses exist as a result off surface water runoff and the interception of high groundwater. Typically, each of these waterways are bordered by hydric soils and hydrophytic plant materials; parameters that make up jurisdictional wetlands, in areas immediately adjacent to the cleared restoration sites. The remainder of the surrounding these areas exists as uplands forest dominated by American Beech (*Fagus grandifolia*) and Hemlock (*Tsuga canadensis*), and includes other common species, including; Witch Hazel (*Hamamelis virginiana*), Hayscented Fern (*Dennstaedtia punctilobula*) and Cinnamon Fern (*Osumda cinnamomea* – FACW).

The wetland areas within the AA were delineated using pink and black striped flags labeled A1-A22 and B1 – B16. Data entry was executed using The Army Corps of Engineers Wetland Determination Forms – Northcentral and northeast Region (Refer to Appendix A). The A-series transect begins at a small wet meadow located immediately south of the active remediation site and follows a treeline existing to the north and east of the remediation site. This boundary terminates due to extent of study area and is not the limits of the jurisdictional wetlands.

The B-series transect begins along the second order ephemeral stream and follows its banks or associated wetlands to the beginning point of the A-series transect. For the most part, areas east of

each of the transects are jurisdictional wetlands, with the exception of a small area of uplands, delineated as a U-series transect, labeled one through four. This upland area is located in the southern portions of the AA. Due to a limited study area, the eastern most boundary of these wetland areas was not delineated. Species commonly seen in these wetland areas include; Red Maple (*Acer rubrum)*, Yellow Birch *(Betula alleghanienesis*), Witch Hazel (*Hamamelis virginiana* – FACU), Cinnamon Fern (*Osumda cinnamomea*), Royal Fern (*Osmunda regalis*), Sensitive Fern (*Onoclea sensibilis*) , amongst other hydrophytic plant materials.

The soils within the AA contained well oxidized subsoil horizons within the upland areas and reduced, or gleyed, soils matrices with in the wetland areas. Redoximorphic features were always present in soil peds containing a reduced matrix chroma 2. The NRCS has the AA mapped with two primary map units; one being Messina silt loam, and the other being Pittsfield fine sandy loam. The Massena series are soils consistent with the hydric soil observations within the delineated wetland areas and the Pittsfield series is consistent with the upland soil peds. Appendix B shows the soils mapping within the AA and the associated descriptions.

Waters within the AA eventually discharge into the nearby Barney Brook, a perennial tributary to the Walloomsac River. The Walloomsac River is part of the Hudson River Watershed.

Wetland Classification

Within the assessment area, wetland classification, under the Cowardin et.al classification (1979) is as follows (Riverine system was not delineated):

Forested Areas Agricultural Fields
System – Palustrine
Subsystem – none
Class – Forested (>33%)
Subclass – Broad-leaved deciduous
Water regime – Saturated
Soil – mineral
Water chemistry – fresh, circumneutral

Vermont Department of Environmental Conservation and the U.S. Environmental Protection Agency (EPA)

Vermont DEC defines wetlands as those areas of the state that are inundated by surface or ground water with a frequency sufficient to support significant vegetation or aquatic life that depend on saturated or seasonally saturated soil conditions for growth and reproduction. Such areas include but are not limited to marshes, swamps, sloughs, potholes, fens, river and lake overflows, mud flats, bogs, and ponds, but excluding such areas as grow food or crops in connection with farming activities. See 10 V.S.A. § 902(5).

For purposes of the wetland rules in Vermont, wetlands are classified as Class I, Class II, or Class III wetlands, as defined at 10 V.S.A. § 902 and Section 2 of these rules. The wetlands within the AA would likely be considered Class II wetlands per these rules.

The US EPA Defines a wetland as those areas inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation adapted for life in saturated soil conditions.

All proposed work shall comply with the environmental standards outlined in Section 404 of the Clean Water Act of 1977 (formerly the Federal Water Pollution Control Act) and Section 10 of the Rivers and Harbors Act of 1899.

Appendix A –

Army Corps of Engineers – Wetland Determination Data Forms – Northcentral and Northeast Region

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Burgess Brothers Superfund City/County: Bennington / Bennington Sampling Date: 8/2012

Applicant/Owner: App: Environmental Partners Group, LLC State: VT Sampling Point: WB010812-WB-A22W

Investigator(s): Rob Van Der Kar Section, Township, Range: 18T 657120mE 4749026mN

Landform (hillslope, terrace, etc.): Ablation till - hillside Local relief (concave, convex, none): concave Slope (%): 3-8% +/-

Subregion (LRR or MLRA): LRR Lat: 42°52'37.2" Long: 73°09'2.7" Datum: NAD83

Soil Map Unit Name: Massena silt loam - 3 to 8 Percent Slopes NWI classification: PFO1

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** Yes X No ____
Hydric Soil Present?	Yes X	No ____	If yes, optional Wetland Site ID: ____
Wetland Hydrology Present?	Yes X	No ____	

Remarks: (Explain alternative procedures here or in a separate report.)
Portions north-northeast of the AA have been significantly altered due to site remediation efforts. The AA however has not been affected as a result of these activities, although it is close to the remediation site.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- X Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ____	Depth (inches): ____
Water Table Present?	Yes X	No ____	Depth (inches): 6" from surface
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): @ surface

Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Wetland hydrology present

VEGETATION – Use scientific names of plants. Sampling Point: A-22W

Tree Stratum (Plot size: 30'R)	Absolute % Cover	Dominant Species?	Indicator Status
1. Betula alleghaniensis	40	Y	FAC
2. Acer rubrum	10	Y	FAC
3. Prunus serotina	7.5	N	FACU
4. Snags	5	N	FACW
5.			
6.			
7.			
	62.5 = Total Cover		

Sapling/Shrub Stratum (Plot size: 15'R)			
1. Acer pensylvanicum	10%	N	FACU
2. Fagus grandifolia	30%	Y	FACU
3. Betula alleghaniensis	20%	Y	FAC
4.			
5.			
6.			
7.			
	60 = Total Cover		

Herb Stratum (Plot size: 5'R)			
1. Juncus effusus	5%	N	OBL
2. Impatiens capensis	15%	Y	FACW
3. Osmunda cinnamomea	25%	Y	FACW
4. Onoclea sensibilis	10%	Y	FACW
5. Solidago grandifolia	7.5%	N	FACW
6. Sagittaria latifolia	7.5%	N	OBL
7.			
8.			
9.			
10.			
11.			
12.			
	70 = Total Cover		

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 85% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	5	x 1 = 5
FACW species	62.5	x 2 = 125
FAC species	70	x 3 = 210
FACU species	47.5	x 4 = 190
UPL species		x 5 =
Column Totals:	185 (A)	530 (B)

Prevalence Index = B/A = 2.86

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (Include photo numbers here or on a separate sheet.)

Meets dominant hydrophytic plant criteria

SOIL

Sampling Point: A-22W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
4-0"	10YR						SL	Oa / A
0->16	10YR5/1	100%					SCL	Cg - reduced matrix

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- X Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No _____

Remarks:

AA meets three parameters for wetland identification.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Burgess Brothers Superfund Site City/County: Bennington / Bennington Sampling Date: 8/2012

Applicant/Owner: App: Environmental Partners Group, LLC State: VT Sampling Point: WB010912-WBA-22

Investigator(s): Rob Van Der Kar Section, Township, Range: UTM 18 T 657120 m E 4749626m N

Landform (hillslope, terrace, etc.): Ablation till - hillside Local relief (concave, convex, none): Concave Slope (%): 3-8 +/-

Subregion (LRR or MLRA): LRR Lat: 42°52'37.2" Long: 73°09'2.7" Datum: NAD83

Soil Map Unit Name: Massena silt loam - 3 to 8 Percent Slopes NWI classification: PFO1

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area within a Wetland?** Yes ____ No X
Hydric Soil Present?	Yes ____	No X	If yes, optional Wetland Site ID: ____
Wetland Hydrology Present?	Yes ____	No X	

Remarks: (Explain alternative procedures here or in a separate report.)

Portions north / northeast of assessment area have been significantly altered due to site remediation efforts. The assessment area however has not been impacted as a result of these activities.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

N/A

Remarks: No indicators (primary or secondary) indicators of wetland hydrology

VEGETATION – Use scientific names of plants. Sampling Point: A-22U

Tree Stratum (Plot size: 30'r)	Absolute % Cover	Dominant Species?	Indicator Status
1. Fagus grandifolia	60%	Y	FACU
2. Pinus strobus	15%	Y	FACU
3. Quercus rubra	5%	N	FACU
4. Betula alleghaniensis	5%	N	FAC
5.			
6.			
7.			
	85% = Total Cover		

Sapling/Shrub Stratum (Plot size: 15'r)			
1. Fagus grandifolia	35%	Y	FACU
2. Betula alleghaniensis	10%	Y	FAC
3. Hamamelis virginiana	10%	Y	FACU
4. Prunus serotina	5%	N	FACU
5.			
6.			
7.			
	60% = Total Cover		

Herb Stratum (Plot size: 5'r)			
1. Mitchella repens	TRACE	N	FACU
2. Athyrium filix-femina	TRACE	N	FAC
3. Trientalis borealis	TRACE	N	FAC
4. Acer rubrum	TRACE	N	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	1% = Total Cover		

Woody Vine Stratum (Plot size: 30'r)			
1. None Present			
2.			
3.			
4.			
	0% = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species	15	x 3 =	45
FACU species	130	x 4 =	520
UPL species		x 5 =	
Column Totals:	145 (A)		565 (B)

Prevalence Index = B/A = 3.89

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ___ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL Sampling Point: A-22U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
2-0	Detritus	—	N/A				---	Detritus
0-1"	10YR3/2	95%	N/A				SL	Ap horizon
1-4"	10YR4/1	95%	N/A				LS	A/E-horizon
4-16	10YR4/6	95	N/A				LS	Bw- some Bhs devel.

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

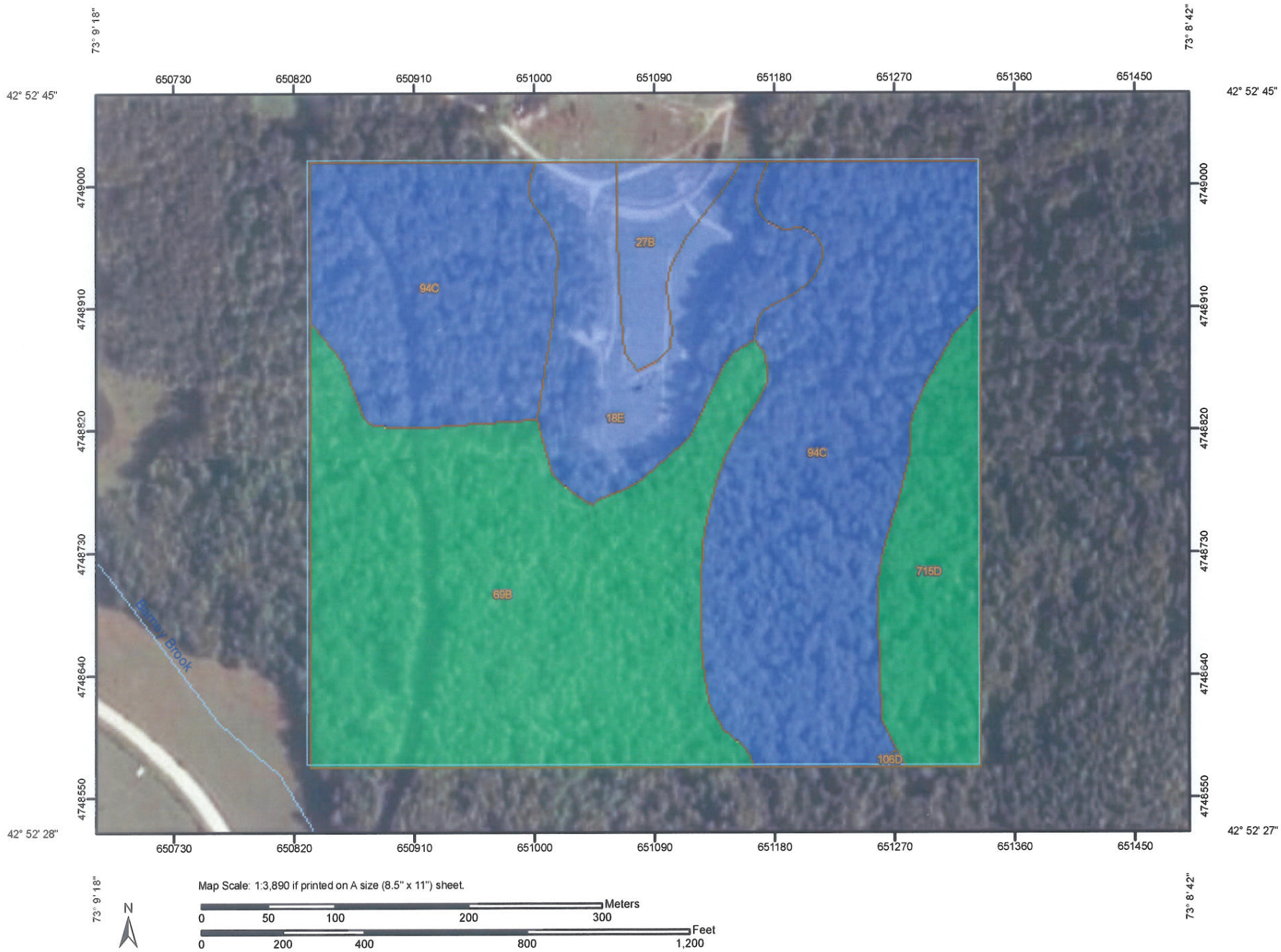
Hydric Soil Present? Yes _____ No X

Remarks:

Does not meet any of the jurisdictional wetland criteria.

Appendix B –
NRCS Soils Data and Mapping

Hydric Rating by Map Unit—Bennington County, Vermont
(Burgess Brothers Superfund Site)



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

Soil Ratings

All Hydric

Partially Hydric

Not Hydric

Unknown Hydric

Not rated or not available

Political Features

Cities

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

MAP INFORMATION

Map Scale: 1:3,890 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 18N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Bennington County, Vermont
Survey Area Data: Version 15, Jan 14, 2010

Date(s) aerial images were photographed: 8/20/2003

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydric Rating by Map Unit

Hydric Rating by Map Unit— Summary by Map Unit — Bennington County, Vermont (VT003)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
18E	Windsor loamy fine sand, 15 to 60 percent slopes	Not Hydric	6.9	12.5%
27B	Udipsamments and Udorthents, gently sloping	Not Hydric	1.9	3.4%
69B	Massena silt loam, 3 to 8 percent slopes, very stony	Partially Hydric	18.6	33.7%
94C	Pittsfield fine sandy loam, 8 to 15 percent slopes, very stony	Not Hydric	22.8	41.3%
106D	Berkshire fine sandy loam, 15 to 25 percent slopes, very stony	Not Hydric	0.0	0.1%
715D	Houghtonville-Rawsonville association, hilly, rocky	Partially Hydric	5.0	9.0%
Totals for Area of Interest			**55.3**	**100.0%**

Description

This rating indicates the proportion of map units that meets the criteria for hydric soils. Map units are composed of one or more map unit components or soil types, each of which is rated as hydric soil or not hydric. Map units that are made up dominantly of hydric soils may have small areas of minor nonhydric components in the higher positions on the landform, and map units that are made up dominantly of nonhydric soils may have small areas of minor hydric components in the lower positions on the landform. Each map unit is designated as "all hydric," "partially hydric," "not hydric," or "unknown hydric," depending on the rating of its respective components.

"All hydric" means that all components listed for a given map unit are rated as being hydric, while "not hydric" means that all components are rated as not hydric. "Partially hydric" means that at least one component of the map unit is rated as hydric, and at least one component is rated as not hydric. "Unknown hydric" indicates that at least one component is not rated so a definitive rating for the map unit cannot be made.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). Under natural conditions, these soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 2002). These criteria are used to identify map unit components that normally are associated with wetlands. The criteria used are selected estimated soil properties that are described in "Soil Taxonomy" (Soil Survey Staff, 1999) and "Keys to Soil Taxonomy" (Soil Survey Staff, 2006) and in the "Soil Survey Manual" (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in "Field Indicators of Hydric Soils in the United States" (Hurt and Vasilas, 2006).

References:

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18.

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.

Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service.

Rating Options

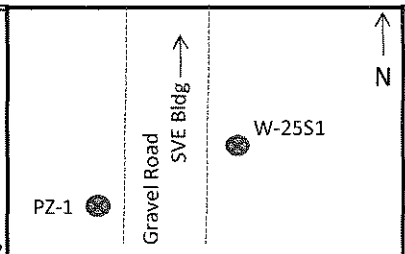
Aggregation Method: Absence/Presence

Tie-break Rule: Lower

APPENDIX B
Boring and Piezometer Construction Logs

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 80-90's
Performed By: NMP, RAV Date: 8/17/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-1
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation: 1086.8'
Approx. Groundwater Elevation: 1082'
Date/Time of Groundwater Elevation: 8/17/12, 08:30
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
1				SILT, dark brown, with roots to 22" organic material	LOAM	6.8			
2						0.2			
3			60"/42"	SILTY FINE SAND, tan/brown, with gravel, orange staining around 36"		0.8			
4									
5					KAME SAND				1
6						0.5			
7				FINE SAND, tan/brown, with trace silt, gravel (wet)					
8			60"/12"						
9									
10									2
11				FINE SANDY SILT, tan/brown, with gravel and cobbles, gradually more dense		0.5			
12						0.4			
13			60"/60"			1.8			
14					A. TILL	0.5			
15						0.8			
16				SILTY FINE SAND, tan/brown, with gravel and cobbles (wet)		0.4			
17						0.4			
18			60"/48"	SAND, medium-coarse, loose, wet		0.5			
19				FINE SANDY SILT, tan/brown, with gravel and cobbles, gradually drier		0.7			
20						0.9			3

NOTES:

1. Groundwater encountered around 5' bgs
2. Shallow screen interval set from 5' - 10' bgs
3. Deep screen interval set from 16' - 21' bgs piezometer materials are 1.5" PVC, with a 2' bentonite seal between the screened intervals from 12' - 14' bgs.

LEGEND

A. Till = Ablation Glacial Till
L. Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

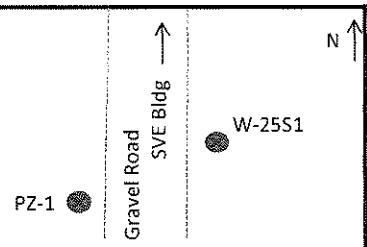
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 80-90's
Performed By: NMP, RAV Date: 8/17/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-1
Sampling Method: 6" casing \ See Site Plan
Approx. Ground Elevation: 1086.8'
Approx. Groundwater Elevation: 1082'
Date/Time of Groundwater Elevation: 8/17/12, 08:30
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
21				SILTY FINE SAND, tan/brown, with rock fragments, and large cobbles - 4"		0.3			
22					A. TILL	1.5			
23			60"/60"			0.6			
24						0.2			
25						0.4			
26				FINE SANDY SILT, tan/brown, with gravel and cobbles		0.4			
27						0.4			
28			60"/60"			0.2			
29						0.3			
30						0			
31				FINE SANDY SILT, tan/brown, with gravel and cobbles, dry, very dense	L. TILL	0.2			
32						0.4			
33			60"/60"			0			
34						0.6			
35						0.3			
36				Bottom of Boring 35' bgs					
37									
38									
39									
40									

NOTES:

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Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

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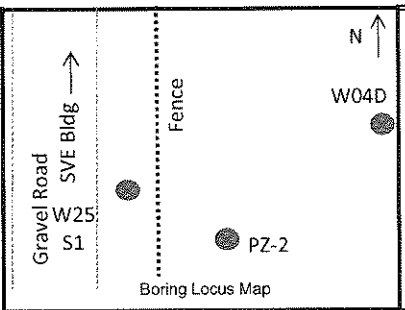
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 80-90's
Performed By: NMP, RAV Date: 7/20/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-2
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation: 1085.6'
Approx. Groundwater Elevation: 1080'
Date/Time of Groundwater Elevation: 7/20/12, 10:40
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
1				SAND, tan/brown, loose, with gravel and cobbles	FILL	0.1			
2						0.3			
3			60"/60"	SILT, dark brown, silt with wood, organic material	BURIED MARSH	4.4	35.0		
4	PZ2-PD-GT1 (4' - 10')			GRAVEL, cobbles, with trace silty fine sand, tan/brown (damp)		2.2			
5									1
6				SAND, tan/brown, medium-coarse, with gravel and cobbles up to 4"		1.2			
7	PZ2-PD-S1 (7') PZ2-PD-S1 (MS) PZ2-PD-S1 (MSD)				KAME SAND	10.2	81.2		
8			60"/60"	SILTY FINE SAND, tan/brown (wet)		1.4			
9						0.1			
10				SILTY FINE SAND, tan/brown, with some medium sand (wet)		0.4			2
11									
12									
13			60"/0"	No Recovery					
14									
15					A. TILL	1.2			
16	PZ2-PD-GT2 (15' - 23')			SILTY FINE SAND, tan/brown, with some gravel and cobbles (wet)		0.8			
17						1.1			
18			60"/60"	SILTY FINE SAND, tan/brown, with gravel and cobbles up to 6", more dense		6.6			
19						14.6			
20						33.2	16.6		

NOTES:

1. Groundwater encountered around 5' bgs
2. Shallow screen interval set from 5' - 10' bgs
3. Deep screen interval set from 17' - 22' bgs

piezometer materials are 1.5" PVC, with a 2' bentonite seal between the screened intervals from 12.5' - 14.5' bgs.

LEGEND

A. Till = Ablation Glacial Till
L. Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

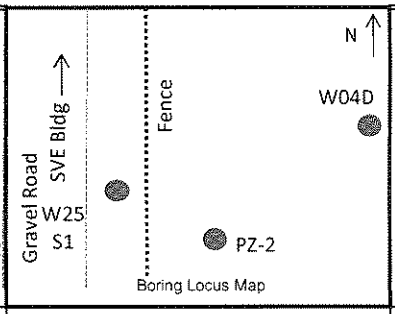
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 80-90's
Performed By: NMP, RAV Date: 7/20/2012
Checked By: Date:



Boring No: PZ-2
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation: 1085.6'
Approx. Groundwater Elevation: 1080'
Date/Time of Groundwater Elevation:
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
21				SILTY FINE SAND, tan/brown, with gravel and cobbles (wet)	A. TILL	0.4			
22						2.0			3
23			60"/60"	SILTY FINE SAND, tan/brown		0.5			
24				SILTY FINE SAND, tan/brown, more dense with gravel up to 2"		2			
25						2.3			
26									
27									
28			60"/0"	No Recovery					
29									
30	PZ2-PD-GT3 (30' - 35')								
31				SILTY FINE SAND, tan/brown, with gravel and cobbles, very dense (dry)	L. TILL	0.2			
32						0.4			
33			60"/60"			1.2			
34						0.1			
35						0.7			
36				Bottom of Boring 35' bgs					
37									
38									
39									
40									

NOTES:

LEGEND

A. Till = Ablation Glacial Till
L. Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

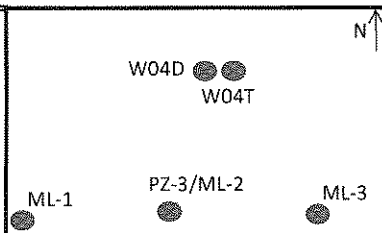
0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

DRAFT

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 80's - 90'S
Performed NMP, AMP Date: 7/17-7/18/12
Checked By: Date:



Boring Locus Map

Boring No: PZ-3/ML-2
Sampling Method: 6" casing witl See Site Plan
Approx. Ground Elevation:
Approx. Groundwater Elevation:
Date/Time of Groundwater Elevation:
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
1				FINE SAND, dark brown, with silt, gravel and roots		0.0			
2									
3			60"/60"	FINE SAND, light brown, with silt	FILL	0.0			
4				SILT, tan/brown, with clay (wet), some gravel		0.3			1
5									
6				FINE SANDY SILT, tan/brown, with gravel (wet)		0.0			
7									
8			60"/36"	SILT, dark brown/black, organic material, wood piece and cobbles (wet)	BURIED MARSH	0.0			2
9	ML2-PD-W1 (8-10)								
10									
11	*PZ3-PD-GT1 (9' - 18')*			SAND, tan/brown, medium-coarse, with gravel (wet)		6.1	124.0		
12				SILTY FINE SAND, tan/brown, with gravel and rock fragments		7.1			
13	PZ3-PD-S1 (12-13)		60"/36"			39.3	83.0		3
14						13.7	24.2		
15					A. TILL	5.5			4, 5
16				FINE SAND, tan/brown, with gravel, gradually more silt content towards bottom		17.5			
17	PZ3-PD-S2 (17-18) PZ150-PD-S1 (dup)					18.7	48, 139		
18			60"/60"			45.3	54.1, 88.1		
19				Boulder					
20				SILTY FINE SAND, tan/brown, with gravel, tight (wet)					

NOTES:

1. Groundwater encountered at 4' bgs
2. Wood stump in bit, no recovery from 8'-10'
3. Rock fragment in bit, no recovery from 13'-15'
4. Attempt to collect ML water sample from 13'-15', abandon vertical profiling technique, and decide to install multi-level piezometers
5. Need to abondon hole due to casing binding with boulders, move location 5' south, advance to 21' and hit hard material, boulder, need to move location. At 3rd hole, hit boulder at 18' and broke drill bit. Abandon location until drilling techniques discussed.

LEGEND

A. Till = Ablation Glacial Till
L. Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

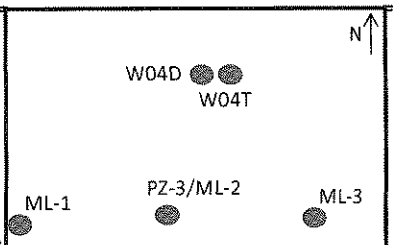
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 80's - 90'S
Performed RAV/NMP Date: 8/13/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-3/ML-2
Sampling Method: 6" casing v See Site Plan
Approx. Ground Elevation:
Approx. Groundwater Elevation:
Date/Time of Groundwater Elevation:
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
21				SILTY FINE SAND, tan/brown, with gravel and cobbles up to 6"	A. TILL	11.1			6
22									
23			60"/18"	Rock in Drill Bit - No Recovery 21.5' - 25'					
24	ML2-PD-W4 (23-25)								
25									
26	PZ3-PD-S3 (26')			SAND - well graded, loose, with gravel and cobbles up to 4"		40.5	454, 280		
27						8.3			
28			60"/48"	SILTY FINE SAND, tan/brown, with gravel, gradually drier material		8.4			7
29	ML2-PD-W5 (28'-30')					18.1	42.1		
30						1.5			
31				SILTY FINE SAND, tan/brown, with cobbles, dry, dense		12.8			
32					L. TILL	2.6			
33			60"/54"			2.6			
34						2.1			
35						1.8			
36				Bottom of Boring 35' bgs					
37									
38									
39									
40									

NOTES:

6. 8/13/12, Return to location (5' south) of last borehole to get beyond 20' bgs
7. Deep Screen interval set from 25'-28' bgs, a shallow screen interval set from 4'-6' bgs, piezometer materials are 1.5" PVC

LEGEND

A. Till = Ablation Glacial Till
L. Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

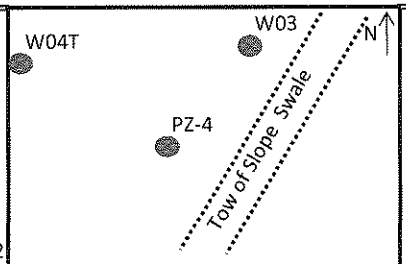
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 80's
Performed NMP, AMP Date: 7/16/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-4
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation: 1081'
Approx. Groundwater Elevation: 1071'
Date/Time of Groundwater Elevation: 7/16/12, 14:00
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
1				FINE SAND, dark brown, with some gravel, trace silt and clay, poorly sorted		0.0			
2									
3			60"/60"	FINE SAND, brown, with silt and cobbles up to 2", little coars sand, poorly sorted (FILL)	FILL	0.0			
4									
5									
6				FINE SAND, brown, with gravel (FILL)		0.0			
7									
8			60"/60"	SILTY FINE SAND, light brown, with gravel, brown organic layers at 7-7.25', and 9-9.5' (Marshy Area?)	BURIED MARSH	0.0			
9									
10						0.7	23.2		
11						1.1			
12				SILTY FINE SAND, tan/brown, with gravel and cobbles up to 5", wet	KAME SAND	3.5	18.8		
13			60"/36"			2.1 6.5 1.9			
14									
15						0.0			1, 2
16				SILTY FINE SAND, tan/brown, some gravel and cobbles up to 5", little clay		0.0			
17				same as above, more wet	A. TILL	0.0			
18			60"/60"	FINE-COARSE SAND, tan/brown, with gravel and cobbles up to 4" and angular, poorly sorted, some clay		3.2			
19									
20									

NOTES:

1. Shallow screen interval set from 10' - 15' bgs
2. Difficult drilling from 15'-20'

LEGEND

A. Till = Ablation Glacial Till
L. Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

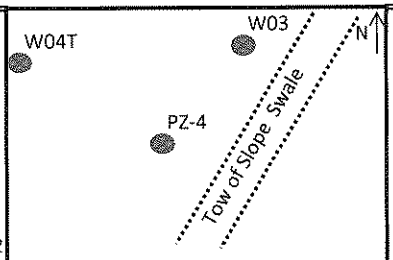
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 80's
Performed NMP, AMP Date: 7/16/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-4
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation: 1081'
Approx. Groundwater Elevation: 1071'
Date/Time of Groundwater Elevation: 7/16/12, 14:00
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
21				SANDY SILT, tan/brown, with gravel up to 3"	A. TILL	1.3			
22						4.9			
23			60"/60"			0.0			
24				FINE SANDY SILT, tan/brown, with gravel and cobbles, very tight (LODGMENT TILL)	L. TILL	1.9			4, 5
25						1.0			
26				SILT, light brown, with gravel and some clay, very tight (LODGMENT TILL)		4.5			
27						3.9			
28			60"/60"			10			
29						2.8			
30	PZ4-PD-S1 (30')					12.4	32.4		
31				Bottom of Boring 30' bgs					
32									
33									
34									
35									
36									
37									
38									
39									
40									

NOTES:

4. Encountered hard material at 24' bgs
5. Deep Screen interval from 19'-24' bgs

piezometer materials are 1.5" PVC, with a 2' bentonite seal between the screened intervals from 16' - 18' bgs.

LEGEND

A. Till = Ablation Glacial Till
L. Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

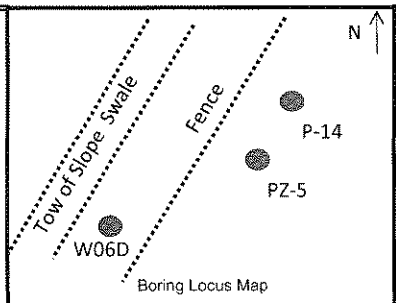
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 80-90's
Performed By: NMP, RAV Date: 7/19-20/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-5
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation: 1082.3'
Approx. Groundwater Elevation: 1079'
Date/Time of Groundwater Elevation: 7/19/12, 12:00
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
1				FINE SAND, tan/brown, very soft, with silt and gravel		0.0			
2									
3	PZ5-PD-GT1 (3.5' - 11.5')		60"/60"	SILT, grey with layers of tan/brown silt (WET)		0.0			1
4				SAND, coarse, with gravel (WET)		0.0			
5				FINE SAND, tan/brown (WET)					
6				FINE SAND, tan/brown, very soft (WET)		0.0			
7				SAND, coarse with gravel, some silt (WET)	KAME SAND	0.0			2
8			60"/60"						
9				FINE SAND, tan/brown, very soft, with silt (WET)		0.0			
10									
11				FINE SAND, tan/brown, very soft (WET)		0.0			
12				FINE SAND, tan/brown, very soft, with silt (WET)		0.0			
13			60"/60"						
14				FINE SAND, tan/brown, very soft, with silt, trace cobbles up to 6"		0.0			
15									
16				FINE SAND, tan/brown, very soft, with silt		0.6			
17						0.0			
18			60"/60"	FINE SAND, tan/brown, very soft, with silt, cobbles up to 4" (WET)					
19					A. TILL	0			
20									3

NOTES:

1. Groundwater encountered around 3.5' bgs
2. Shallow screen interval set from 3' - 8' bgs
3. Deep screen interval set from 15' - 20' bgs piezometer materials are 1.5" PVC, with a 2' bentonite seal between the screened intervals from 10' - 12' bgs.

LEGEND

A. Till = Ablation Glacial Till
L. Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

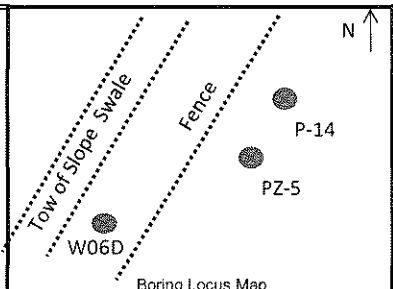
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 80-90's
Performed By: NMP, RAV Date: 7/19-20/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-5
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation: 1082.3'
Approx. Groundwater Elevation: 1079'
Date/Time of Groundwater Elevation: 7/19/12, 12:00
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
21	PZ5/6-PD-GT2 (21' - 25')			ROCK Fragments, 6" of rock fragments, white quartzite material	L. TILL				4
22				SILT, dense, with trace fine sand and gravel		0.0			
23			60"/60"						
24									
25									
26				Bottom of Boring - 25' bgs					
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									

NOTES:

4. Encountered hard material at 20.5' bgs, possible boulder, to recover 20-25' core

LEGEND

A. Till = Ablation Glacial Till
L. Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

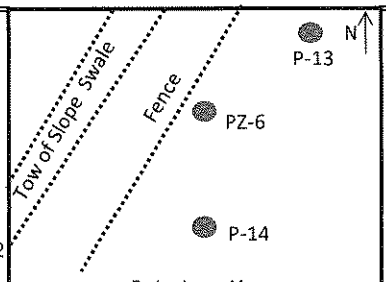
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 80-90's
Performed By: NMP, RAV Date: 7/19/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-6
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation: 1081'
Approx. Groundwater Elevation: 1076'
Date/Time of Groundwater Elevation: 7/19/12, 11:30
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
1				LOAM - silty sand with grass and roots with trace gravel	LOAM				
2						0.3			
3			60"/36"	FINE SAND - tan/brown, dense, with silt and gravel	FILL	0.1			
4									
5						0.2			1
6						0.6			
7				FINE SAND, tan/brown, with silt (WET)					
8			60"/12"						
9									2
10					A. TILL				
11									
12				FINE SAND, tan/brown, with silt, and large cobble 5" in diameter (WET)		0.0			
13			60"/12"						
14									
15						0.0			
16				FINE SAND, tan/brown, with silt and cobbles (WET)		0.0			
17	PZ5/6-PD-GT2 (17' - 18')					0.0			
18			60"/60"	SAND, loose, dry with gravel		0.0			3
19				FINE SAND, tan/brown, dense, damp, with silt, gravel and cobbles		1.6			
20					L. TILL	2.4			

NOTES:

1. Groundwater encountered around 5' bgs
2. Shallow screen interval set from 4' - 9' bgs
3. Deep screen interval set from 13' - 18' bgs

piezometer materials are 1.5" PVC, with a 2' bentonite seal between the screened intervals from 10' - 12' bgs.

LEGEND

A. Till = Ablation Glacial Till
L. Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

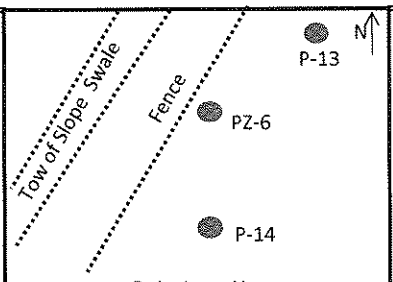
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 80-90's
Performed By: NMP, RAV Date: 7/19/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-6
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation: 1081'
Approx. Groundwater Elevation: 1076'
Date/Time of Groundwater Elevation: 7/19/12, 11:30
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
21				Refusal at 21 feet, possible boulder.					4
				Bottom of Boring - 21' bgs					
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									

NOTES:

4. Encountered hard material at 21' bgs, boulder

LEGEND

A. Till = Ablation Glacial Till
L. Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

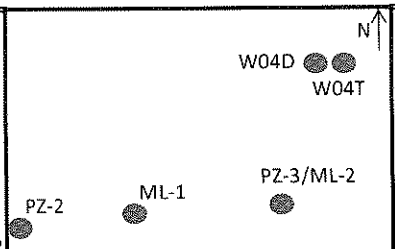
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 80-90's
Performed By: NMP, RAV Date: 7/25/2012
Checked By: Date:



Boring Locus Map

Boring No: ML-1
Sampling Method: 6" casing v See Site Plan
Approx. Ground Elevation:
Approx. Groundwater Elevation: 5' bgs
Date/Time of Groundwater Elevation: 7/25/12, 8:10
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
1				SAND & GRAVEL, brown, with some silt	FILL	2.1			
2						3.7			
			60"/60"	SILT, grey, with black roots (organics)	BURIED MARSH				
3						1.9			
4				SILTY FINE SAND, tan/brown (damp)		25.7	191, 36.2		
5	ML1-PD-S1 (5')					38.5	274, 124		1
6				FINE SAND, tan/brown, with some silt, very wet		57.6			
7					KAME SAND ?	16.5			
8			60"/60"			18.9			
9	ML1-PD-W1 (8-10)			SILTY FINE SAND, tan/brown, with gravel up to 2"		54.1			
10	ML1-PD-S2 (9.5-10)					69	87.2		
11									
12				No Recovery					
13			60"/0"						
14	ML1-PD-W2 (13-15)								
15					A. TILL				
16				FINE SAND, tan/brown, some gravel, some cobbles up to 3", very wet		3.7			
17						5.5			
18			60"/60"	FINE SAND, tan/brown, some gravel, some cobbles		16.8	7.9		
19	ML1-PD-W3 (18-20)					3			
20						11.9			

NOTES:

1. Groundwater encountered around 5' bgs

LEGEND

A. Till = Ablation Glacial Till
L. Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

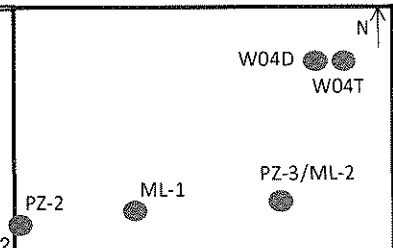
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 80-90's
Performed By: NMP, RAV Date: 7/25/2012
Checked By: Date:



Boring Locus Map

Boring No: ML-1
Sampling Method: 6" casing v See Site Plan
Approx. Ground Elevation:
Approx. Groundwater Elevation: 5' bgs
Date/Time of Groundwater Elevation: 7/25/12, 8:10
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
21				SILTY FINE SAND, tan/brown, with gravel and cobbles	A. TILL	2.5			
22						2.4			
23			60"/60"			5.1			
24	ML1-PD-W4 (23-25)			Same as above, more dry, more dense		21.1	79.4		
25						10.9			
26	ML1-PD-S3 (27')			SILTY FINE SAND, tan/brown, with cobbles, dry	L. TILL	4.9			
27	ML1-PD-S3 (MS) ML1-PD-S3 (MSD)					14.7	54		
28			60"/60"			2.6			
29						1			
30						0.9			
31				Bottom of Boring 30' bgs					
32									
33									
34									
35									
36									
37									
38									
39									
40									

NOTES:

LEGEND

A. Till = Ablation Glacial Till
L. Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

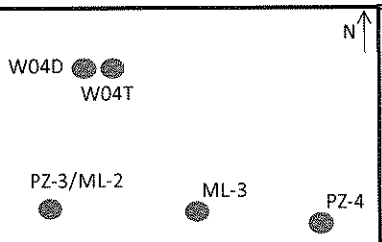
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 80-90's
Performed By: NMP, RAV Date: 7/24/2012
Checked By: Date:



Boring Locus Map

Boring No: ML-3
Sampling Method: 6" casing v See Site Plan
Approx. Ground Elevation:
Approx. Groundwater Elevation: 5' bgs
Date/Time of Groundwater Elevation: 7/24/12, 9:25
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
1				SAND, brown/dark brown, fine to medium with quartzite cobble in drill bit					
2									
3			60"/18"	No Recovery					
4									
5					FILL	0.3			1
6				3" rock fragments, angular		0.3			
7				SAND, tan/brown, silty fine sand with gravel and trace cobbles		0.3			
8			60"/60"			0.2			
9	ML3-PD-W1 (8-10)					0.2			
10				SILT, black, organic material, with wood pieces	BURIED MARSH	0.2			
11				SILTY FINE SAND, tan/brown, with gravel, with mixed marsh material (v. wet)					
12						0.2			
13	ML3-PD-W2 (13-15) ML151-PD-W2 (DUP)		60"/30"	SILTY FINE SAND, tan/brown, with gravel		0.3			
14	ML3-PD-W2 (MS) ML3-PD-W2 (MSD)					5.5	11.9		
15					A. TILL	1.7			
16				SILTY FINE SAND, tan/brown, soft, with some gravel, trace cobbles (wet)		1.6			
17						3.6			
18			60"/60"	SILTY FINE SAND, tan/brown, with gravel up to 3", angular, more stiff		0.4			
19	ML3-PD-W3 (18-20)					4.5	8.3		
20	ML3-PD-S1 (20') ML152-PD-S1 (DUP)					85	38.1		

NOTES:

1. Groundwater encountered around 5' bgs

LEGEND

A. Till = Ablation Glacial Till
L. Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

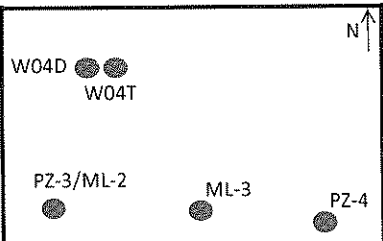
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 80-90's
Performed By: NMP, RAV Date: 7/24/2012
Checked By: Date:



Boring Locus Map

Boring No: ML-3
Sampling Method: 6" casing v See Site Plan
Approx. Ground Elevation:
Approx. Groundwater Elevation: 5' bgs
Date/Time of Groundwater Elevation: 7/24/12, 9:25
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
21				SILTY FINE SAND, tan/brown, soft, with gravel and cobbles (wet)	A. TILL	2.1			
22						1.5			
23	ML3-PD-S2 (23')		60"/60"	SILTY FINE SAND, tan/brown, with gravel and cobbles, more dry/stiff, still plastic		12.8	17.2		
24	ML3-PD-W4 (23-25)					1.6			
25						6.1			
26						6.1			
27	*ML3-PD-GT1 (27'-30')*		60"/60"	SILTY FINE SAND, with gravel, some cobbles up to 5", stiff, dry		13.5			
28					L. TILL	16.5	22.1		
29	ML3-PD-S3 (29')					23.8	43.7		
30						9.1			
31				Bottom of Boring 30' bgs					
32									
33									
34									
35									
36									
37									
38									
39									
40									

NOTES:

LEGEND

A. Till = Ablation Glacial Till
L. Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

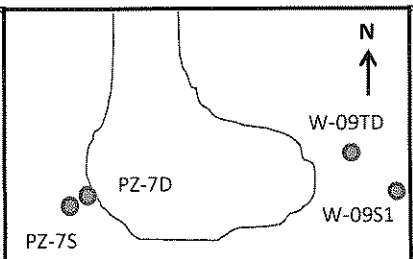
0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

DRAFT

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 80-90's
Performed By: AMP, RAV Date: 7/23/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-7S
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation:
Approx. Groundwater Elevation:
Date/Time of Groundwater Elevation: 7/23/12,
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
1				LOAM - brown/black sand and silt, with piece of hillslope liner	LOAM	0.0			
2				FINE SANDY SILT, medium brown		0.0			
3			60"/60"	SILT with some fine sand, and little clay, light grey and dark grey layering (damp)	Kame Sand	0.0			
4				FINE SAND, tan/brown, with sandy silt, trace pebbles and cobbles (angular), thick layer of fine sand at 4' bgs		0.0			
5						0.0			1
6				SILTY FINE SAND, tan/brown, with angular gravel and cobbles, little clay (WET)		1.6			
7	PZ7-PD-GT2 (4' - 10')				A. TILL	0.2			
8			60"/60"	SANDY SILT, tan/brown, with some clay, gravel and cobbles		0.1			
9						0.2			
10						0.5			3
11									2
12				No Recovery					
13			60"/0"						
14				Large piece of quartzite rock in bottom of core barrel.					
15									4
16				Bottom of Boring 15' bgs					
17									
18									
19									
20									

NOTES:

1. Groundwater encountered around 5' bgs
2. Hard drilling from 11' - 15' bgs
3. Shallow screen interval set from 5' - 10' bgs piezometer materials are 1.5" PVC
4. Very hard drilling with boulders from 11' - 15' decide to set shallow well, and abandon hole, to come back and drill deeper hole with new materials in August

LEGEND

A. Till = Ablation Glacial Till
L Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

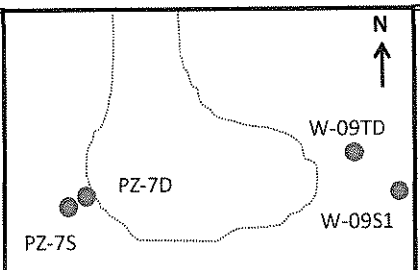
0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

DRAFT

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 80-90's
Performed By: AMP, RAV Date: 8/15/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-7D
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation:
Approx. Groundwater Elevation:
Date/Time of Groundwater Elevation:
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
1					LOAM				
2					Kame Sand				
3				SEE					
4				PZ-7					
5				BORING					
6				LOG					
7				FOR					
8				0 - 15 feet					
9				DETAILS					
10					A. TILL				
11									
12									
13									
14									
15									1
16				SILTY FINE SAND, large rock fragment at 15', blueish/grey quartzite					
17									2
18			24"/24"						
19									
20									

NOTES:

1. Drill down to 15' bgs before collecting samples PZ-7 was advanced on 7/23/12, and hit refusal with boulders
2. Hit hard material at 17' bgs - possible boulder, advance with stronger bit to get past rock.

LEGEND

A. Till = Ablation Glacial Till
L Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pacl

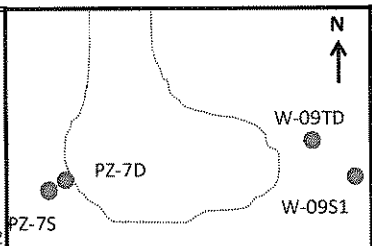
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 80-90's
Performed By: NMP, RAV Date: 8/15/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-7D
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation:
Approx. Groundwater Elevation:
Date/Time of Groundwater Elevation:
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
21				Rock fragments, quartzite		0.5			
22				SILTY FINE SAND, tan/brown, with gravel and cobbles, more clay and silt at the bottom		0.5			3
23			60"/60"		A. TILL	0.4			
24						0.6			
25						1.0			
26				SILTY FINE SAND, tan/brown, with clay (WET), many cobbles, angular and gravel throughout		0.4			
27						0.6			
28			60"/60"			1.4			
29				Same as above, more dry and compact		0.6			
30						1.4			
31				SILTY FINE SAND, tan/brown, with gravel and cobbles, dry		1.2			
32	PZ7D-PD-GT1 (30' - 35')				L. TILL	2.6			
33			60"/60"			1.7			
34						1.3			
35						1.3			
				Bottom of Boring 35' bgs					
36									
37									
38									
39									
40									

NOTES:

3. Screen interval set from 17' - 22'

piezometer materials are 1.5" PVC

LEGEND

A. Till = Ablation Glacial Till
L Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

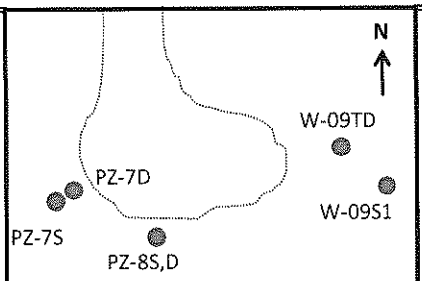
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 80-90's
Performed By: NMP, RAV Date: 8/15/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-8
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation:
Approx. Groundwater Elevation: 5' bgs
Date/Time of Groundwater Elevation: 8/15/12, 15:30
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
1				SILT, dark brown, organic material, with trace fine sand	SILT	2.7			
2				SILTY SAND, tan, with trace gravel, root systems to 18"		1.6			
3			60"/24"						
4				No Recovery					
5									1
6									
7				SAND, medium-coarse, with rock frag, and gravel (WET)		0.4			2
8			60"/36"			0.8			
9				FINE SAND, tan/brown, with silt and gravel medium dense (WET)		3.0			3
10					A. TILL	2.9			
11				SILTY FINE SAND, tan/brown, with some gravel and rock fragments		3.2			
12						2.1			
13			60"/60"	SILT/CLAY, tan/brown, with trace gravel and rock fragments		1.4			
14						3.4			
15						2.5			
16				SILTY SAND, tan, well mixed		2.8			
17						1.1			
18			60"/60"	SILTY FINE SAND, tan/brown with gravel and cobbles, angular, more clay content towards bottom (wet)		2.7			
19						1.5			
20						2.1			4

NOTES:

1. Groundwater encountered around 5' bgs
2. Encountered hard material from 7'-8' bgs
3. Shallow screen interval set from 4' - 9' bgs
4. Deep screen interval set from 15' - 20' bgs

piezometer materials are 1.5" PVC, with a 2' bentonite seal between the screened intervals from 11' - 13' bgs.

LEGEND

A. Till = Ablation Glacial Till
L Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pacl

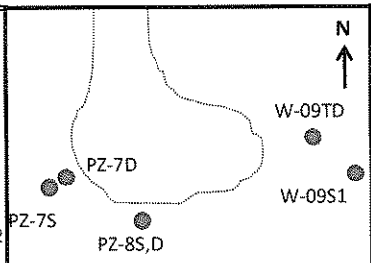
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 80-90's
Performed By: NMP, RAV Date: 8/15/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-8
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation:
Approx. Groundwater Elevation: 5' bgs
Date/Time of Groundwater Elevation: 8/15/12, 15:30
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
21				SILTY FINE SAND, tan/brown, with gravel and cobbles (damp)		1.5			
22						3.5			
23			60"/60"	FINE SANDY SILT, tan/brown, with gravel and cobbles, dense, dry	L. TILL	1.2			
24						3.4			
25						1.4			
26				Bottom of Boring 25' bgs					
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									

NOTES:

LEGEND

A. Till = Ablation Glacial Till
L Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
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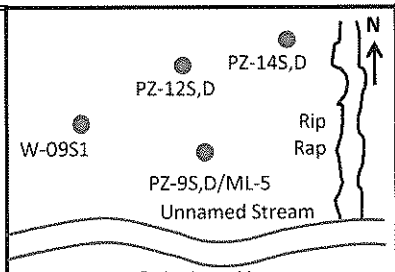
0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 80-90's
Performed By: NMP, WCS, RAV Date: 7/26/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-9/ML-5
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation:
Approx. Groundwater Elevation: 5' bgs
Date/Time of Groundwater Elevation: 8/15/12, 15:30
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
1				FINE SAND, brown/black, with silt, organic materials, roots to 12"	LOAM	0.4			
2						1.6			
3			60"/42"	FINE SAND, tan/brown, with silt, some gravel and cobbles (WET)		0.8			
4					KAME SAND				
5									1
6	PZ9-PD-GT1 (5' - 20')			GRAVEL with rock fragments		0.0			
7				FINE SAND, tan/brown, with silt		0.0			2
8			60"/60"	SAND, medium-coarse with gravel (WET)		0.0			
9	ML5-PD-W1 (8-10)					0.0			3
10						0.0			
11				FINE SAND, tan/brown, with silt, gravel, trace cobbles (WET)		0.1			
12						0.1			
13			60"/60"	SILTY FINE SAND, tan/brown, more dense and dry 14-15' bgs		0.1			
14	ML5-PD-W2 (13-15)					0.1			
15					A. TILL	0.1			
16				No Recovery					4
17									
18									
19	ML5-PD-W3 (18-20)			FINE SANDY SILT, with some gravel, trace cobbles, rock fragments		0.1			
20						0.4			5

NOTES:

1. Groundwater encountered around 5' bgs
2. Encountered hard material from 7'-8' bgs
3. Shallow screen interval set from 4' - 9' bgs
4. Boulder at 16' bgs
5. Deep screen interval set from 15' - 20' bgs

piezometer materials are 1.5" PVC, with a 2' bentonite seal between the screened intervals from 11' - 13' bgs.

LEGEND

A. Till = Ablation Glacial Till
L Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

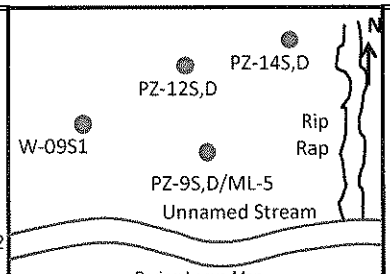
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 80-90's
Performed By: NMP, WCS, RAV Date: 7/26/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-9/ML-5
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation:
Approx. Groundwater Elevation: 5' bgs
Date/Time of Groundwater Elevation: 8/15/12, 15:30
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
21				FINE SANDY SILT, tan/brown, some gravel, wet and pliable	A. TILL	0.6			
22						0.4			
23			60"/60"	FINE SANDY SILT, tan/brown, some gravel, stiff, dry	L. TILL	0.9			
24						2.9			
25						1.6			
26				Bottom of Boring 25' bgs					
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									

NOTES:

LEGEND

A. Till = Ablation Glacial Till
L Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

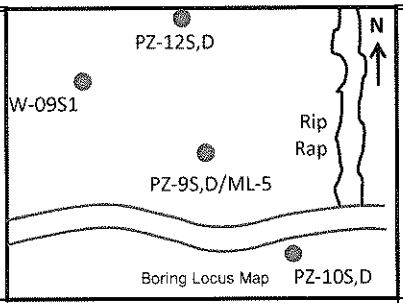
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Overcast, 70's - 80's
Performed By: NMP, RAV Date: 8/21/2012
Checked By: Date:



Boring Locus Map

Unnamed Stream
Boring No: PZ-10
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation:
Approx. Groundwater Elevation: 5' bgs
Date/Time of Groundwater Elevation: 8/21/12, 15:10
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
1				SILT, brown/black, with fine sand, organic material, with roots and gravel throughout.	PEAT	1.1			
2									
3			60"/20"		KAME SAND				
4									
5						3.4			1
6				GRAVEL, with coarse sand (WET)		0.3			
7				SILT, dark brown		3.3			
8			60"/42"	FINE SANDY SILT, tan/brown, with gravel, some cobbles (WET)		0.7			2
9									
10						0.2			
11				SILT/CLAY, tan/brown, with gravel	A. TILL	0.1			
12						2.0			
13			60"/54"	SAND, tan/brown, coarse, with some silt		0.9			
14				FINE SANDY SILT, tan/brown, with gravel, and cobbles		2.2			
15	PZ10-PD-GT2 (13' - 18')					0.3			
16						0.2			
17				FINE SANDY SILT, tan/brown, with gravel, and cobbles, layers of silt and fine sand		1.4			
18			60"/60"			1.6			
19						0.5			
20									

NOTES:

1. Groundwater encountered around 5' bgs
2. Shallow screen interval set from 3' - 8' bgs
3. Deep screen interval set from 21' - 26' bgs

piezometer materials are 1.5" PVC, with a 2' bentonite seal between the screened intervals from 11' - 13' bgs.

LEGEND

A. Till = Ablation Glacial Till
L Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

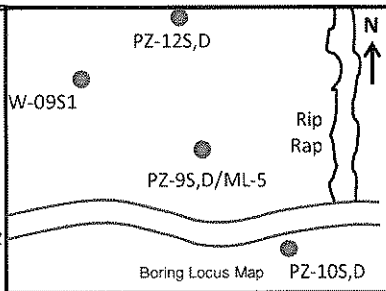
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

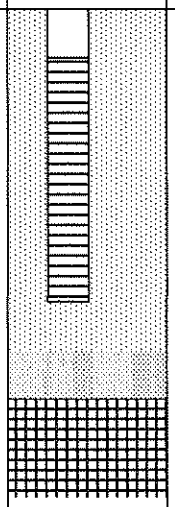
Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Overcast, 70's - 80's
Performed By: NMP, RAV Date: 8/21/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-10
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation:
Approx. Groundwater Elevation: 5' bgs
Date/Time of Groundwater Elevation: 8/21/12, 15:10
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
21				FINE SANDY SILT, tan/brown, with gravel, and cobbles (WET)		0.4			
22				FINE SANDY SILT, tan/brown, with gravel, and cobbles, more dry and dense	A. TILL	0.1			
23			60"/36"	at bottom of sample		0.3			
24									
25						2.3			
26				SILTY FINE SAND, tan/brown, with gravel, (WET)	L. TILL	8.1	1.6		3
27				FINE SANDY SILT, tan/brown, with gravel, and cobbles, dry, dense		1.1			
28	PZ10-PD-GT3 (27' - 30')		60"/60"			1.7			
29						0.8			
30									
31				Bottom of Boring 30' bgs					
32									
33									
34									
35									
36									
37									
38									
39									
40									



NOTES:

3. Deep screen interval set from 21' - 26' bgs piezometer materials are 1.5" PVC, with a 2' bentonite seal between the screened intervals from 11' - 13' bgs.

LEGEND

A. Till = Ablation Glacial Till
L Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

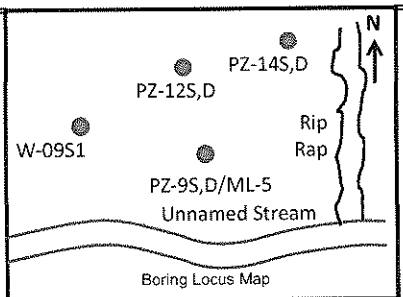
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 70's - 80's
Performed By: NMP, RAV Date: 8/20/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-12
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation:
Approx. Groundwater Elevation: 5' bgs
Date/Time of Groundwater Elevation: 8/20/12, 09:35
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
1				SILTY FINE SAND, brown, with trace gravel, roots		14.0	24.0		
2	PZ12-PD-S1 (2')			SILT, brown, with cobble		12.0	29.0		
3			60"/30"	FINE SANDY SILT, tan (damp)					
4				No Recovery					
5									1
6									
7									
8			60"/24"	SILTY FINE SAND, tan/brown, with gravel (WET)		6.1			
9	PZ12-PD-S2 (9') PZ160-PD-S1 (9', DUP)				A. TILL	17.4	18.1		
10						13.7	9.4		2
11									
12									
13			60"/30"	FINE SANDY SILT, tan/brown, with gravel (WET)		14.0	9.7		
14						1.8			
15						6.8			
16									
17				No recovery 15' - 20'. Rock fragments in drill bit.					
18			60"/0						
19									
20									3, 4

NOTES:

1. Groundwater encountered around 5' bgs
2. Shallow screen interval set from 5' - 10' bgs
3. Rock fragment in drill bit, no recovery
4. Deep screen interval set from 15' - 20' bgs

piezometer materials are 1.5" PVC, with a 3' bentonite seal between the screened intervals from 11' - 14' bgs.

LEGEND

A. Till = Ablation Glacial Till
L Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

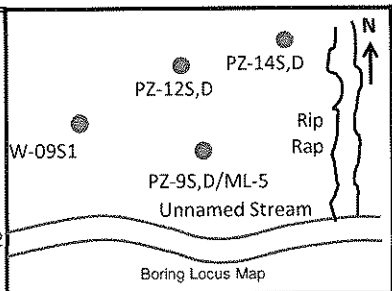
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 70's - 80's
Performed By: NMP, RAV Date: 8/20/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-12
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation:
Approx. Groundwater Elevation: 5' bgs
Date/Time of Groundwater Elevation: 8/20/12, 09:35
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
21				FINE SANDY SILT, tan/brown, with gravel up to 2"	A. TILL	0.5			
22						0.5			
23			60"/60"			0.5			
24						0.5			
25						0.6			
26				FINE SANDY SILT, tan/brown, with gravel, trace rock fragments, dry, dense	L. TILL	0.5			
27						0.6			
28			60"/60"			0.6			
29						0.5			
30						0.6			
31				Bottom of Boring 30' bgs					
32									
33									
34									
35									
36									
37									
38									
39									
40									

NOTES:

LEGEND

A. Till = Ablation Glacial Till
L Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

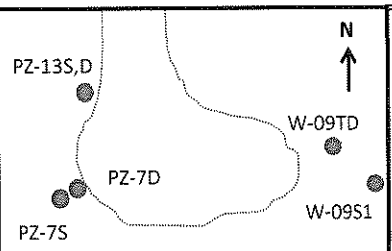
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

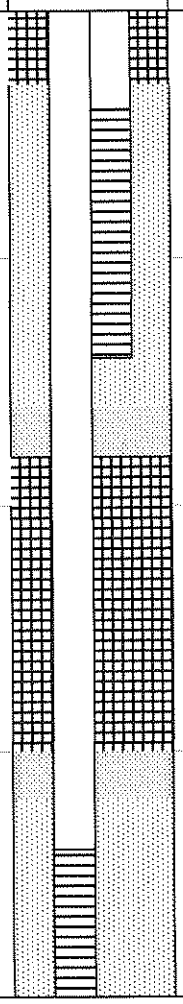
Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Overcast, 70's - 80's
Performed By: NMP, RAV Date: 8/16/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-13
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation:
Approx. Groundwater Elevation: 5' bgs
Date/Time of Groundwater Elevation: 8/16/12, 12:10
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
1				SILTY FINE SAND, brown, with roots			0.8		
2				SILT, grey/orange - redox features			1.3		
3			60"/36"	FINE SAND, tan/brown, some silt			0.7		
4					KAME SAND/ FILL				
5							0.7		1
6				FINE SAND, brown/orange, with rock fragments, buried marsh material			0.9		
7				SILTY FINE SAND, tan/brown, with gravel and rock fragments, more silt/clay content towards bottom			1.1		2
8			60"/60"				0.7		
9							0.5		
10					A. TILL		0.3		
11				SILTY FINE SAND, tan/brown, with gravel and rock fragments			0.4		
12							0.6		
13			60"/60"	FINE SANDY SILT, tan/brown, gradually more dry and compact			0.4		
14							0.5		
15							1.5		3
16				SILTY FINE SAND, tan/brown, with gravel and cobbles			0.4		
17							0.3		
18			60"/30"						
19				No recovery from 17.5' - 20', large rock fragment in drill bit.					
20									



NOTES:

1. Groundwater encountered around 5' bgs
2. Shallow screen interval set from 2' - 7' bgs
3. Rock in drill bit, prevented full recovery

LEGEND

A. Till = Ablation Glacial Till
L Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

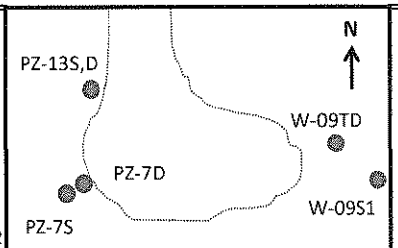
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Overcast, 70's - 80's
Performed By: NMP, RAV Date: 8/16/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-13
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation:
Approx. Groundwater Elevation: 5' bgs
Date/Time of Groundwater Elevation: 8/16/12, 12:10
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
21				SAND, well graded, with some silt and gravel (WET)	A. TILL	0.9			
22				SILTY FINE SAND, tan/brown, with gravel		0.9			4
23			60"/60"	FINE SANDY SILT, tan/brown, with gravel and rock fragments (DRY)		2.1			
24						6.5	0.5		
25						3.6			5
26				FINE SANDY SILT, tan/brown, with gravel and cobbles (DRY)	L. TILL	4.5			
27						1.9			
28			60"/24"	No recovery from 27' - 30', large rock fragment in drill bit.					
29									
30									
31				Bottom of Boring 30' bgs					
32									
33									
34									
35									
36									
37									
38									
39									
40									

NOTES:

4. Deep screen interval set from 17' - 22' bgs piezometer materials are 1.5" PVC, with a 5' bentonite seal between the screened intervals from 9' - 14' bgs.
5. Large rock fragment in drill bit, prevented full recovery

LEGEND

A. Till = Ablation Glacial Till
L Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

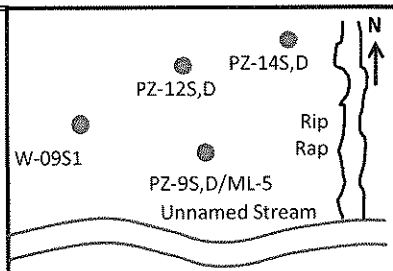
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 70's - 80's
Performed By: NMP Date: 8/20/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-14
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation:
Approx. Groundwater Elevation: 2' bgs
Date/Time of Groundwater Elevation: 8/20/12, 14:00
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
1				FINE SANDY SILT, brown		5.5			
2	PZ14-PD-S1 (2') PZ14-PD-S1 (MS) PZ14-PD-S1 (MSD)		60"/54"	FINE SAND, tan, with some silt, coarse sand layer at 2.5', trace gravel (WET)		10.0	17.6		1
3						2.3			
4					KAME SAND	9.9	1.2		
5									
6				FINE SAND, tan/brown, with some silt, gravel up to 3" (WET)		0.1			
7						0.4			2
8			60"/42"			0.3			
9									
10									
11				FINE SANDY SILT, tan/brown, with some gravel and cobbles up to 5" (WET)		0.3			
12					A. TILL	0.4			
13			60"/36"			0.2			
14									
15									
16				SILTY FINE SAND, tan/brown (WET)		1.0			3
17				SILTY FINE SAND, tan/brown, with gravel and cobbles (damp)		1.4			
18			60"/48"			1.0			
19						3.9			
20									

NOTES:

1. Groundwater encountered around 2' bgs
2. Shallow screen interval set from 2' - 7' bgs
3. Deep screen interval set from 11' - 16' bgs

piezometer materials are 1.5" PVC, with a 2' bentonite seal between the screened intervals from 8' - 10' bgs.

LEGEND

A. Till = Ablation Glacial Till
L Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

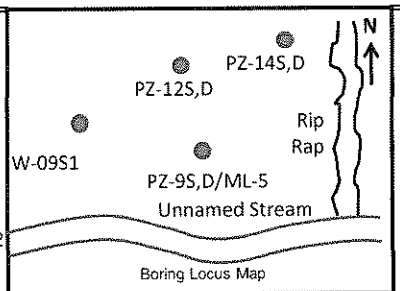
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 70's - 80's
Performed By: NMP Date: 8/20/2012
Checked By: Date:



Boring Locus Map

Boring No: PZ-14
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation:
Approx. Groundwater Elevation: 2' bgs
Date/Time of Groundwater Elevation: 8/20/12, 14:00
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
21				FINE SANDY SILT, tan/brown, with gravel and cobbles throughout (DRY)		0.7			
22					L. TILL	0.8			
23			60"/60"			1.2			
24						2.1			
25						7.5			
26				Bottom of Boring 25' bgs					
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									

NOTES:

LEGEND

A. Till = Ablation Glacial Till
L Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

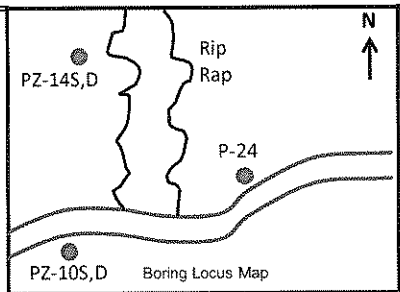
Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Sunny, 70's - 80's
Performed By: NMP Date: 8/21/2012
Checked By: Date:



Boring No: P-24
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation:
Approx. Groundwater Elevation: 2' bgs
Date/Time of Groundwater Elevation: 8/21/12, 12:10
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
1				SILT, brown, organic material with roots and gravel	PEAT	1.5			
2				FINE SAND, grey, with trace silt (damp)		0.0			1
3			60"/48"	FINE SAND, tan/brown, with silt, gravel and rock fragments at bottom (WET)		0.0			
4						3.0			
5					KAME SAND	0.2			
6				FINE SAND, tan/brown, with some silt and gravel (WET)		0.2			
7						1.0			2
8			60"/60"			1.5			
9						1.1			
10						1.7			
11				FINE SANDY SILT, tan/brown, with gravel throughout, more dense at bottom		2.8			
12						4.7			
13			60"/54"	Same as above, more dry, some small cobbles	A. TILL	4.2			
14						5.4	0.2		
15									
16				Bottom of Boring 15' bgs					
17									
18									
19									
20									

NOTES:

1. Groundwater encountered around 2' bgs
2. Screen interval set from 2' - 7' bgs

piezometer material is 1.5" PVC

LEGEND

A. Till = Ablation Glacial Till
L Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Mostly Cloudy, 60's - 80's
Performed By: NMP Date: 8/14/2012
Checked By: Date:

N

Boring Locus Map

Boring No: ML-4
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation:
Approx. Groundwater Elevation: 1' bgs
Date/Time of Groundwater Elevation: 8/14/12; 11:45
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
1				SILT, black/brown, with roots, organics		1.0			
2				SILTY FINE SAND, brown, with roots (WET)		0.8			1
3			60"/48"	SILTY FINE SAND, tan/orange, layering of redox mottling		4.3			
4				SILTY FINE SAND, tan/grey, cobble at bottom (4")		5.4			
5						3.3			
6				SAND, tan/brown, well sorted, wth gravel, trace silt (WET)	KAME SAND	1.9			
7						3.6			
8			60"/60"	SILTY FINE SAND, tan/brown, with gravel (WET)		6.5			2
9						5.3			
10						3.5			
11				FINE SANDY SILT, with gravel throughout (WET)					
12						1.0			
13			60"/48"			2.0			
14	ML4-PD-W1 (13-15)				A. TILL	2.8			
15						1.6			
16				SILTY FINE SAND, tan/brown, with gravel		0.9			
17				SAND, loose, medium-coarse with some silt, gravels and cobbles		1.9			
18			60"/60"			0.5			
19	ML4-PD-W2 (18-20)			SILTY FINE SAND, tan/brown, with gravel and cobbles		3.1			
20						0.8			

NOTES:

1. Groundwater encountered around 1' bgs
2. Attempted ML sampling from 8'-10', and 7'-10', no recharge in well.

LEGEND

A. Till = Ablation Glacial Till
L Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

0-10 Coarse Soil N Value - Loose
10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

BORING LOG

Project: Pre-Design Investigation
Location: Burgess Bros. Superfund Site
Client: Burgess Brothers Steering Committee
Driller: ADT - Chris Jenkens
Drilling Methods: Sonic Geoprobe
Weather: Mostly Cloudy, 60's - 80's
Performed By: NMP Date: 8/14/2012
Checked By: Date:

N

Boring Locus Map

Boring No: ML-4
Sampling Method: 6" casing with 4" core barrel
Approx. Ground Elevation:
Approx. Groundwater Elevation: 1' bgs
Date/Time of Groundwater Elevation: 8/14/12; 11:45
Datum:
Project No. 106-1203.00

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description	Stratum Change Depth (feet)	PID Readings (ppm)	PID Head space (ppm)	Well Construction Observations	Note No.
21				SILTY FINE SAND, tan/brown (WET)			5.5		
22				FINE SANDY SILT, tan/brown, with gravel and cobbles (DRY)			3.5		
23			60"/60"		L. TILL		2.0		
24							1.6		
25							1.4		
26				Bottom of Boring 25' bgs					
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									

NOTES:

LEGEND

A. Till = Ablation Glacial Till
L Till = Lodgement Till
Riser
Screen
Bentonite
Sand Filter Pack
Choker Sand Pack

Trace - Approximately 0 to 10%
Little - Approximately 10 to 20%
Some - Approximately 20 to 35%
And - Approximately 35 to 50%

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10-30 Coarse Soil N Value - Medium Dense
30-50 Coarse Soil N Value - Dense
>50 Coarse Soil N Value - Very Dense

0-4 Fine Soil N Value - Soft
4-8 Fine Soil N Value - Medium Stiff
8-15 Fine Soil N Value - Stiff
15-30 Fine Soil N Value - Very Stiff
>30 Fine Soil N Value - Hard

APPENDIX C
SiREM ZVI Treatability Reports

Prepared for:

XDD, LLC
101 East Mill Street, Suite D
Quakertown, PA 18951

FINAL

Treatability Study Report

Column Study to Evaluate Remediation of Chlorinated Solvents in Groundwater Using Zero Valent Iron

Burgess Brothers Superfund Site
Woodford and Bennington, Vermont

Prepared by:

130 Research Lane, Suite 2
Guelph, Ontario N1G 5G3

SiREM Ref: TL0343

22 April 2013

siremlab.com

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LIST OF ABBREVIATIONS

CO_2	carbon dioxide
cDCE	cis-1,2-dichloroethene
cVOC	chlorinated volatile organic compound
°C	degrees Celsius
°C/min	degrees Celsius per minute
cm	centimeters
°F	degrees Fahrenheit
ft	feet
ft/day	feet per day
DHG	dissolved hydrocarbon gases
DOC	dissolved organic carbon
GC	gas chromatograph
g	grams
$t_{½}$	half life
hrs	hours
IC	ion chromatograph
ICP-AES	inductively coupled plasma – atomic emission spectroscopy
MCLs	maximum contaminant levels
µg/L	micrograms per liter
µL	microliters
mg/L	milligrams per liter
mL	milliliters
mL/min	milliliters per minute
min	minute
mm	millimeters
mM	millimolar
mmol/kg Fe/day	millimoles per kilogram iron per day
mV	millivolts
ORP	oxidation reduction potential
%	per cent
PRB	permeable reactive barrier
RPM	revolutions per minute
QL	quantitation limit
r^2	coefficient of determination
SiO_3^{2-}	silica
SiREM	SiREM Laboratories
PCE	tetrachloroethene
TDS	total dissolved solids
TOC	total organic carbon
TCE	trichloroethene
VC	vinyl chloride
XDD	XDD LLC
ZVI	zero valent iron

1 Introduction

SiREM Laboratory (SiREM) was retained by XDD LLC (XDD) to perform a bench scale treatability column study to assess the use of the zero valent iron (ZVI) permeable reactive barrier (PRB) technology for the remediation of chlorinated volatile organic compounds (cVOCs) in groundwater from the Burgess Brothers Superfund Site located in Woodford and Bennington, Vermont (the site).

This report contains the study objectives and scope of work (Section 2); experimental methods (Section 3); cVOC results and discussion including calculation of cVOC degradation half-lives (Section 4); estimation of residence time required for ZVI PRB design (Section 5); discussion of inorganic chemistry changes during the column study (Section 6); and the study conclusions (Section 7). Report references are provided in Section 8.

2 Objectives and Scope of Work

This section provides the study objectives and the scope of work completed to satisfy the project objectives.

2.1 Objectives

The primary objectives of the laboratory ZVI column study were to:

- Determine degradation rates for the main compounds of potential concern (i.e., tetrachloroethene [PCE], trichloroethene [TCE], cis-1,2-dichloroethene [cDCE] and vinyl chloride [VC]) in site groundwater with a commercial granular ZVI under flowing water conditions;
- Characterize chlorinated breakdown products of cVOCs detected in the site groundwater and to quantify the rates of degradation; and
- Evaluate changes in inorganic geochemistry caused by ZVI corrosion chemistry, including possible mineral precipitation.

2.2 Scope of Work

A single ZVI column study was set up and performed using 100 per cent (%) granular ZVI and site groundwater containing cVOCs. On 11 September 2012 the granular ZVI was packed into the column with care. The column and ZVI materials specifications are provided in Table 1. A schematic of the column is provided in Figure 1.

The groundwater for this study was collected by Environmental Partners Group personnel from the site and was received by SiREM on 31 August 2012. On 6 September 2012 (Day 0) the site groundwater was transferred into the influent reservoir with care taken to minimize volatile losses to the extent practicable. The initial PCE, TCE, cDCE and VC concentrations in the influent reservoir were below the target concentrations of 25,000, 6,000, 6,000 and 2,000 micrograms per liter (µg/L) respectively. Therefore, on 10 September 2012 the influent reservoir water was amended with 230 microliters (µL) of PCE, 53 µL of TCE, 51 µL of cDCE and 10 milliliters (mL) of VC to achieve the target concentrations. On 13 September 2012 the pump was started to feed the water from the influent reservoir vertically upward through the column for a period of seven weeks. A flow velocity of about 1.64 feet/day was selected in consultation with XDD to allow the study to be completed in a reasonable time. This flow rate has been used in numerous previous ZVI column tests to assure a sufficient volume of groundwater passes through the column within the test period in order to assess potential long-term changes to cVOC treatment efficacy.

Water samples were collected from seven sampling ports located along the column length as well as from the column influent and effluent for analysis of pH, oxidation-reduction potential (ORP), cVOCs, dissolved hydrocarbon gases (DHGs), cations, anions, alkalinity, total sulfide, total dissolved solids (TDS) and metals according to the schedule presented in Table 2.

The cVOC concentration trends from the column study were used to calculate the degradation rates for each compound detected using a multicomponent first-order kinetic model. The degradation rates obtained, expressed as half-lives, were then corrected for groundwater temperature and used to calculate the residence time required in the field to achieve the regulatory criteria for all compounds. Finally, the column water chemistry data were used to assess the potential effects of water chemistry on the long-term reactivity of ZVI under site conditions.

3 Study Methods and Materials

This section describes the methods used to construct and operate the ZVI column, and to collect water samples for analysis during the ZVI column treatability study.

3.1 Column Construction

The column study consisted of one column containing 100% granular ZVI (CC-1004) provided by Connelly-GPM Inc. (Chicago, IL). This commercial ZVI source has been used for numerous ZVI PRB applications (Gillham et al., 2010). Based on the manufacturer's specifications, the granular ZVI used in the column study has a particle size range from 0.25 to 2.0 millimeters (mm; 8 to 50 US Mesh).

The column was constructed of Plexiglas™ with a length of 1.64 feet (ft) (50 centimeters [cm]) and an internal diameter of 0.12 ft (1.5 inches, 3.8 cm) (Figure 1). Seven sampling ports were positioned vertically along the central axis of the column at distances of 0.08, 0.16, 0.33, 0.50, 0.66, 1.0 and 1.3 ft from the influent end. The column influent and effluent ports were also sampled. All sampling ports within the column (excluding influent and effluent) were constructed using a nylon Swagelok compression fitting tapped into the column. A 16 gauge needle was positioned through the fitting and secured by tightening the ferrule. Glass wool was threaded through the needle to ensure minimal particulates from entering the samples. Each sample port was then fitted with a Luer-Lock™ fitting so that a glass syringe could be attached to the port for collection of water samples.

To ensure a homogeneous column material bed, the ZVI was packed vertically in the column in 100 gram (g) increments. Values of bulk density, porosity, and pore volume were determined by weight and are provided in Table 1. The column experiment was performed at room temperature (22±1 degrees Celsius [ºC]). After column packing, the dry ZVI material was purged with carbon dioxide (CO_2) gas for 2 hours prior to saturation with water to remove air. CO_2 is a more soluble gas compared to oxygen and nitrogen and assures that any trapped gas dissolves in water and prevents creation of gas bubbles in the columns.

A Masterflex® peristaltic pump was used to feed site water vertically upwards through the column. The pump tubing consisted of Viton® 2-stop tubing. All other tubing was 1/16 inch inside diameter Teflon® tubing.

3.2 Site Groundwater Storage and Usage

Six 1-gallon bottles were received by SiREM personnel on 31 August 2012 and stored in cold storage (4°C) until study commencement. A Chain of Custody Record for the water received from the site is provided in Appendix A. Site water was siphoned into the influent reservoir (i.e., a Teflon® bag) with minimal headspace. The influent reservoir contained two Swagelok fittings with Teflon® septa.

3.3 Sampling Procedure

After removing the stagnant water from the sampling needles, 4.0 mL samples were collected from the sampling ports using glass on glass syringes. A 250 µL to 1 mL water sample (depending on the sample location and dilution required) was removed from the glass syringe and transferred immediately into an autosampler vial for gas chromatograph (GC) analysis of cVOCs/DHGs. The remaining sample volume was transferred into a 5 mL plastic vial for ORP and pH measurement. When anion sample collection was required a 0.5 mL sample was transferred to 1.5 mL eppendorf tubes, which were stored frozen until time of analysis.

Water samples for cation, alkalinity, TDS and metals analyses were collected from the column influent and effluent only. Total sulfide samples were collected form the column influent, effluent and middle port only. For cations, a 50 mL unfiltered sample was collected into a 110 mL bottle and acidified to a pH of 2 with nitric acid. For alkalinity and TDS 100 mL unfiltered samples were collected into 110 mL bottles and left unpreserved. For metals a 75 mL unfiltered sample was collected into a 110 mL bottle and acidified to pH 2 with nitric acid. For total sulfide a 25 mL unfiltered sample was collected into a 30 mL bottle and preserved with zinc acetate and sodium hydroxide. Confirmatory samples for cVOC analysis were also collected from the influent and effluent into 2.8 mL vials and 40 mL VOA vials preserved with hydrochloric acid.

Water samples for cation, alkalinity, TDS, metals, total sulfide and confirmatory cVOC analyses were placed in coolers with ice packs and shipped under chain of custody to Test America in South Burlington, Vermont for analysis.

3.4 Analytical Methods

This section describes the methods of analysis for pH, ORP, cVOCs, DHGs, cations, anions, alkalinity, TDS, metals and total sulfide.

3.4.1 Analysis of ORP and pH

The ORP measurements were performed at SiREM using a Corning 313 meter with double junction ORP electrode (Ag/AgCl reference). A 3.0 mL sample was collected (as described in section 2.3) and the ORP probe was inserted into the sample vial on the lab bench. A single point calibration of the meter was performed at each sampling event with Zobell ORP calibration solution.

The pH measurements were performed using an Oakton pH spear with a combination pH electrode (Oakton, Vernon Hills, IL). Immediately after ORP measurement the pH probe was inserted into the same sample vial on the lab bench for pH measurement. The pH spear was calibrated at each sampling event according to the manufacturer's instructions using pH 4.0, 7.0 and 10 standards.

3.4.2 Analysis of cVOCs and Dissolved Hydrocarbon Gases

Water sample cVOC and DHG (i.e., ethene, ethane and methane) analyses were performed at SiREM using a Hewlett-Packard (Hewlett Packard 7890) GC equipped with an auto sampler

(Hewlett Packard G1888) programmed to heat each sample vial to 75°C for 45 min prior to headspace injection into a GSQ Plot column (0.53 millimeters x 30 meters, J&W) and a flame ionization detector. Sample vials were heated to ensure that all cVOCs in the aqueous sample would partition into the headspace. The injector temperature was 200°C, and the detector temperature was 250°C. The oven temperature was programmed as follows: 35°C for 2 min, increased to 100°C at 50 degrees Celsius per minute (°C/min), then increased to 185°C at 25°C/min and held at 185°C for 6.80 min. The carrier gas was helium at a flow rate of 11 milliliters per minute (mL/min).

After withdrawing a 250 µL to 1 mL sample, the sample was injected into a 10 mL auto sampler vial containing between 5.75 and 5.0 mL of acidified deionized water (pH ~2). The water was acidified to inhibit microbial activity between microcosm sampling and GC analysis. The vial was sealed with an inert Teflon®-lined septum and aluminum crimp cap for automated injection of 3 mL of headspace onto the GC. One cVOC standard was analyzed with each set of samples to verify the instrument five-point calibration curve using methanolic stock solutions containing known concentrations of the target analytes. Calibration was performed using external standards purchased as standard solutions (Sigma, St Louis, Missouri), where known volumes of standard solutions were added to acidified water in auto sampler vials and analyzed as described above for column samples. The calibration concentrations range from 10 to 10,000 µg/L. Data were integrated using Chemstation Software (Agilent Technologies, Santa Clara, California).

The quantitation limits (QL) for the cVOCs and DHGs were typically 10 µg/L to 20 µg/L based on the lowest concentration standards that were included in the linear calibration trend and the dilution factor applied for a particular sample.

As outlined in the sampling plan samples from the influent and effluent were collected on weeks 1, 4 and 7 and sent to Test America (Burlington, VT) for cVOC analyses using EPA Method 8260B

3.4.3 Analysis of Major Anions

Anion (chloride, nitrate-nitrogen [nitrate], nitrite-nitrogen [nitrite], phosphate and sulfate) analyses were performed at SiREM on a Dionex DX-600 ion chromatograph (IC) equipped with a Dionex AS-40 auto sampler and an AS18 column, the sample loop volume was 25 µL. An isocratic separation was performed using 33 millimolar (mM) reagent grade sodium hydroxide (Fisher Scientific, Ottawa, ON) eluent for 13 min. One standard was analysed with each set of samples tested in order to verify the seven-point calibration using external standards of known concentrations. External standards were prepared gravimetrically using chemicals of the highest purity available (Sigma St Louis, MO or Bioshop, Burlington, ON). Data were integrated using Peaknet Chromatography software (Dionex, Oakville, ON). The calibration concentrations ranged from 100 to 10,000 µg/L.

A 0.5 mL sample was withdrawn, after which the sample was placed in a 1.5 mL micro-centrifuge tube. Samples were centrifuged for five minutes at 13,000 revolutions per minute

(RPM) to remove solids. The supernatant was removed, diluted 50-fold in deionized water and placed in a Dionex auto sampler vial with a cap that filters the sample during automated injection onto the IC.

3.4.4 Analysis of Cations, Alkalinity, TDS, metals and total sulfide

Water sample cation, alkalinity, TDS, metals and total sulfide analyses were performed by Test America of Burlington, VT. Cations were analyzed using inductively coupled plasma atomic emission spectroscopy (ICP-AES) (US EPA Method 6010C). Carbonate alkalinity (expressed as milligrams $CaCO_3$ per liter) in water was determined using method US EPA Method SM 2320B. Total sulfide was detected in accordance with US EPA Method 376.2 and TDS was determined using US EPA Method SM 2540C. Metals in water were determined using US EPA Method 6020A and mercury was determined using US EPA method 7470A.

4 cVOC Results, Reaction Pathways and Degradation Parameters

This section discusses the observed water cVOC concentration trends. The column data are then quantified in terms of anticipated cVOC degradation pathways and kinetic rates.

4.1 cVOC Results

The water sample cVOC concentration data are provided in Table 3 and Figure 3. Analytical results for the cVOC compounds detected (PCE, TCE, cDCE and VC) as well as dechlorination products (ethene and ethane) and methane from the last sampling event (week 7) are presented in Figure 2. An influent PCE concentration of 20,510 µg/L was degraded to 316 µg/L in the column effluent at a residence time of 24 hours. The TCE concentration decreased from an influent value of 4,809 to 43 µg/L in the column effluent. An influent concentration of cDCE of 5,481 µg/L was degraded to 41 µg/L in the column effluent. The VC concentration decreased from an influent value of 1,290 to 17 µg/L at a residence time of 19.2 hours (hrs) and VC was below the detection limit of 10 µg/L in the column effluent.

The observed cVOC trends are representative of behavior for those compounds in the presence of iron. However, the temporal cVOC concentration trends within the column showed a gradual migration of cVOC concentration profiles with increasing volume of flow (Table 3). This type of temporal trend is indicative of a gradual reduction of iron reactivity due to passivation by mineral precipitation or organic coatings, which is discussed further in Section 6.2.

4.2 Quality Control cVOC Analyses

Confirmatory cVOC samples analyzed by US EPA Method 8260B were collected during baseline and column influent and effluent sampling on weeks 1, 4 and 7. Table 4 presents the cVOC analytical data from SiREM and Test America. In general, the PCE, TCE, cDCE and VC concentrations measured by SiREM in the baseline and column influent samples were 13% to 38% higher than those measured by Test America. The difference was much less pronounced for the column effluent samples. The week 1 effluent samples for both laboratories were reported as non detects for all cVOCs. At week 4 SiREM reported PCE below the detection limit of 10 µg/L, while Test America reported a value of 29 µg/L. SiREM reported TCE, cDCE and VC below 10 µg/L, which were consistent with Test America results of 2.4, 0.59 and <1.3 µg/L for TCE, cDCE and VC, respectively. Influent week 7 results for PCE, TCE and cDCE from Test America were a factor of approximately 2 to 3 lower than the SIREM values. Test America's analytical report flagged those values as they were determined beyond the calibration range and therefore those values are not valid. The effluent values at week 7 were very similar in both laboratories.

SiREM analyzed the cVOC samples immediately after collection from the column. Volatile losses during shipping and sample handling may have contributed to the lower cVOC concentrations measured at Test America. Moreover, a relatively high dilution factor of 244.4 was used on the baseline and column influent samples at week 4 analyzed by Test America. In contrast, a dilution factor of 4 was used by SiREM for cVOC analyses on the baseline and column influent samples. The higher dilution factor may have also contributed to the differences observed in results between the two laboratories.

4.3 cVOC Reaction Pathways and Kinetic Expressions

Two dominant pathways of degradation of chlorinated hydrocarbon compounds by ZVI include hydrogenolysis and reductive *β*-elimination (Gillham et al., 2010). In the hydrogenolysis reaction, a chlorine atom is replaced by a hydrogen atom, accompanied by the addition of two electrons (from the iron). Reductive *β*-elimination involves release of two chlorine atoms and the formation of an additional carbon-carbon bond. Both pathways are thought to occur simultaneously (Arnold and Roberts, 2000). Figure 3 illustrates those pathways for the chlorinated ethene sequence starting from PCE, through TCE, DCE-isomers, VC and finally ethene and ethane. Both of the chlorinated acetylenes are highly unstable and degrade rapidly, primarily through reductive dechlorination to acetylene (Arnold and Roberts, 2000). Another ZVI-mediated transformation mechanism, hydrogenation, involves the addition of two hydrogen atoms across two carbon atoms with the removal of a C-C bond (e.g., reduction of acetylene to ethane, and ethene to ethane as shown in Figure 3).

Based on previous research, the VOC degradation in contact with ZVI appears to be first-order with respect to the concentration of the contaminant (pseudo first-order) (Gillham et al., 2010):

$$\frac{\partial C}{\partial t} = -kt \tag{1}$$

After integration, the equation can be presented in the form of the exponential decay equation:

$$C = C_0 e^{-kt} \tag{2}$$

Where: C is the concentration in solution at a particular time (t),

C_o is the initial concentration, and

k is the first-order rate constant.

The rate constant (k) is a measure of the reaction rate and can be calculated directly from Equation 2. The time at which the initial concentration declines by one-half, (C/C_o = 0.5), is the half-life ($t_{1/2}$).

$$t_{1/2} = \frac{\ln(2)}{k} \tag{3}$$

4.4 Determination of Degradation Parameters from Column Data

Due to the complexity of the ZVI-induced dechlorination mechanisms (Figure 3), the laboratory data were interpreted using a multi-component kinetic model to quantify degradation rates of compounds that are present in the water initially, as well as potential degradation products. In the model, potential breakdown products are concurrently produced and degraded as described by first-order kinetic equations. Each pathway is characterized by a rate constant (k) and the mole fraction of the compound that follows that particular path (f). Since chlorinated acetylenes are unstable, short-lived, intermediates are rapidly reduced to ethene (Arnold and Roberts, 2000).

These compounds are not typically detected in the solution phase and are therefore not explicitly contained in the degradation model. Therefore, first-order rate equations for each cVOC included in the model are as follows:

$$\frac{\partial PCE}{\partial t} = -k_{PCE} PCE \tag{4}$$

$$\frac{\partial TCE}{\partial t} = f_{PCE1} k_{PCE} PCE - k_{TCE} TCE \tag{5}$$

$$\frac{\partial cDCE}{\partial t} = f_{PCE2} k_{PCE} PCE + f_{TCE1} k_{TCE} TCE - k_{cDCE} cDCE \tag{6}$$

$$\frac{\partial VC}{\partial t} = f_{PCE3} k_{PCE} PCE + f_{TCE2} k_{TCE} TCE + f_{cDCE} k_{cDCE} cDCE - k_{VC} VC \tag{7}$$

These equations were adapted for the computer program Scientist® Version 3.0 (Micromath Research, 2008). The program can be used to fit the first-order equations to experimental data using the least squares best-fit method. The degradation rate and molar conversion are determined for each compound sequentially starting with the most chlorinated cVOC.

The results from the model fitting of column data include half-lives for all cVOCs selected and statistical fit data including coefficient of determination (r^2) values. The half-lives and molar conversions determined from the cVOC profiles from the last four sampling events (Weeks 4, 5, 6 and 7) are shown in Table 5a, along with the corresponding r^2 values. Figure C1 (Appendix C) shows the laboratory data and the fitting results for the sampling events.

The degradation model provided relatively good fits to the cVOC concentration profiles with r^2 values of more than 0.95. Based on the last cVOC profiles, the calculated half-lives were 5.1 hrs for PCE, 3.8 hrs for TCE, 3.5 hrs for cDCE and 2.4 hrs for VC. The half-life values for all cVOCs increased with time which is an indication of gradual passivation of ZVI with respect to dechlorination of cVOCs (Table 5a). This phenomenon is also confirmed by the ORP trends indicating a decreasing corrosion rate, as described in Section 6.0. The cVOC degradation half-lives values achieved at the end of this study were generally at the higher end of the ranges achieved in previous commercial ZVI studies for the compounds reported by Gillham et al. (2010).

Based on a request from XDD, an additional calculation of cVOC half-lives has been performed using the concentration profiles from the initial part of the column, corresponding to a residence time of 10 hrs (Table 5b; Figure C2 in Appendix C). This analysis was performed based on an observation that the cVOC concentration trends, especially those for PCE, along the column length appeared to indicate the existence of two zones with different degradation kinetics at the end of the test (Figure 4). That is, a slower degradation rate was observed in the initial part of the column, likely affected by inorganic precipitation and other ZVI coatings, while faster degradation rates were observed near the effluent end the column which was less affected by those geochemical effects. Moreover, although the degradation rates decreased (i.e. cVOC half-lives increased) in the influent part of the column, partial ZVI reactivity was retained. That is, partial removal of influent VOC degradation still occurred in the influent part of the column at the

end of the test and the VOC half-lives appeared more stable in the last two sampling events than earlier in the test. Based on this observation it is assumed that this method of calculation resulted in half-life values corresponding to longer-term reactivity of ZVI under site conditions. Specifically, additional passivation effects would have affected mostly the tail end of the column with the bulk cVOC half-lives in the entire ZVI zone converging to the values calculated for the influent part of the column. The gradual loss of reactivity should still be accounted for in the PRB design to provide a sufficient residence time for cVOC treatment to the target concentrations, as described below.

5 Field Scale PRB Design Considerations

The laboratory half-lives were obtained at a temperature of 22°C (72 degrees Fahrenheit [°F]). Field groundwater temperature was not provided at the time of this report. For the purpose of this evaluation, we have assumed the minimum field groundwater temperature is approximately 10°C (50°F). Based on the previous research, cVOC degradation half-lives increase by 100% per every 6°C to 8°C temperature decrease within a temperature range of 5 to 25°C (O'Hannesin et al., 2004). Therefore, the laboratory half-life values were increased by a factor of 2.7 to obtain the anticipated field values (Table 6).

The residence time calculations for the field ZVI PRB were performed assuming the influent cVOC concentration scenarios provided by XDD and using the temperature corrected laboratory half-lives obtained at the end of the study (Table 6). The Scientist® program described in Section 4.4 was used to simulate the change in cVOC concentrations over time using the first-order kinetic equations. In simulation mode, the model calculates the cVOC concentrations over time, from which the time required for the cVOCs to degrade to their regulatory criteria can be determined.

Based on the simulations performed, the residence time required to achieve Federal drinking water maximum contaminant levels (MCLs) in a PRB at the site using Connelly GPM ZVI ranges from 167 to 174 hrs (Table 6). The required ZVI thickness can be obtained by multiplying the residence time required by the groundwater flow rate anticipated in the location of the proposed PRB.

6 Inorganic Chemistry Results and Discussion

Previous research has shown that the inorganic composition of the treated groundwater can have a profound influence on the reactivity of commercial granular ZVI materials. Most of these effects are related to long-term performance. Therefore, evaluation of changes in inorganic chemistry along the flow path through the ZVI column is a crucial component of design considerations for a ZVI PRB.

6.1 Column Data

Inorganic parameter samples were collected at baseline and on weeks 1, 4 and 7. The water sample inorganic chemical concentration data are summarized in Tables 7, 8 and 9. Laboratory reports of analysis for the cations, alkalinity, TDS, metals and total sulfide are compiled in Appendix B.

When iron is exposed to water, several reactions occur as a result of iron corrosion:

$$Fe^{\circ} \rightarrow Fe^{2+} + 2e^{-} \quad (8)$$

This iron corrosion drives the geochemical changes that occur as groundwater flows through the PRB. When groundwater first contacts the granular iron, any dissolved oxygen present is consumed via iron corrosion:

$$4Fe^{\circ} + 3O_{2(aq)} + 12H^{+} \rightarrow 4Fe^{3+} + 6H_2O \quad (9)$$

It should be noted that dissolved oxygen (DO) was not measured in the test. It is likely that the water in the influent bag was likely oxygenated. The solubility of DO at the test temperature of 22°C is approximately 9 mg/L. The same column procedure has been used in numerous previous ZVI tests and the exposure to DO has not typically resulted in a similar degree of reactivity loss observed in this test.

After the initial, rapid depletion of any dissolved oxygen and other oxidizers (e.g., nitrate which was present in the site water at low concentrations of less than 1 mg/L), the water corrosion of iron dominates to produce hydrogen and hydroxide resulting in an increase in pH and decline in Eh:

$$Fe^{\circ} + 2H_2O \rightarrow Fe^{2+} + H_{2(aq)} + 2OH^{-} \quad (10)$$

The ORP and pH profiles within the column are presented in Table 7 and Figure 5. The ORP decreased within the iron column from 0 milliVolts (mV) in the influent to a value of -90 mV at the end of the study. The observed decreases in ORP were much less pronounced compared to the results of previous ZVI studies and considering that the ZVI reduction potential is -440 mV. These ORP trends indicate a decreasing rate of ZVI corrosion in contact with site water, likely caused by ZVI passivation due to inorganic precipitation and or organic coatings, as described below. The pH values increased from an influent value of 6.8 to 8.1 within the column which was the expected result of the reaction shown in Eq. 10.

Dechlorination of cVOCs is a redox reaction, whereby ZVI acts as an electron donor and cVOC compounds are electron acceptors. For example, dechlorination of PCE can be represented by the following reaction:

$$4Fe^0 + C_2Cl_4 + 4H^+ \rightarrow C_2H_4 + 4Fe^{2+} + 4Cl^- \quad (11)$$

Therefore, degradation of cVOCs consumes ZVI and generates dissolved iron. The oxidized iron contributes to the creation of secondary precipitates on ZVI grains, as described below. Some iron minerals created by oxidized iron may be passivating (hematite/goethite or siderite), while others such as magnetite or green rust allow electron transfer from the core of ZVI grains to aqueous phase and do not impede ZVI corrosion substantially (Gillham et al., 2010).

The influent calcium concentration of 87 mg/L at week 1 decreased to 0.634 mg/L in the column effluent (Table 9). The carbonate alkalinity value at week 1 decreased from an initial value of 397 to 11.5 mg/L within the column (Table 9). The losses of calcium and alkalinity indicate the formation of both calcium and iron carbonate minerals:

Aragonite/Calcite: $Ca^{2+} + CO_3^{2-} \rightarrow CaCO_{3(s)}$ (12)

Siderite: $Fe^{2+} + CO_3^{2-} \rightarrow FeCO_{3(s)}$ (13)

Potassium and chloride behave as conservative tracers in iron systems and, as expected, their concentrations remained essentially unchanged within the column (Tables 8 and 9). Dissolved iron increased from less than 0.2 mg/L in the column influent to 0.651 mg/L in the column effluent (Table 9). Tests conducted with different types of ZVI materials resulted in water corrosion rates on the order of 0.1 to 0.6 millimoles per kilogram iron per day (mmol/kg Fe/day), with a value of 0.3 mmol/kg Fe/day measured for granular ZVI such as Connelly (Reardon, 2005). Based on a corrosion rate of 0.3 mmol/kg Fe/day, approximately 80 mg/L dissolved iron would be expected in the column effluent at the flow rate used. Since only a 0.4 mg/L increase in dissolved iron was observed in the column, the ferrous iron generated by the reaction illustrated in Eq. 10 and (11) was consumed by precipitation of iron (oxy) hydroxides and siderite.

The concentration of sulfate of approximately 7 to 11 mg/L in the column influent remained unchanged or increased along the column length within the study period (Table 8). The increase in sulfate concentrations observed in the initial part of the study was likely due to sulfate leaching from ZVI. No sulfide was detected in the collected samples; however, declines in sulfate concentrations and formation of sulfide minerals have been observed at a number of field sites as groundwater passes through the ZVI PRBs.

Silicon was present in the week 1 column influent at a concentration of 7.2 mg/L that decreased to 0.106 mg/L in the column effluent in response to geochemical conditions created by ZVI corrosion. Silica (SiO_3^{2-}) is thought to precipitate or adsorb on ZVI surfaces leading to the formation of a silica film or gel on the ZVI surface that may hinder contaminant access to active sites (Klausen et al., 2003).

Concentration trends of dissolved organic carbon (DOC) are not provided as part of this report; however, XDD has stated that historically the levels of TOC/DOC at the site were between 5 and 7 mg/L. SiREM analyzed the influent groundwater for TOC and obtained a value of 2.6 mg/L. Although these are not high concentrations, previous research suggests that accumulation of certain types of organic matter, such as humic acids, on the surface of iron particles can inhibit electron transfer between the underlying metal and the contaminant, resulting in surface passivation and decreasing rates of contaminant reduction (Tratnyek et al., 2001). Another process postulated to inhibit the rates of cVOC degradation is hydrophobic partitioning, whereby hydrophobic contaminants (e.g. chlorinated hydrocarbons) are preferentially partitioned to micelle or membrane-like hydrophobic interiors formed by surfactant aggregates (Tratnyek et al., 2001).

6.2 Possible Mineral Precipitates and Their Effect

Iron corrosion reactions (Equations 8-10) promote the reductive dechlorination reactions, but at the same time are sources of ferrous iron and alkalinity. Because low concentrations of dissolved iron were detected in the column effluent, iron (oxy) hydroxides and siderite are expected to form throughout a PRB. Iron (oxy) hydroxides ultimately transform to magnetite, which is electron-conducting, and does not substantially reduce the reactivity of the iron and its rate of formation is not expected to cause a significant decline in permeability (Gillham et al., 2010). However, the potential adverse effects of other secondary precipitates such as calcium and iron carbonates created on ZVI grains need to be considered in terms of long-term efficiency of the PRB system.

Based on this column study data and results of previous ZVI column studies (see Section 6.1), the primary reasons for the apparent loss of ZVI reactivity and reducing conditions observed in the study was likely loss of reactive sites on ZVI particles due to:

- Calcium carbonate and iron carbonate precipitation;
- Silica precipitation and/or adsorption; and
- Organic coating formation.

Regardless of the reason of the observed loss of ZVI reactivity, it is likely that similar processes will occur in a ZVI PRB at the site. The impact of this phenomenon will be proportional to the groundwater velocity and the resulting mass flux of the passivating constituents. Based on the reported field groundwater flow velocity of approximately 0.055 feet per day (ft/day) or 20 ft/year and the study flow rate of 1.64 ft/day, the operational period simulated by the 7 week long column study is expected to be approximately 30 times longer in the field. Therefore, it is anticipated that a ZVI PRB designed based on the half-lives detected at the end of this study would degrade the influent cVOCs to concentrations below MCLs for approximately 4 years. After that operation time, the effluent of the ZVI PRB may exceed the cVOC design criteria. In order to sustain efficient treatment of cVOCs, the ZVI thickness would need to be increased to accommodate the gradual passivation of ZVI.

7 Summary and Conclusions

Bench-scale column treatability testing using site water indicated that:

i) Connelly GPM ZVI degraded the cVOCs present in the site water. The degradation half-lives generated in the study were generally longer than those reported in literature for this ZVI source (Gillham et al., 2010) and other groundwaters with comparable cVOC composition. A relatively rapid ZVI passivation, manifested by a gradual breakthrough of cVOC concentration profiles through the column, was observed during the study.

ii) Based on the anticipated half-lives at site field groundwater temperature (50ºF/10ºC) obtained at the end of the study and the cVOC scenarios provided, a residence time ranging from 167 to 174 hours would be required in a Connelly ZVI PRB to achieve the Federal MCL target levels.

iii) The observed ZVI passivation within the study period was mainly attributed to the exposure to carbonate alkalinity, silicon and potentially dissolved organic carbon in the site groundwater.

iv) Based on theoretical calculations, a ZVI PRB constructed of Connelly ZVI and designed based on the cVOC degradation rates obtained in this study would achieve the anticipated treatment of cVOCs for 4 years. The ZVI thickness would need to be increased proportionally to provide a long term treatment of influent cVOCs to concentrations below the design criteria.

8 References

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TABLES

TABLE 1
COLUMN AND ZVI MATERIALS SPECIFICATIONS
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

ZVI Supplier	Connelly GPM
ZVI Size Range	US Mesh 8 to 50 (0.25 - 2.0 millimeters)
ZVI Content	100 percent
ZVI Dry Weight	1428 grams
Column Length	1.64 feet (50 centimeters)
Column Inside Diameter	0.12 feet (3.8 centimeters)
Measured Pore Volume	301 milliliters
Volume of Column	567 cubic centimeters
Porosity	0.53
Bulk Density	2.52 grams per cubic centimeter
ZVI:Solution Ratio	4.75 grams per milliliter
Average Flow rate	1.65 feet per day
Average Residence Time	23.9 hours

Notes:
ZVI - zero valent iron

TABLE 2
ZVI COLUMN SAMPLING SCHEDULE
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

Event		Baseline (Week 0)									Weekly (7 events)			Week 1, 4, 7 only				Week 1 and 7 only	
Sample Location		pH, ORP	cVOCs	DHGs	Anions	Cations	Alkalinity	Total Sulfide	TDS	Metals	pH, ORP	cVOCs	DHGs	Anions	Total Sulfide	TDS	Metals	Cations	Alkalinity
Column Influent		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Sampling Ports	A										●	●	●	●					
	B										●	●	●	●					
	C										●	●	●	●					
	D										●	●	●	●					
	E										●	●	●	●	●				
	F										●	●	●	●					
	G										●	●	●	●					
Column Effluent											●	●	●	●	●	●	●	●	●

Notes:

cVOCs - chlorinated volatile organic compounds

DHGs - dissolved hydrocarbon gases

ORP - oxidation-reduction potential

TDS - total dissolved solids

ZVI - zero valent iron

● indicates sample collected

TABLE 3
WATER SAMPLE cVOC AND DHG RESULTS
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

Sample Location		Influent	Port A	Port B	Port C	Port D	Port E	Port F	Port G	Effluent
Column Distance (feet)		**0.00**	**0.08**	**0.16**	**0.33**	**0.49**	**0.66**	**0.98**	**1.31**	**1.64**
Residence Time (hours)		**0.0**	**1.2**	**2.3**	**4.8**	**7.2**	**9.7**	**14.3**	**19.2**	**24.0**
Compound	PV	Concentration (µg/L)								
PCE	Baseline	17,080	--	--	--	--	--	--	--	--
	6.8	25,952	14,201	12,152	6,710	2,058	445	<20	<20	<20
	12.3	22,491	16,037	13,403	8,863	5,245	3,036	406	<20	<20
	18.6	24,206	15,617	10,094	4,769	2,487	1,370	617	173	<20
	25.0	26,441	14,991	13,434	8,875	5,736	3,725	1,198	161	<10
	31.2	26,439	15,656	12,490	7,461	4,953	3,608	2,029	437	57
	38.0	21,885	17,018	13,760	8,111	6,397	5,273	2,913	964	191
	44.6	20,510	15,748	13,627	10,165	7,339	5,164	3,741	1,612	316
TCE	Baseline	5,897	--	--	--	--	--	--	--	--
	6.8	5,963	2,181	1,815	1,277	606	251	<20	<20	<20
	12.3	5,627	1,999	950	773	522	328	135	<20	<20
	18.6	5,709	1,700	679	369	255	141	89	37	<20
	25.0	6,032	1,865	1,258	583	347	236	105	182	<10
	31.2	6,011	2,515	1,241	621	357	524	274	83	22
	38.0	5,405	3,553	2,458	1,319	933	688	343	128	48
	44.6	4,809	3,580	2,820	2,009	1,208	825	571	240	43
cis-1,2-DCE	Baseline	6,141	--	--	--	--	--	--	--	--
	6.8	5,995	1,559	1,065	819	574	403	163	49	<20
	12.3	5,883	887	250	152	87	63	32	<20	<20
	18.6	6,033	1,049	288	83	24	20	<20	<20	<20
	25.0	6,118	1,240	384	104	36	30	<10	<10	<10
	31.2	6,058	2,114	682	219	86	53	17	<10	<10
	38.0	5,336	3,585	2,359	1,371	843	602	250	85	16
	44.6	5,481	4,162	3,293	2,565	1,475	1,062	712	250	41
VC	Baseline	1,925	--	--	--	--	--	--	--	--
	6.8	1,912	159	96	494	24	<20	<20	<20	<20
	12.3	1,921	107	20	83	<20	<20	<20	<20	<20
	18.6	1,798	152	25	58	<20	<20	<20	<20	<20
	25.0	1,857	191	39	71	<20	<10	<10	<10	<10
	31.2	1,825	370	72	167	<20	<10	<10	<10	<10
	38.0	1,467	760	410	177	90	60	18	<10	<10
	44.6	1,290	858	618	364	157	116	61	17	<10
Ethene	Baseline	--	--	--	--	--	--	--	--	--
	6.8	214	803	931	1,198	1,224	1,401	1,481	1,543	985
	12.3	171	379	295	444	540	457	381	341	120
	18.6	182	333	214	225	202	171	147	105	47
	25.0	182	309	212	221	233	194	94	78	19
	31.2	170	393	308	346	318	262	211	101	29
	38.0	106	457	561	756	854	791	600	353	105
	44.6	61	306	478	909	1,080	973	887	598	170

TABLE 3
WATER SAMPLE cVOC AND DHG RESULTS
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

Sample Location		Influent	Port A	Port B	Port C	Port D	Port E	Port F	Port G	Effluent
Column Distance (feet)		**0.00**	**0.08**	**0.16**	**0.33**	**0.49**	**0.66**	**0.98**	**1.31**	**1.64**
Residence Time (hours)		**0.0**	**1.2**	**2.3**	**4.8**	**7.2**	**9.7**	**14.3**	**19.2**	**24.0**
Compound	PV	Concentration (µg/L)								
Ethane	Baseline	--	--	--	--	--	--	--	--	--
	6.8	74	1,637	1,801	2,237	2,239	2,368	2,118	1,797	1,034
	12.3	55	2,078	2,368	3,020	3,624	3,514	3,394	4,111	3,131
	18.6	61	2,278	3,123	3,145	3,592	3,729	4,912	5,182	5,337
	25.0	67	1,781	2,590	2,974	3,225	3,174	2,320	3,993	2,489
	31.2	70	1,706	2,540	3,188	3,228	3,568	4,220	4,230	3,708
	38.0	52	955	1,563	1,916	2,533	3,376	3,784	4,175	3,171
	44.6	54	446	926	1,159	1,843	2,239	2,537	3,321	3,338
Methane	Baseline	--	--	--	--	--	--	--	--	--
	6.8	2,437	1,512	1,614	1,823	1,720	1,945	1,969	1,797	908
	12.3	1,507	1,283	1,160	1,430	1,543	1,508	1,468	1,815	1,348
	18.6	1,500	1,148	1,175	1,152	1,207	1,227	1,504	1,374	1,549
	25.0	1,641	903	942	991	971	970	657	1,236	719
	31.2	1,239	810	777	842	806	858	976	946	812
	38.0	297	377	390	389	443	491	508	548	454
	44.6	52	67	66	70	79	65	69	81	94

Notes:

-- - sample not collected

< - compound not detected, the associated value is the quantitation limit

µg/L - micrograms per liter

cDCE - cis-1,2-dichloroethene

cVOC - chlorinated volatile organic compounds

DHG - dissolved hydrocarbon gases

PCE - tetrachloroethene

PV - pore volumes

TCE - trichloroethene

VC - vinyl chloride

TABLE 4

cVOC ANALYTICAL RESULTS COMPARISON BETWEEN SIREM AND TEST AMERICA

Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

Analyte		SIREM		Test America	
		Concentration (µg/L)			
		Influent	***Effluent***	***Influent***	***Effluent***
Baseline	Tetrachloroethene	17,080		15,500	
	Trichloroethene	5,897		4,600	
	cis-1,2-Dichloroethene	6,141		5,150	
	Vinyl chloride	1,925		1,300	
Week 1	Tetrachloroethene	25,952	<10	16,000	<4
	Trichloroethene	5,963	<10	4,400	<4
	cis-1,2-Dichloroethene	5,995	<10	5,100	1.7J
	Vinyl chloride	1,912	<10	1,300	<4
Week 4	Tetrachloroethene	26,441	<10	20,000	29
	Trichloroethene	6,032	<10	5,000	2.4
	cis-1,2-Dichloroethene	6,118	<10	5,300	0.59
	Vinyl chloride	1,857	<10	1,400	<1.3
Week 7	Tetrachloroethene	20,510	316	6,500 E	390
	Trichloroethene	4,809	43	2,200 E	54
	cis-1,2-Dichloroethene	5,481	41	2,800 E	51
	Vinyl chloride	1,290	<10	500	<5.6

Notes:

µg/L - micrograms per liter

< - compound not detected, the associated value is the quantitation limit

NA - not available

cVOC - chlorinated volatile organic compounds

E - result exceeded calibration range

TABLE 5a
CALCULATED cVOC HALF-LIFE VALUES
Based on Entire cVOC Profiles
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

Compound	Pore Volume	Influent Concentration (µg/L)	Half-life[a] (hours)	r^2	Conversion (%mol)
Tetrachloroethene	25.0	26,441	2.7	0.952	
	31.2	26,439	2.7	0.973	
	38.0	21,885	4.1	0.989	
	44.6	20,510	5.1	0.991	
Trichoroethene					PCE=>TCE
	25.0	6,032	0.85	0.975	0%
	31.2	6,011	1.04	0.979	0%
	38.0	5,405	2.5	0.985	0%
	44.6	4,809	3.8	0.992	0%
cis 1,2-Dichloroethene					TCE=>cDCE
	25.0	6,118	0.53	0.999	1%
	31.2	6,058	0.77	0.999	1%
	38.0	5,336	2.4	0.989	1%
	44.6	4,162	3.5	0.998	1%
Vinyl Chloride					cDCE=>VC
	25.0	1,857	0.36	0.998	1%
	31.2	1,825	0.52	0.987	1%
	38.0	1,467	1.3	0.994	1%
	44.6	1,290	2.4	0.994	1%

Notes:
[a] Half-life calculated based on test temperature of 22°C
µg/L - micrograms per liter
cVOC - chlorinated volatile organic compound
r^2 - coefficient of determination

TABLE 5b
CALCULATED cVOC HALF-LIFE VALUES
Based on cVOC Profiles Within the First 10 hr Residence Time In Column
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

Compound	Pore Volume	Influent Concentration (µg/L)	Half-life[a] (hours)	r^2
Tetrachloroethene	25.0	26,441	3.7	0.978
	31.2	26,439	3.5	0.969
	38.0	21,885	4.6	0.965
	44.6	20,510	5.1	0.995
Trichoroethene	25.0	6,032	2.3	0.911
	31.2	6,011	2.7	0.783
	38.0	5,405	3.3	0.963
	44.6	4,809	3.9	0.995
cis 1,2-Dichloroethene	25.0	6,118	1.3	0.896
	31.2	6,058	1.4	0.940
	38.0	5,336	3.1	0.977
	44.6	4,162	3.8	0.993
Vinyl Chloride	25.0	1,857	1.1	0.562
	31.2	1,825	1.5	0.485
	38.0	1,467	2.1	0.964
	44.6	1,290	2.7	0.985

Notes:
[a] Half-life calculated based on test temperature of 22°C
µg/L - micrograms per liter
cVOC - chlorinated volatile organic compound
r^2 - coefficient of determination

TABLE 6
RESIDENCE TIME CALCULATIONS FOR PRB DESIGN
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

Compound	Target Level [b] (µg/L)	Field Anticipated Half-lives [c] (hrs)	Anticipated Influent Concentration[a] (µg/L)	
			Compliance Boundary Kame Sand	Compliance Boundary Ablation Till
Tetrachloroethene	5	13.7	33,000	24,000
Trichloroethene	5	10.5	2,100	1,600
cis-1,2-Dichloroethene	70	10.2	2,200	2,600
Vinyl Chloride	2	7.4	400	430
Residence time (hrs)			***174***	***167***

Notes:

PRB -permeable reactive barrier
µg/L - micrograms per liter
[a] Provided by XDD
[b] US EPA Federal Drinking Water Maximum Contaminant Levels (MCLs) assumed
[c] Laboratory values at end of test (Table 5b) and corrected by a factor of 2.7 to simulate a temperature of 10°C (50°F)

TABLE 7
WATER SAMPLE ORP AND pH RESULTS
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

Sample Location		Influent	Port A	Port B	Port C	Port D	Port E	Port F	Port G	Effluent
Column Distance (feet)		**0.00**	**0.08**	**0.16**	**0.33**	**0.49**	**0.66**	**0.98**	**1.31**	**1.64**
Residence Time (hours)		**0.0**	**1.2**	**2.3**	**4.8**	**7.2**	**9.7**	**14.3**	**19.2**	**24.0**
Analyte	PV	Instrument Readings								
pH	0.0	--	--	--	--	--	--	--	--	--
	6.8	8.1	7.8	8.5	8.2	7.2	8.3	7.6	6.2	4.3
	12.3	7.4	7.9	7.3	8.7	8.3	7.7	7.6	6.2	5.6
	18.6	7.0	8.0	8.8	9.0	9.0	8.9	6.7	6.0	6.1
	25.0	6.9	6.6	6.8	6.1	6.3	6.2	5.9	4.7	5.1
	31.2	6.9	7.1	7.4	8.2	8.4	6.6	6.9	7.3	5.4
	38.0	7.4	7.3	7.0	7.6	6.2	7.0	7.0	7.4	6.8
	44.6	6.8	6.8	6.8	7.7	7.6	7.7	8.1	7.8	8.1
ORP (mV)	0.0	--	--	--	--	--	--	--	--	--
	6.8	18	-11	-8	44	64	65	53	68	124
	12.3	56	-52	-49	68	80	84	86	24	108
	18.6	24	-18	31	-93	-138	-62	11	23	97
	25.0	170	-109	-18	175	155	154	147	152	160
	31.2	167	-108	120	191	196	182	170	189	188
	38.0	185	-60	-10	175	165	160	160	159	125
	44.6	0	-90	-83	-32	-41	-44	-44	-42	-7

Notes:

mV - millivolts

ORP - Oxidation Reduction Potential

PV - pore volumes

µg/L -micrograms per liter

-- - sample not collected

TABLE 8
WATER SAMPLE ANION RESULTS
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

Sample Location		Influent	Port A	Port B	Port C	Port D	Port E	Port F	Port G	Effluent
Column Distance (feet)		**0.00**	**0.08**	**0.16**	**0.33**	**0.49**	**0.66**	**0.98**	**1.31**	**1.64**
Residence Time (hours)		**0.00**	**1.2**	**2.3**	**4.8**	**7.2**	**9.7**	**14.3**	**19.2**	**24.0**
Analyte	PV	Concentration (mg/L)								
Chloride	0.0	19	--	--	--	--	--	--	--	--
	6.8	14	22	24	28	29	32	32	37	48
	25	17	32	33	36	41	41	45	47	47
	44.6	15	20	23	28	32	31	34	40	41
Nitrite-Nitrogen	0.0	<0.09	--	--	--	--	--	--	--	--
	6.8	0.18	0.22	0.24	0.25	0.28	0.30	0.29	0.31	0.34
	25	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
	44.6	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
Nitrate-Nitrogen	0.0	0.71	--	--	--	--	--	--	--	--
	6.8	0.34	0.57	0.68	0.24	0.37	0.94	0.44	1.3	0.50
	25	0.10	0.12	0.15	0.13	0.19	0.14	0.23	0.20	0.14
	44.6	0.12	0.08	0.35	0.25	0.35	0.10	0.23	0.20	0.12
Sulfate	0.0	10	--	--	--	--	--	--	--	--
	6.8	7.1	8.2	9.3	10	17	34	41	23	11
	25	11	12	11	13	13	13	23	46	59
	44.6	7.6	7.5	12.4	1.6	2.2	1.9	4.5	3.7	21
Phosphate	0.0	0.97	--	--	--	--	--	--	--	--
	6.8	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
	25	<0.07	<0.07	<0.07	<0.07	<0.07	0.49	<0.07	<0.07	<0.07
	44.6	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07

Notes:
mg/L - milligrams per liter
PV - pore volumes
-- - sample not collected
< - compount not detected, the associated value is the quantitation limit

TABLE 9
WATER SAMPLE CATION, ALKALINITY, TDS, METALS AND SULFIDE RESULTS
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

Analyte	Reporting Limit (µg/L)	Baseline		Week 1		Week 4		Week 7	
		Baseline (1)	Baseline (2)	Influent	Effluent	Influent	Effluent	Influent	Effluent
	Concentration (µg/L)								
Calcium	5,000	51,100	53,900	86,900	634	--	--	98,800	11,700
Iron	200	<200	<200	<200	651	--	--	760	<200
Magnesium	5,000	17,700	18,400	29,400	<5,000	--	--	36,000	21,200
Manganese	15	713	744	1,130	91	--	--	570	243
Silicon	100	4,540	4,700	7,230	106	--	--	7,840	268
Potassium	5,000	14,300	17,400	14,400	9,340	--	--	17,800	18,900
Silver	2	<2.0	<2.0	<2.0	0.099J	0.018J	0.047J	0.28 J	<2.0
Arsenic	2	0.84J	115	0.73J	0.11J	0.33J	1.3J	1.3 J	<2.0
Berillium	2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Cadmium	3	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Chromium	4	0.2JB	0.52JB	<4.0	0.82JB	0.24J	1.4J	0.91 JB	1.0 JB
Copper	20	0.86J	0.74J	0.48J	2.6J	1.9J	6.2J	1.6 J	0.69 J
Nickel	20	65	65	71	1.8J	78	7.7J	48.5	9.9 J
Lead	2	<2.0	<2.0	<2.0	0.033J	0.10J	0.032J	0.20J	0.032J
Antimony	20	<20	<20	<20	<20	<20	<20	0.11J	0.099J
Selenium	2	<2.0	449	<2.0	<2.0	0.32J	0.46J	<2.0	0.33 J
Thallium	2	<2.0	0.1 J	<2.0	<2.0	0.12J	0.11J	<2.0	<2.0
Zinc	20	0.98J	0.88J	1.5J	0.88J	0.92J	10.5J	2.4 JB	<20
Mercury	0.2	<0.2	<0.2	0.16J	<0.2	<0.2	<0.2	<0.2	<0.2
Alkalinity	5,000	330,000	355,000	397,000	11,500	--	--	337,000	94,100
Sulfide	50	17J	19J	<50	<50	<50	<50	0.050 UH	0.021JH
Total Dissolved Solids	5,000	487,000	489,000	328,000	238,000	489,000	159,000	103,000	30,000

Notes:

µg/L - micrograms per liter

< - compound not detected, the associated value is the reporting limit

NA - not available

J - Result is less than the reporting limit, but greater than or equal to the method detecion limit and the concentration is an approximate value

U - analyzed but not detected

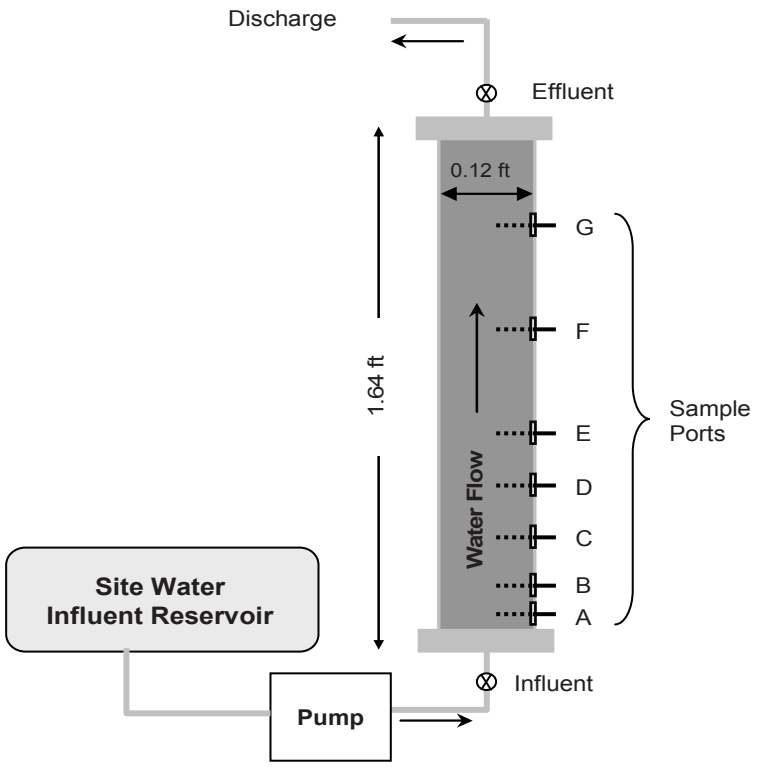
TDS - total dissolved solids

B - Compound was found in the blank and sample

H - sample was prepped or analyzed beyond the specified holding time

-- - sample not collected

FIGURES



Notes:
ft - feet

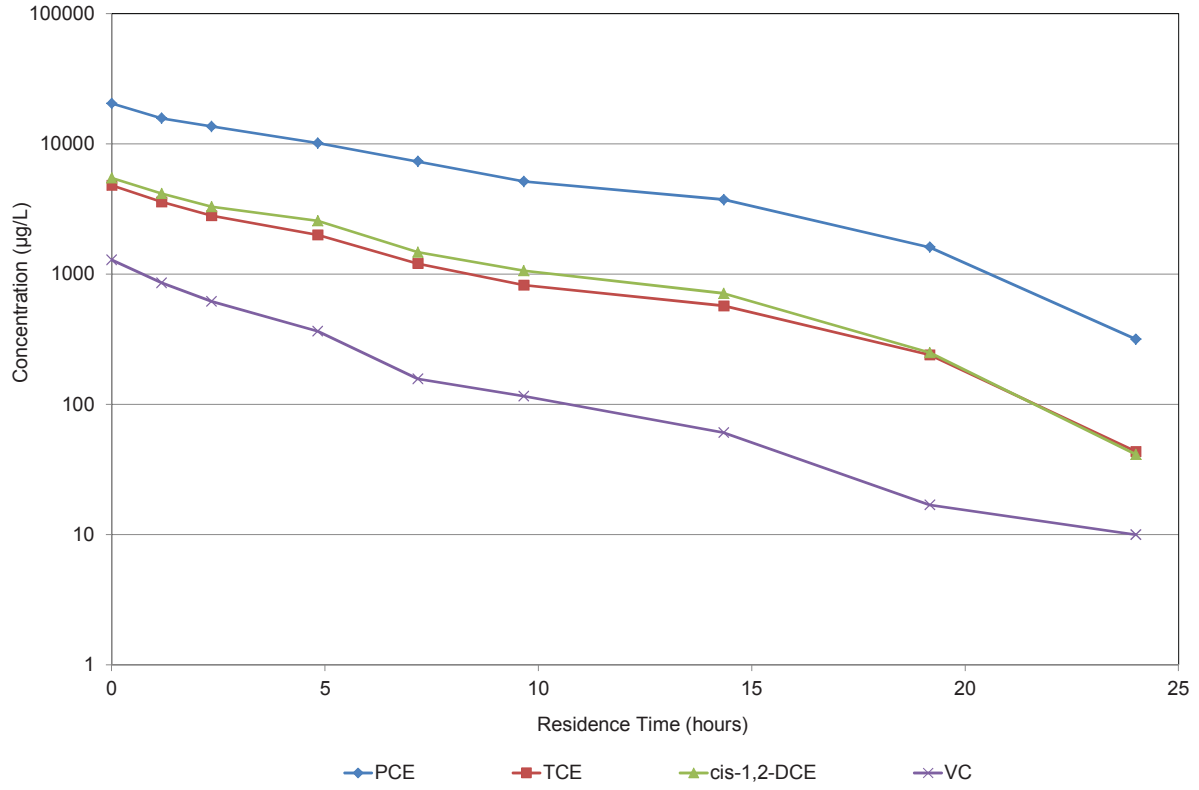
Schematic of Column Study Set Up

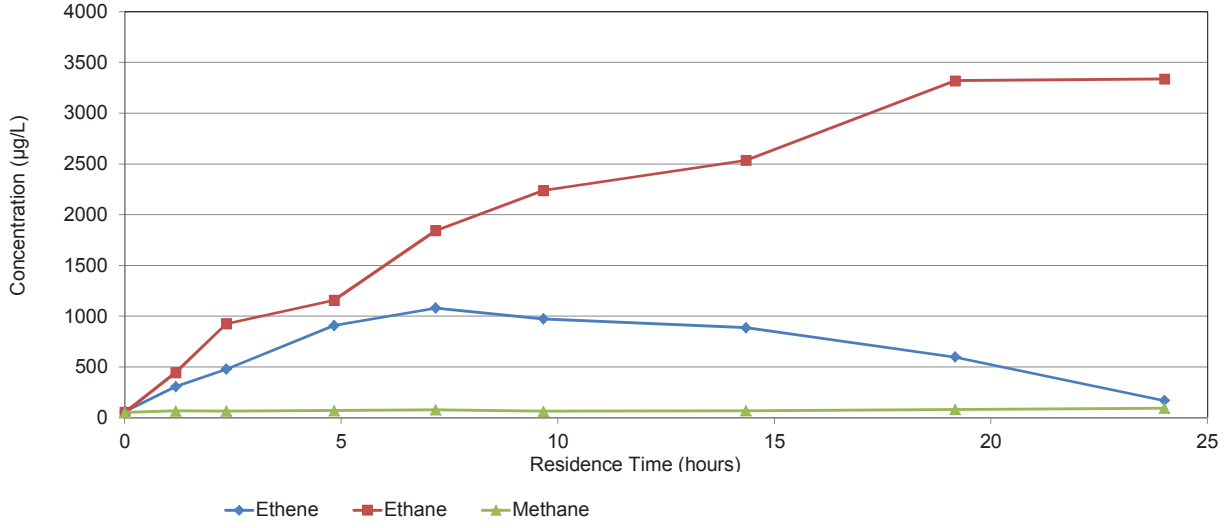
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

SiREM

Apr 2013

Figure: **1**





ZVI Column Water cVOC and DHG
Concentrations Versus Residence Time at Week 7
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

SiREM

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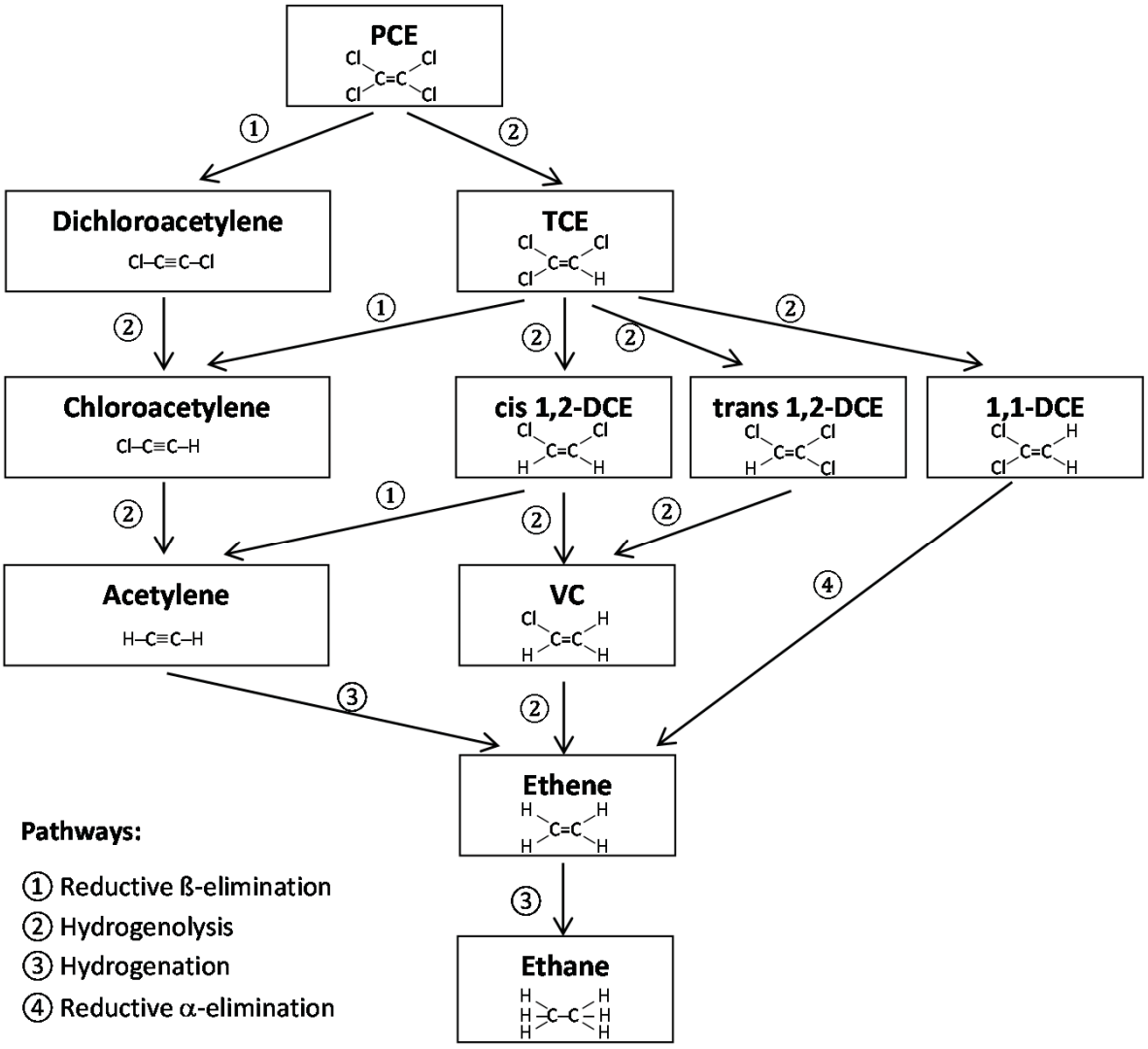
Figure: **2**

cVOC - chlorinated volatile organic compound
DHG - dissolved hydrocarbon gases



(modified from Arnold and Roberts, 2000)

Chlorinated Ethene Degradation Pathways with ZVI

Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

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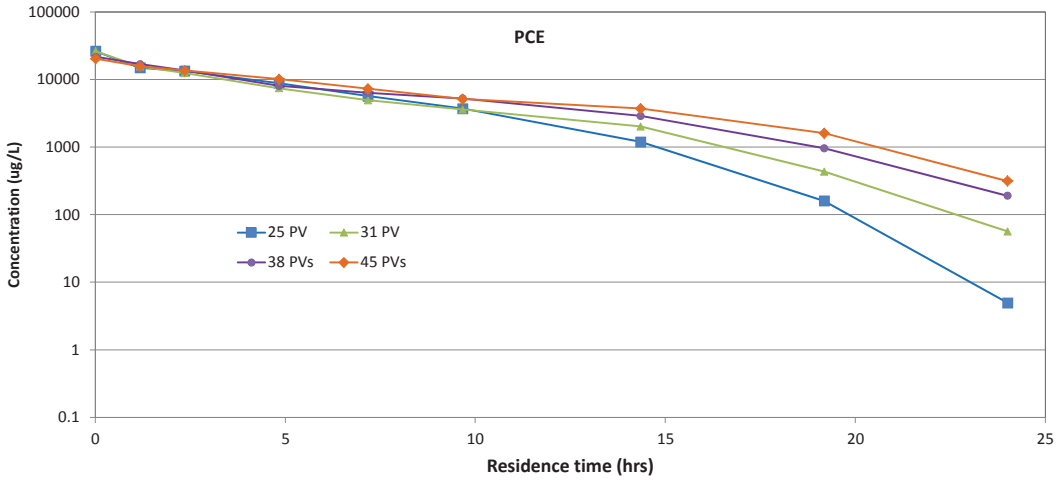
Figure: **3**



hrs - hours
PVs -pore volumes
ug/L - micrograms per liter

ZVI Column PCE Concentration Trends
Weeks 4, 5, 6 and 7
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

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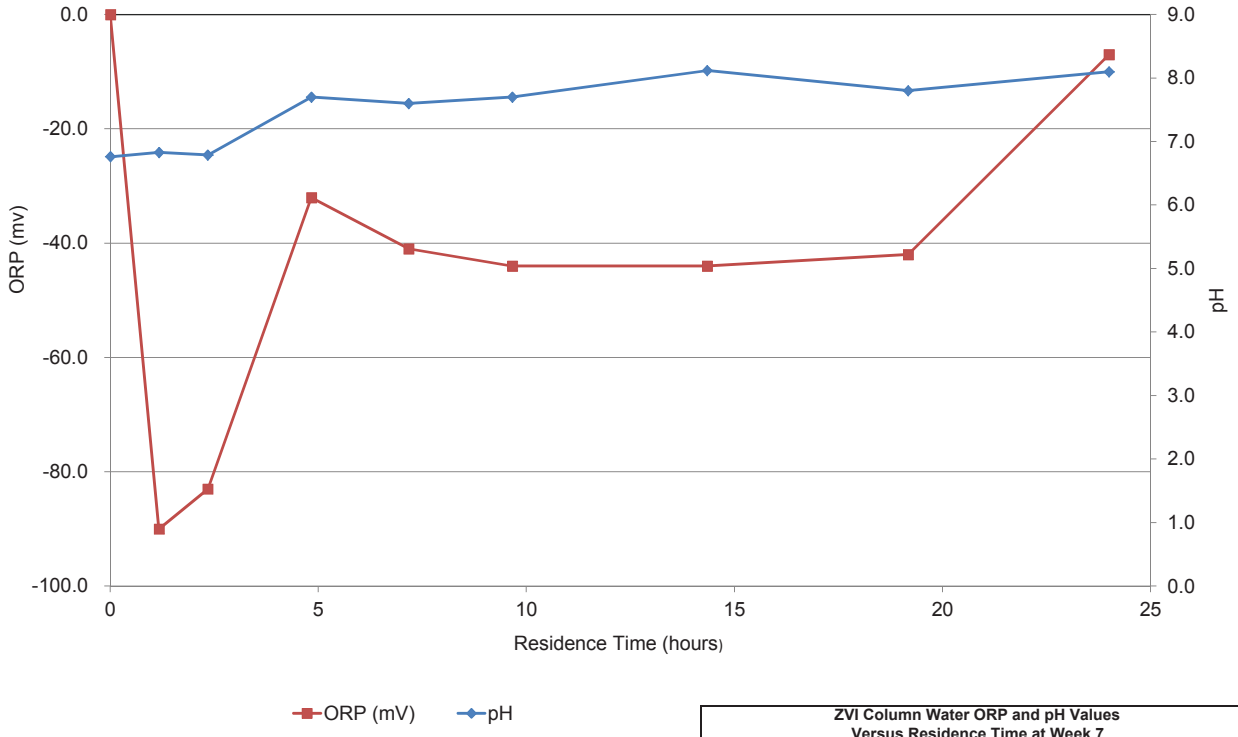
Figure: **4**



ZVI Column Water ORP and pH Values
Versus Residence Time at Week 7
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

SiREM

Apr 2013

Figure: **5**

mV - millivolts
ORP - oxidation reduction potential

Prepared for:

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FINAL

Treatability Study Report

Supplementary Column Study to Evaluate Remediation of Chlorinated Solvents in Groundwater Using Zero Valent Iron

Burgess Brothers Superfund Site
Woodford and Bennington, Vermont

Prepared by:

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1 May 2013

siremlab.com

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Appendix A: Chain of Custody Record
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Appendix C: First-Order Fitting Results

LIST OF ABBREVIATIONS

CO_2	carbon dioxide
cDCE	cis-1,2-dichloroethene
cVOC	chlorinated volatile organic compound
°C	degrees Celsius
°C/min	degrees Celsius per minute
cm	centimeters
°F	degrees Fahrenheit
ft	feet
ft/day	feet per day
DHG	dissolved hydrocarbon gases
DOC	dissolved organic carbon
GC	gas chromatograph
g	grams
$t_{½}$	half life
hrs	hours
IC	ion chromatograph
ICP-AES	inductively coupled plasma – atomic emission spectroscopy
MCLs	maximum contaminant levels
µg/L	micrograms per liter
µL	microliters
mg/L	milligrams per liter
mL	milliliters
mL/min	milliliters per minute
min	minute
mm	millimeters
mM	millimolar
mmol/kg Fe/day	millimoles per kilogram iron per day
mV	millivolts
ORP	oxidation reduction potential
%	per cent
PRB	permeable reactive barrier
RPM	revolutions per minute
QL	quantitation limit
r^2	coefficient of determination
SiO_3^{2-}	silica
SiREM	SiREM Laboratories
PCE	tetrachloroethene
TDS	total dissolved solids
TCE	trichloroethene
VC	vinyl chloride
XDD	XDD LLC
ZVI	zero valent iron

1 Introduction

SiREM Laboratory (SiREM) was retained by XDD LLC (XDD) to perform a bench scale treatability column study to assess the use of the zero valent iron (ZVI) permeable reactive barrier (PRB) technology for the remediation of chlorinated volatile organic compounds (cVOCs) in groundwater from the Burgess Brothers Superfund Site located in Woodford and Bennington, Vermont (the site). This study followed a column test performed in 2012 to determine ZVI reaction rates using alternative ZVI sources.

This report contains the study objectives and scope of work (Section 2); experimental methods (Section 3); cVOC results and discussion including calculation of cVOC degradation half-lives (Section 4); estimation of residence time required for ZVI PRB design (Section 5); discussion of inorganic chemistry changes during the column study (Section 6); and the study conclusions (Section 7). Report references are provided in Section 8.

2 Objectives and Scope of Work

This section provides the study objectives and the scope of work completed to satisfy the project objectives.

2.1 Objectives

The primary objectives of the laboratory ZVI column study were to:

- Determine degradation rates for the main compounds of potential concern (i.e., tetrachloroethene [PCE], trichloroethene [TCE], cis-1,2-dichloroethene [cDCE] and vinyl chloride [VC]) in site groundwater with two types of commercial granular ZVI under flowing water conditions;
- Characterize chlorinated breakdown products of cVOCs detected in the site groundwater and to quantify the rates of degradation; and
- Evaluate changes in inorganic geochemistry caused by ZVI corrosion chemistry, including possible mineral precipitation.

2.2 Scope of Work

Two ZVI columns were set up and performed using 100 per cent (%) granular ZVI and site groundwater containing cVOCs. On 15 January 2013 the granular ZVIs were packed into the columns with care. The column and ZVI materials specifications are provided in Table 1. A schematic of the column is provided in Figure 1.

The groundwater for this study was collected by Environmental Partners Group personnel from the site and was received by SiREM on 8 January 2013. On 9 January 2013, the site groundwater was transferred into a clean 100 liter (L) stainless steel pressure vessel and mixed. This mixed water was used to fill the influent reservoir with care taken to minimize volatile losses to the extent practicable. The remaining water was transferred into 4L bottles and stored in the cold room for future use.

The initial PCE, TCE, cDCE and VC concentrations in the influent reservoir were below the target concentrations of 25,000, 6,000, 6,000 and 2,000 micrograms per liter (µg/L) respectively. Therefore, on 10 January 2013 the influent reservoir water was amended with 235 microliters (µL) of PCE, 53 µL of TCE, 51 µL of cDCE and 11 milliliters (mL) of VC to achieve the target concentrations. On 16 January 2013 the pump was started to feed the water from the influent reservoir vertically upward through the columns for a period of ten weeks. A flow velocity of about 1.64 feet/day was selected in consultation with XDD to allow the study to be completed in a reasonable time. This flow rate has been used in numerous previous ZVI column tests to assure a sufficient volume of groundwater passes through the column within the test period in order to assess potential long-term changes to cVOC treatment efficacy.

Water samples were collected from seven sampling ports located along the column length as well as from the column influent and effluent for analysis of pH, oxidation-reduction potential (ORP), cVOCs, dissolved hydrocarbon gases (DHGs), cations, anions, alkalinity, total dissolved solids (TDS) and metals according to the schedule presented in Table 2.

The cVOC concentration trends from the column study were used to calculate the degradation rates for each compound detected using a multicomponent first-order kinetic model. The degradation rates obtained, expressed as half-lives, were then corrected for groundwater temperature and used to calculate the residence time required in the field to achieve the regulatory criteria for all compounds. Finally, the column water chemistry data were used to assess the potential effects of water chemistry on the long-term reactivity of ZVI under site conditions.

3 Study Methods and Materials

This section describes the methods used to construct and operate the ZVI columns, and to collect water samples for analysis during the ZVI column treatability study.

3.1 Column Construction

The column study consisted of two columns containing 100% granular ZVI (CC-1004) provided by Connelly-GPM Inc. (Chicago, IL) and Peerless Metal Powders (Detroit, MI). Those commercial ZVI sources have been used for numerous ZVI PRB applications (Gillham et al., 2010). Based on the manufacturer's specifications, the granular ZVIs used in the column study have a particle size range from 0.25 to 2.0 millimeters (mm; 8 to 50 US Mesh).

The columns were constructed of Plexiglas™ with a length of 1.64 feet (ft) (50 centimeters [cm]) and an internal diameter of 0.12 ft (1.5 inches, 3.8 cm) (Figure 1). Seven sampling ports were positioned vertically along the central axis of the columns at distances of 0.08, 0.16, 0.33, 0.50, 0.66, 1.0 and 1.3 ft from the influent end. The column influent and effluent ports were also sampled. All sampling ports within the columns (excluding influent and effluent) were constructed using a nylon Swagelok compression fitting tapped into the column. A 16 gauge needle was positioned through the fitting and secured by tightening the ferrule. Glass wool was threaded through the needle to ensure minimal particulates from entering the samples. Each sample port was then fitted with a Luer-Lock™ fitting so that a glass syringe could be attached to the port for collection of water samples.

To ensure a homogeneous column material bed, the ZVI was packed vertically in the columns in 100 gram (g) increments. Values of bulk density, porosity, and pore volume were determined by weight and are provided in Table 1. The column experiment was performed at room temperature (22±1 degrees Celsius [ºC]). After column packing, the dry ZVI material was purged with carbon dioxide (CO_2) gas for 2 hours prior to saturation with water to remove air. CO_2 is a more soluble gas compared to oxygen and nitrogen and assures that any trapped gas dissolves in water and prevents creation of gas bubbles in the columns.

A Masterflex® peristaltic pump was used to feed site water vertically upwards through the columns. The pump tubing consisted of Viton® 2-stop tubing. All other tubing was 1/16 inch inside diameter Teflon® tubing.

3.2 Site Groundwater Storage and Usage

Fourteen (14) 1-gallon bottles were received by SiREM personnel on 8 January 2013 and stored in cold storage (4°C) until study commencement. A Chain of Custody Record for the water received from the site is provided in Appendix A. Site water was first transferred into a clean 100 liter (L) stainless steel pressure vessel and mixed. This mixed water was transferred into the influent reservoir (i.e., a Teflon® bag) with minimal headspace. The influent reservoir contained two Swagelok fittings with Teflon® septa. The influent reservoir was replaced with fresh spiked groundwater on 11 February 2013 and 8 March 2013.

3.3 Sampling Procedure

After removing the stagnant water from the sampling needles, 4.0 mL samples were collected from the sampling ports using glass on glass syringes. A 250 µL to 1 mL water sample (depending on the sample location and dilution required) was removed from the glass syringe and transferred immediately into an autosampler vial for gas chromatograph (GC) analysis of cVOCs/DHGs. The remaining sample volume was transferred into a 5 mL plastic vial for ORP and pH measurement. When anion sample collection was required a 0.5 mL sample was transferred to 1.5 mL eppendorf tubes, which were stored frozen until time of analysis.

Water samples for cation, alkalinity, TDS and metals analyses were collected from the column influent and effluent only. For cations, a 50 mL unfiltered sample was collected into a 110 mL bottle and acidified to a pH of 2 with nitric acid. For alkalinity and TDS 100 mL unfiltered samples were collected into 110 mL bottles and left unpreserved. For metals a 75 mL unfiltered sample was collected into a 110 mL bottle and acidified to pH 2 with nitric acid. Confirmatory samples for cVOC analysis were also collected from the influent and effluent into 2.8 mL vials and 40 mL VOA vials preserved with hydrochloric acid.

Water samples for cation, alkalinity, TDS metals and confirmatory cVOC analyses were placed in coolers with ice packs and shipped under chain of custody to Test America in South Burlington, Vermont for analysis.

3.4 Analytical Methods

This section describes the methods of analysis for pH, ORP, cVOCs, DHGs, cations, anions, alkalinity, TDS and metals.

3.4.1 Analysis of ORP and pH

The ORP measurements were performed at SiREM using a Corning 313 meter with double junction ORP electrode (Ag/AgCl reference). A 3.0 mL sample was collected (as described in section 2.3) and the ORP probe was inserted into the sample vial on the lab bench. A single point calibration of the meter was performed at each sampling event with Zobell ORP calibration solution.

The pH measurements were performed using an Oakton pH spear with a combination pH electrode (Oakton, Vernon Hills, IL). Immediately after ORP measurement the pH probe was inserted into the same sample vial on the lab bench for pH measurement. The pH spear was calibrated at each sampling event according to the manufacturer's instructions using pH 4.0, 7.0 and 10 standards.

3.4.2 Analysis of cVOCs and Dissolved Hydrocarbon Gases

Water sample cVOC and DHG (i.e., ethene, ethane and methane) analyses were performed at SiREM using a Hewlett-Packard (Hewlett Packard 7890) GC equipped with an auto sampler (Hewlett Packard G1888) programmed to heat each sample vial to 75°C for 45 min prior to headspace injection into a GSQ Plot column (0.53 millimeters x 30 meters, J&W) and a flame

ionization detector. Sample vials were heated to ensure that all cVOCs in the aqueous sample would partition into the headspace. The injector temperature was 200°C, and the detector temperature was 250°C. The oven temperature was programmed as follows: 35°C for 2 min, increased to 100°C at 50 degrees Celsius per minute (°C/min), then increased to 185°C at 25°C/min and held at 185°C for 6.80 min. The carrier gas was helium at a flow rate of 11 milliliters per minute (mL/min).

After withdrawing a 250 µL to 1 mL sample, the sample was injected into a 10 mL auto sampler vial containing between 5.75 and 5.0 mL of acidified deionized water (pH ~2). The water was acidified to inhibit microbial activity between microcosm sampling and GC analysis. The vial was sealed with an inert Teflon®-lined septum and aluminum crimp cap for automated injection of 3 mL of headspace onto the GC. One cVOC standard was analyzed with each set of samples to verify the instrument five-point calibration curve using methanolic stock solutions containing known concentrations of the target analytes. Calibration was performed using external standards purchased as standard solutions (Sigma, St Louis, Missouri), where known volumes of standard solutions were added to acidified water in auto sampler vials and analyzed as described above for column samples. The calibration concentrations range from 10 to 10,000 µg/L. Data were integrated using Chemstation Software (Agilent Technologies, Santa Clara, California).

The quantitation limits (QL) for the cVOCs and DHGs were typically 10 µg/L to 20 µg/L based on the lowest concentration standards that were included in the linear calibration trend and the dilution factor applied for a particular sample.

As outlined in the sampling plan samples from the influent and effluent were collected on weeks 1, 4 and 8 and sent to Test America (Burlington, VT) for cVOC analyses using EPA Method 8260B

3.4.3 Analysis of Major Anions

Anion (chloride, nitrate-nitrogen [nitrate], nitrite-nitrogen [nitrite], phosphate and sulfate) analyses were performed at SiREM on a Dionex DX-600 ion chromatograph (IC) equipped with a Dionex AS-40 auto sampler and an AS18 column, the sample loop volume was 25 µL. An isocratic separation was performed using 33 millimolar (mM) reagent grade sodium hydroxide (Fisher Scientific, Ottawa, ON) eluent for 13 min. One standard was analysed with each set of samples tested in order to verify the seven-point calibration using external standards of known concentrations. External standards were prepared gravimetrically using chemicals of the highest purity available (Sigma St Louis, MO or Bioshop, Burlington, ON). Data were integrated using Peaknet Chromatography software (Dionex, Oakville, ON). The calibration concentrations ranged from 100 to 10,000 µg/L.

A 0.5 mL sample was withdrawn, after which the sample was placed in a 1.5 mL micro-centrifuge tube. Samples were centrifuged for five minutes at 13,000 revolutions per minute (RPM) to remove solids. The supernatant was removed, diluted 50-fold in deionized water and

placed in a Dionex auto sampler vial with a cap that filters the sample during automated injection onto the IC.

3.4.4 Analysis of Cations, Alkalinity, TDS and metals

Water sample cation, alkalinity, TDS and metals analyses were performed by Test America of Burlington, VT. Cations were analyzed using inductively coupled plasma atomic emission spectroscopy (ICP-AES) (US EPA Method 6010C). Carbonate alkalinity (expressed as milligrams $CaCO_3$ per liter) in water was determined using method US EPA Method SM 2320B. TDS was determined using US EPA Method SM 2540C. Metals in water were determined using US EPA Method 6020A and mercury was determined using US EPA method 7470A.

4 cVOC Results, Reaction Pathways and Degradation Parameters

This section discusses the observed water cVOC concentration trends. The column data are then quantified in terms of anticipated cVOC degradation pathways and kinetic rates.

4.1 cVOC Results

At a nominal flow velocity of 1.64 ft/day, approximately 64 pore volumes (PVs) of groundwater passed through the Connelly column during the test. The Peerless column was terminated after 54 PVs in consultation with XDD due to low reactivity observed. One pore volume corresponded to a residence time of approximately 24 hrs in both columns. The water sample cVOC compounds detected (PCE, TCE, cDCE and VC) as well as dechlorination products (ethene and ethane) and methane from both columns data are provided in Tables 3 and 4. Concentration trends for cVOCs and DHGs from the last complete sampling events are presented in Figures 2 and 3. An influent PCE concentration of approximately 24,000 µg/L was degraded to 297 and 1,810 µg/L in the effluents of the Connelly and Peerless columns, respectively. The TCE concentration decreased from an influent value of approximately 6,300 µg/L to 54 and 113 µg/L in the effluents of the Connelly and Peerless columns, respectively. An influent concentration of cDCE of approximately 6,000 µg/L was degraded to 267 and 1,140 µg/L in the effluents of the Connelly and Peerless columns, respectively. The VC concentration decreased from an influent value of approximately 1,000 µg/L in the Connelly column to 19 µg/L in the effluent and from approximately 2,000 µg/L in the Peerless column to 224 µg/L in the effluent.

4.2 Quality Control cVOC Analyses

Confirmatory cVOC samples analyzed by US EPA Method 8260B were collected during baseline and column influent and effluent sampling on weeks 1, 4 and 8. Table 5 presents the cVOC analytical data from SiREM and Test America. In general, the PCE, TCE, cDCE and VC concentrations measured by SiREM in the baseline and column influent samples were approximately 20% to 30% higher than those measured by Test America. A larger difference of 54% and 60% was observed between influent measurement for TCE at Week 1 and VC at week 4, respectively. The differences in analytical results between the two laboratories were much less pronounced for the column effluent samples, but again the SiREM reported values were generally slightly higher. There was a substantial difference in effluent results for Peerless column effluents at week 8, with SiREM values being up to two orders of magnitude higher than the Test America results. SiREM was informed by Test America that a dilution error had occurred for this sample.

SiREM analyzed the cVOC samples immediately after collection from the column. Volatile losses during shipping and sample handling may have contributed to the lower cVOC concentrations measured at Test America. Moreover, a relatively high dilution factor of up to 383 was used on the baseline and column influent samples analyzed by Test America. In contrast, a dilution factor of 4 was used by SiREM for cVOC analyses on the baseline and column influent samples. The higher dilution factor may have contributed to the differences observed in results between the two laboratories.

4.3 cVOC Reaction Pathways and Kinetic Expressions

Two dominant pathways of degradation of chlorinated hydrocarbon compounds by ZVI include hydrogenolysis and reductive *β*-elimination (Gillham et al., 2010). In the hydrogenolysis reaction, a chlorine atom is replaced by a hydrogen atom, accompanied by the addition of two electrons (from the iron). Reductive *β*-elimination involves release of two chlorine atoms and the formation of an additional carbon-carbon bond. Both pathways are thought to occur simultaneously (Arnold and Roberts, 2000). Figure 3 illustrates those pathways for the chlorinated ethene sequence starting from PCE, through TCE, DCE-isomers, VC and finally ethene and ethane. Both of the chlorinated acetylenes are highly unstable and degrade rapidly, primarily through reductive dechlorination to acetylene (Arnold and Roberts, 2000). Another ZVI-mediated transformation mechanism, hydrogenation, involves the addition of two hydrogen atoms across two carbon atoms with the removal of a C-C bond (e.g., reduction of acetylene to ethane, and ethene to ethane as shown in Figure 4).

Based on previous research, the VOC degradation in contact with ZVI appears to be first-order with respect to the concentration of the contaminant (pseudo first-order) (Gillham et al., 2010):

$$\frac{\partial C}{\partial t} = -kt \tag{1}$$

After integration, the equation can be presented in the form of the exponential decay equation:

$$C = C_0 e^{-kt} \tag{2}$$

Where: C is the concentration in solution at a particular time (t),

C_o is the initial concentration, and

k is the first-order rate constant.

The rate constant (k) is a measure of the reaction rate and can be calculated directly from Equation 2. The time at which the initial concentration declines by one-half, ($C/C_o = 0.5$), is the half-life ($t_{1/2}$).

$$t_{1/2} = \frac{\ln(2)}{k} \tag{3}$$

4.4 Determination of Degradation Parameters from Column Data

Due to the complexity of the ZVI-induced dechlorination mechanisms (Figure 4), the laboratory data were interpreted using a multi-component kinetic model to quantify degradation rates of compounds that are present in the water initially, as well as potential degradation products. In the model, potential breakdown products are concurrently produced and degraded as described by first-order kinetic equations. Each pathway is characterized by a rate constant (k) and the mole fraction of the compound that follows that particular path (f). Since chlorinated acetylenes are unstable, short-lived, intermediates are rapidly reduced to ethene (Arnold and Roberts, 2000).

These compounds are not typically detected in the solution phase and are therefore not explicitly contained in the degradation model. Therefore, first-order rate equations for each cVOC included in the model are as follows:

$$\frac{\partial PCE}{\partial t} = -k_{PCE} PCE \tag{4}$$

$$\frac{\partial TCE}{\partial t} = f_{PCE1} k_{PCE} PCE - k_{TCE} TCE \tag{5}$$

$$\frac{\partial cDCE}{\partial t} = f_{PCE2} k_{PCE} PCE + f_{TCE1} k_{TCE} TCE - k_{cDCE} cDCE \tag{6}$$

$$\frac{\partial VC}{\partial t} = f_{PCE3} k_{PCE} PCE + f_{TCE2} k_{TCE} TCE + f_{cDCE} k_{cDCE} cDCE - k_{VC} VC \tag{7}$$

These equations were adapted for the computer program Scientist® Version 3.0 (Micromath Research, 2008). The program can be used to fit the first-order equations to experimental data using the least squares best-fit method. The degradation rate and molar conversion are determined for each compound sequentially starting with the most chlorinated cVOC.

The results from the model fitting of column data include half-lives for all cVOCs selected and statistical fit data including coefficient of determination (r^2) values. The half-lives determined from the cVOC profiles from the last five sampling events for Connelly ZVI and the last four events for Peerless ZVI are shown in Table 6a, along with the corresponding r^2 values and molar conversion rates. The concentration profiles were also fitted using linear fit on log-transformed data. This method appeared to provide a better fit to the later time column concentration profiles for TCE, cDCE and VC (Table 6b). Results of data fitting using both methods are provided in Appendix C.

The cVOC degradation half-lives values achieved in the Connelly ZVI column were substantially shorter than those measured in the Peerless ZVI column (Table 6a and 6b). Nonetheless, the Connelly half-lives were at the higher end of the ranges achieved in previous commercial ZVI studies for the compounds reported by Gillham et al. (2010). Half-lives gradually increased with time indicating passivation of ZVI with respect to cVOC dechlorination. The gradual loss in reactivity should be accounted for in the PRB design to provide sufficient residence time for cVOC treatment to cleanup levels.

In comparison to the first column study performed with the same site water using Connelly iron, the results obtained at the conclusion of this study indicate much higher cVOC degradation rates. As discussed in the report for the original Connelly iron, the rapid decrease in reactivity observed in the Connelly column was unexpected, considering water geochemistry. Although both Connelly studies used ZVI material from the same sample batch provided by the manufacturer, the ORP measured in the second column test was much lower than in the first test, indicating a much more reactive material in the second test. Therefore, it appears the ZVI material packed in the two columns had different properties. Although half-lives are relatively high compared to previous ZVI studies, the results obtained in the second column test are closer to the ZVI behavior expected based on previous results with waters of similar chemistry.

5 Field Scale PRB Design Considerations

The laboratory half-lives were obtained at a temperature of 22°C (72 degrees Fahrenheit [°F]). Field groundwater temperature was not provided at the time of this report. For the purpose of this evaluation, we have assumed the minimum field groundwater temperature is approximately 10°C (50°F). Based on the previous research, cVOC degradation half-lives increase by 100% per every 6°C to 8°C temperature decrease within a temperature range of 5 to 25°C (O'Hannesin et al., 2004). Therefore, the laboratory half-life values were increased by a factor of 2.7 to obtain the anticipated field values (Table 7).

The more conservative half-lives obtained using the linear fit on log-transferred column VOC data for Connelly ZVI (Table 6b) were used for the preliminary design calculations. The residence time calculations for the field ZVI PRB were performed using influent concentration scenarios provided by XDD and the temperature corrected laboratory half-lives obtained at the end of the study (Table 7). Due to substantially lower degradation rates obtained for Peerless ZVI, compared to those for Connelly, PRB design calculation were not performed for the Peerless material.

Based on the simulations performed, the residence time required to achieve Federal drinking water maximum contaminant levels (MCLs) in a PRB at the site using Connelly GPM ZVI ranges from 112 to 116 hrs (Table 7). The required ZVI thickness can be obtained by multiplying the residence time required by the groundwater flow rate anticipated in the location of the proposed PRB.

6 Inorganic Chemistry Results and Discussion

Previous research has shown that the inorganic composition of the treated groundwater can have a profound influence on the reactivity of commercial granular ZVI materials. Most of these effects are related to long-term performance. Therefore, evaluation of changes in inorganic chemistry along the flow path through the ZVI column is a crucial component of design considerations for a ZVI PRB.

6.1 Column Data

Inorganic parameter samples were collected at baseline and on weeks 1, 4 and 8. The water sample inorganic chemical concentration data are summarized in Tables 8, 9 and 10. Laboratory reports of analysis for the cations, alkalinity, TDS and metals are compiled in Appendix B.

When iron is exposed to water, several reactions occur as a result of iron corrosion:

$$Fe^{\circ} \rightarrow Fe^{2+} + 2e^{-} \quad (8)$$

This iron corrosion drives the geochemical changes that occur as groundwater flows through the PRB. When groundwater first contacts the granular iron, any dissolved oxygen present is consumed via iron corrosion:

$$4Fe^{\circ} + 3O_{2(aq)} + 12H^{+} \rightarrow 4Fe^{3+} + 6H_2O \quad (9)$$

It should be noted that dissolved oxygen (DO) was not measured in the test. It is likely that the water in the influent bag was likely oxygenated. The solubility of DO at the test temperature of 22°C is approximately 9 mg/L. The same column procedure has been used in numerous previous ZVI tests and the exposure to DO has not typically resulted in a similar degree of reactivity loss observed in this test.

After the initial, rapid depletion of any dissolved oxygen and other oxidizers (e.g., nitrate which was not present in the site water), the water corrosion of iron dominates to produce hydrogen and hydroxide resulting in an increase in pH and decline in Eh:

$$Fe^{\circ} + 2H_2O \rightarrow Fe^{2+} + H_{2(aq)} + 2OH^{-} \quad (10)$$

The ORP and pH profiles within the columns are presented in Table 8 and Figure 5. The ORP decreased within the columns from approximately +100 milliVolts (mV) in the influent to -150 mV and -350 mV in the Connelly and Peerless columns, respectively. The pH values increased from an influent value of 7.5 to approximately 9 in both columns which was the expected result of the reaction shown in Eq. 10.

Dechlorination of cVOCs is a redox reaction, whereby ZVI acts as an electron donor and cVOC compounds are electron acceptors. For example, dechlorination of PCE can be represented by the following reaction:

$$4Fe^0 + C_2Cl_4 + 4H^+ \rightarrow C_2H_4 + 4Fe^{2+} + 4Cl^- \quad (11)$$

Therefore, degradation of cVOCs consumes ZVI and generates dissolved iron. The oxidized iron contributes to the creation of secondary precipitates on ZVI grains, as described below. Some iron minerals created by oxidized iron may be passivating (hematite/goethite or siderite), while others such as magnetite or green rust allow electron transfer from the core of ZVI grains to aqueous phase and do not impede ZVI corrosion substantially (Gillham et al., 2010).

The influent calcium concentration of approximately 100 mg/L decreased to 11 mg/L in effluents of in both columns (Table 10). Magnesium decreased from an influent value of approximately 47 mg/L to approximately 30 mg/L in both columns. The carbonate alkalinity value decreased from an initial value of approximately 300 mg/L to approximately 100 mg/L in both columns (Table 10). The losses of calcium, magnesium and alkalinity indicate the formation of calcium carbonate minerals and potentially mixed Ca-Mg carbonate minerals:

$$\text{Aragonite/Calcite: } Ca^{2+} + CO_3^{2-} \rightarrow CaCO_{3(s)} \quad (12)$$

Potassium and chloride behave as conservative tracers in iron systems and, as expected, their concentrations remained essentially unchanged within the column (Tables 9 and 10). Dissolved iron remained essentially unchanged from the influent values 0.2 mg/L within both columns (Table 10). Tests conducted with different types of ZVI materials resulted in water corrosion rates on the order of 0.1 to 0.6 millimoles per kilogram iron per day (mmol/kg Fe/day), with a value of 0.3 mmol/kg Fe/day measured for granular ZVI such as Connelly (Reardon, 2005). Based on a corrosion rate of 0.3 mmol/kg Fe/day, approximately 80 mg/L dissolved iron would be expected in the column effluent at the flow rate used. Since no change in dissolved iron was observed in the column, the ferrous iron generated by the reaction illustrated in Eq. 10 and 11 was likely consumed by precipitation of iron (oxy) hydroxides and siderite.

The trends in concentration of sulfate of approximately 5 to 14 mg/L within the columns varied during the test period (Table 9). The increase in sulfate concentrations observed in the initial part of the study was likely due to sulfate leaching from ZVI. A decrease in sulfate was observed along both columns in the last sampling event indicating that sulfate reduction conditions may have been created.

Silicon present in the week 7 column influent at a concentration of approximately 9.2 mg/L decreased to 0.801 and 0.302 mg/L within the Peerless and Connelly columns, respectively in response to geochemical conditions created by ZVI corrosion (Table 10). Silica (SiO_3^{2-}) is thought to precipitate or adsorb on ZVI surfaces leading to the formation of a silica film or gel on the ZVI surface that may hinder contaminant access to active sites (Klausen et al., 2003).

6.2 Possible Mineral Precipitates and Their Effect

Iron corrosion reactions (Equations 8-10) promote the reductive dechlorination reactions, but at the same time are sources of ferrous iron and alkalinity. Because low concentrations of dissolved iron were detected in the column effluent, iron (oxy) hydroxides and iron carbonate

are expected to form throughout a PRB. Iron (oxy) hydroxides ultimately transform to magnetite, which is electron-conducting, they do not substantially reduce the reactivity of the iron and the rate of formation is not expected to cause a significant decline in permeability (Gillham et al., 2010). However, the potential adverse effects of other secondary precipitates, such as calcium and iron carbonate, created on ZVI grains need to be considered in terms of long-term efficiency of the PRB system.

Based on the observed levels of calcium and carbonate in site groundwater, carbonate precipitation on ZVI grains is expected to be the main process influencing the ZVI longevity at the site. While there is little doubt that inorganic precipitates (mostly iron oxy-hydroxides and carbonates) will form over time in a ZVI PRB at the site, their impact will likely be proportional to the groundwater velocity which is approximately 30 times less than that used in this study. That is, it is anticipated that a ZVI PRB designed based on the cVOC degradation rates from this column test, including a safety factor to account for the observed gradual increases in cVOC half-lives, would be able to last for a long time without the need for rehabilitation.

7 Summary and Conclusions

Bench-scale column treatability testing using site water indicated that:

i) Connelly ZVI degraded the cVOCs present in the site water at faster rates compared to Peerless ZVI. The Connelly degradation half-lives generated in the study were generally at the higher end of the ranges achieved in previous commercial ZVI studies for the compounds reported (Gillham et al., 2010) and other groundwaters with comparable cVOC composition.

ii) Based on the anticipated half-lives at site field groundwater temperature (50ºF/10ºC) obtained at the end of the study and the cVOC concentration scenarios provided, a residence time ranging from 112 to 116 hours would be required in a Connelly ZVI PRB to achieve the Federal MCL target levels.

iii) Due to the presence of relatively high concentrations of calcium and alkalinity in the site groundwater, ZVI passivation due to mineral precipitation such as carbonates and iron oxy-hydroxides is expected to occur with time and influence the long-term efficiency of the PRB at the site. Therefore, it is recommended that an engineering safety factor be included in the ZVI volume design calculations for the proposed PRB to assure long-term efficiency.

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TABLES

TABLE 1
COLUMN AND ZVI MATERIALS SPECIFICATIONS
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

ZVI Supplier	Connelly GPM	Peerless
ZVI Size Range	US Mesh 8 to 50 (0.25 - 2.0 millimeters)	
ZVI Content	100 percent	
ZVI Dry Weight	1,286 g	1,773 g
Column Length	1.64 feet (50 centimeters)	
Column Inside Diameter	0.12 feet (3.8 centimeters)	
Measured Pore Volume	332 mL	274 mL
Volume of Column	567 cubic centimeters	
Porosity	0.58	0.48
Bulk Density	2.27 g/cm3	3.12 g/cm^3
ZVI:Solution Ratio	3.87 g/mL	6.48 g/mL
Average Flow rate	1.64 feet per day	
Average Residence Time	24hours	

Notes:

g/cm^3 - grams per cubic centimeter

g/mL - grams per milliliter

ZVI - zero valent iron

TABLE 2
ZVI COLUMN SAMPLING SCHEDULE
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

Event		Baseline (Week 0)								Weekly (9 events for CON, 7 events for PL)			Week 1, 2, 4, and 8	Week 1 and 8		
Sample Location		pH, ORP	cVOCs	DHGs	Anions	Cations	Alkalinity	TDS	Metals	pH, ORP	cVOCs	DHGs	Anions	Cations	TDS[a]	Alkalinity
Column Influent		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Sampling Ports	A									●	●	●	●			
	B									●	●	●	●			
	C									●	●	●	●			
	D									●	●	●	●			
	E									●	●	●	●			
	F									●	●	●	●			
	G									●	●	●	●			
Column Effluent										●	●	●	●	●	●	●

Notes:

[a] TDS also collected at Week 4

cVOCs - chlorinated volatile organic compounds

DHGs - dissolved hydrocarbon gases

ORP - oxidation-reduction potential

TDS - total dissolved solids

ZVI - zero valent iron

● indicates sample collected

TABLE 3
CONNELLY ZVI COLUMN - WATER SAMPLE cVOC AND DHG RESULTS
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

Sample Location		Influent	Port A	Port B	Port C	Port D	Port E	Port F	Port G	Effluent
Column Distance (feet)		**0.00**	**0.08**	**0.16**	**0.33**	**0.49**	**0.66**	**0.98**	**1.31**	**1.64**
Residence Time (hours)		**0.0**	**1.2**	**2.3**	**4.8**	**7.2**	**9.7**	**14.3**	**19.2**	**24.0**
Compound	PV	Concentration (µg/L)								
PCE	Baseline	19,664	--	--	--	--	--	--	--	--
	5.3	22,052	12,992	8,231	2,730	1,441	1,670	98	<20	<20
	12.0	22,641	14,610	9,668	4,535	4,390	3,228	149	<20	<20
	18.5	23,074	12,783	9,678	5,892	4,228	3,688	448	76	<10
	24.3	22,287	13,466	8,643	5,229	4,028	2,970	334	193	77
	30.4	24,897	15,100	10,859	6,943	4,322	3,543	555	185	74
	36.8	23,366	14,942	10,300	5,117	3,751	2,496	182	148	102
	50.3	26,689	18,394	12,739	7,675	4,884	3,291	237	197	120
	63.9	25,969	21,636	17,387	11,108	6,595	5,117	667	440	297
TCE	Baseline	5,878	--	--	--	--	--	--	--	--
	5.3	5,909	2,147	1,140	472	249	309	37	<20	77
	12.0	5,632	913	384	199	204	190	<20	<20	<20
	18.5	5,627	778	404	258	224	259	48	24	<10
	24.3	5,651	1,354	569	395	323	292	75	32	21
	30.4	5,836	2,225	1,141	692	441	386	84	37	19
	36.8	5,640	2,628	1,550	665	504	324	36	25	29
	50.3	6,416	4,080	2,512	1,172	735	445	34	34	25
	63.9	6,284	4,899	3,732	1,716	899	610	84	70	54
cDCE	Baseline	6,274	--	--	--	--	--	--	--	--
	5.3	6,254	1,571	672	235	148	193	37	<20	<20
	12.0	5,945	270	56	<20	<20	28	<20	<20	<20
	18.5	5,762	286	108	42	31	45	<10	<10	<10
	24.3	5,917	807	256	141	135	130	33	24	16
	30.4	6,051	1,919	908	590	451	459	184	110	66
	36.8	6,002	2,545	1,724	999	913	779	176	125	99
	50.3	6,351	4,497	3,104	2,039	1,612	1,369	330	349	265
	63.9	6,247	5,183	4,240	2,285	1,503	1,301	329	314	267
VC	Baseline	1,765	--	--	--	--	--	--	--	--
	5.3	1,830	146	37	<20	<20	<20	<20	<20	<20
	12.0	1,616	28	<20	<20	<20	<20	<20	<20	<20
	18.5	1,018	40	<20	<20	<20	<10	<10	<10	<10
	24.3	1,041	68	16	<20	<20	<10	<10	<10	<10
	30.4	2,035	380	139	67	47	45	18	<10	<10
	36.8	1,939	514	257	125	108	90	19	11	<10
	50.3	2,138	1,218	693	376	278	232	50	44	30
	63.9	944	691	480	223	136	111	26	23	19

TABLE 3
CONNELLY ZVI COLUMN - WATER SAMPLE cVOC AND DHG RESULTS
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

Sample Location		Influent	Port A	Port B	Port C	Port D	Port E	Port F	Port G	Effluent
Column Distance (feet)		**0.00**	**0.08**	**0.16**	**0.33**	**0.49**	**0.66**	**0.98**	**1.31**	**1.64**
Residence Time (hours)		**0.0**	**1.2**	**2.3**	**4.8**	**7.2**	**9.7**	**14.3**	**19.2**	**24.0**
Compound	PV	Concentration (µg/L)								
Ethene	Baseline	<10	--	--	--	--	--	--	--	--
	5.3	140	678	744	751	684	982	759	624	649
	12.0	90	190	148	148	191	222	97	41	32
	18.5	59	147	128	204	170	264	130	100	51
	24.3	59	244	229	305	324	419	349	309	193
	30.4	50	393	444	649	570	688	607	482	289
	36.8	37	500	612	760	665	779	541	457	352
	50.3	33	465	824	1159	1,148	1329	875	855	620
	63.9	<20	402	656	1159	1,154	1348	938	942	773
Ethane	Baseline	257	--	--	--	--	--	--	--	--
	5.3	65	1,941	2,577	2,206	2,136	2,843	2,800	2,357	2,314
	12.0	66	2,437	2,691	2,575	3,654	4,190	4,466	3,928	4,731
	18.5	22	2,035	2,511	3,990	3,050	4,396	3,736	4,429	4,621
	24.3	22	1,735	2,433	2,747	2,647	2,337	2,362	1,968	1,896
	30.4	22	1,241	1,365	1,988	1,860	2,056	2,346	2,521	2,111
	36.8	20	1,089	1,816	2,519	2,373	3,032	4,226	4,433	4,694
	50.3	27	598	1,344	2,036	2,244	2,840	3,826	4,144	3,751
	63.9	18	363	870	1,866	2,217	2,546	3,561	3,887	4,106
Methane	Baseline	1,810	--	--	--	--	--	--	--	--
	5.3	1,294	995	1,176	993	1,017	1,360	1,418	1,263	1,279
	12.0	682	431	455	405	587	696	788	764	1,011
	18.5	305	186	213	301	247	321	256	314	382
	24.3	275	183	206	196	184	117	96	79	73
	30.4	257	118	135	142	134	147	120	125	108
	36.8	199	113	117	127	118	139	126	133	144
	50.3	113	116	127	132	128	109	114	120	105
	63.9	114	121	122	132	130	109	111	117	122

Notes:

-- - sample not collected

< - compound not detected, the associated value is the quantitation limit

µg/L - micrograms per liter

cDCE - cis-1,2-dichloroethene

cVOC - chlorinated volatile organic compounds

DHG - dissolved hydrocarbon gases

PCE - tetrachloroethene

PV - pore volumes

TCE - trichloroethene

VC - vinyl chloride

TABLE 4
PEERLESS ZVI COLUMN - WATER SAMPLE cVOC AND DHG RESULTS
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

Sample Location		Influent	Port A	Port B	Port C	Port D	Port E	Port F	Port G	Effluent
Column Distance (feet)		**0.00**	**0.08**	**0.16**	**0.33**	**0.49**	**0.66**	**0.98**	**1.31**	**1.64**
Residence Time (hours)		**0.0**	**1.2**	**2.3**	**4.8**	**7.2**	**9.7**	**14.3**	**19.2**	**24.0**
Compound	PV	Concentration (µg/L)								
PCE	Baseline	19,664	--	--	--	--	--	--	--	--
	7.2	22,296	12,144	11,005	7,350	6,114	3,348	2,625	2,210	568
	14.1	24,053	17,553	14,150	9,254	7,932	5,985	3,204	2,771	1,268
	20.9	27,380	16,728	13,404	9,718	9,895	6,767	4,962	3,382	1,710
	27.1	22,630	15,887	14,612	9,774	9,669	5,777	3,350	2,983	1,838
	33.7	24,897	16,654	15,990	11,026	10,132	6,254	4,149	3,153	1,845
	40.4	23,366	15,401	14,720	10,011	9,858	5,813	3,892	3,292	1,836
	53.8	26,689	--	--	--	--	--	4,788	--	1,810
TCE	Baseline	5,878	--	--	--	--	--	--	--	--
	7.2	6,065	3,251	2,780	1,959	1,596	988	767	710	521
	14.1	6,020	3,627	2,764	1,866	1,481	1,128	669	570	298
	20.9	6,040	3,426	2,505	1,894	1,783	1,076	772	525	292
	27.1	5,844	3,202	2,795	1,930	1,612	832	371	303	192
	33.7	5,836	3,240	2,992	2,013	1,521	830	414	263	168
	40.4	5,640	3,361	2,811	1,776	1,394	694	321	216	128
	53.8	6,416	--	--	--	--	--	458	--	113
cDCE	Baseline	6,274	--	--	--	--	--	--	--	--
	7.2	6,265	4,515	4,238	3,562	3,018	2,273	1,873	1,904	1,300
	14.1	6,292	4,001	3,334	2,684	2,167	1,832	1,339	1,221	823
	20.9	6,259	3,634	2,886	2,431	2,324	1,729	1,462	1,164	807
	27.1	6,077	3,250	2,907	2,241	2,166	1,603	1,050	958	660
	33.7	6,051	3,272	3,087	2,517	2,362	1,870	1,447	1,233	894
	40.4	6,002	3,461	3,059	2,467	2,495	1,855	1,433	1,378	863
	53.8	6,351	--	--	--	--	--	2,001	--	1,140
VC	Baseline	1,765	--	--	--	--	--	--	--	--
	7.2	1,821	1,006	868	658	559	414	364	345	261
	14.1	1,749	776	571	425	308	265	199	169	126
	20.9	1,662	633	441	354	311	222	183	143	115
	27.1	1,065	368	305	214	205	145	90	83	65
	33.7	2,035	668	609	435	401	299	229	192	155
	40.4	1,939	763	621	456	445	319	251	242	176
	53.8	2,138	--	--	--	--	--	404	--	224

TABLE 4
PEERLESS ZVI COLUMN - WATER SAMPLE cVOC AND DHG RESULTS
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

Sample Location		Influent	Port A	Port B	Port C	Port D	Port E	Port F	Port G	Effluent
Column Distance (feet)		**0.00**	**0.08**	**0.16**	**0.33**	**0.49**	**0.66**	**0.98**	**1.31**	**1.64**
Residence Time (hours)		**0.0**	**1.2**	**2.3**	**4.8**	**7.2**	**9.7**	**14.3**	**19.2**	**24.0**
Compound	PV	Concentration (µg/L)								
Ethene	Baseline	<10	--	--	--	--	--	--	--	--
	7.2	125	749	860	803	786	804	848	801	832
	14.1	95	683	771	802	616	738	739	728	706
	20.9	59	534	692	886	729	700	687	674	697
	27.1	59	643	694	688	714	687	610	604	546
	33.7	50	655	719	769	687	693	731	699	664
	40.4	37	451	617	737	724	748	746	693	714
	53.8	25	--	--	--	--	--	937	--	773
Ethane	Baseline	257	--	--	--	--	--	--	--	--
	7.2	53	255	301	260	254	260	266	239	244
	14.1	52	283	342	371	279	380	403	392	367
	20.9	62	292	372	541	380	405	388	382	399
	27.1	21	365	389	392	385	388	361	337	319
	33.7	22	412	399	405	333	353	385	368	359
	40.4	20	354	420	440	415	414	408	363	460
	53.8	34	--	--	--	--	--	458	--	392
Methane	Baseline	1,810	--	--	--	--	--	--	--	--
	7.2	1,023	366	343	228	260	250	313	290	297
	14.1	668	226	187	146	119	132	140	154	167
	20.9	282	146	136	139	120	81	81	85	89
	27.1	268	136	126	104	107	64	60	59	62
	33.7	257	109	108	95	88	88	57	53	61
	40.4	199	90	92	86	83	85	51	50	53
	53.8	89	--	--	--	--	--	52	--	48

Notes:

-- - sample not collected

< - compound not detected, the associated value is the quantitation limit

µg/L - micrograms per liter

cDCE - cis-1,2-dichloroethene

cVOC - chlorinated volatile organic compounds

DHG - dissolved hydrocarbon gases

PCE - tetrachloroethene

PV - pore volumes

TCE - trichloroethene

VC - vinyl chloride

TABLE 5
cVOC ANALYTICAL RESULTS COMPARISON BETWEEN SIREM AND TEST AMERICA
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

Analyte		SIREM			Test America		
		Concentration (µg/L)					
		*Influent**			*Influent1**	*Influent2**	
Baseline	Tetrachloroethene	22,052			20,000	21,000	
	Trichloroethene	5,909			4,800	5,200	
	cis-1,2-Dichloroethene	6,254			4,800	5,300	
	Vinyl Chloride	1,830			1,300	1,500	
Week 1		*PL Efluent*	*CON Effluent*		*PL Efluent*	*CON Effluent*	
	Tetrachloroethene	568	<20		400	<1.0	
	Trichloroethene	521	77		240	<1.0	
	cis-1,2-Dichloroethene	1,300	<20		1,000	10	
	Vinyl Chloride	261	<20		190	0	
Week 4		Influent	CON Effluent		Influent	CON Effluent	
	Tetrachloroethene	24,897	74		18,000	65	
	Trichloroethene	5,836	19		4,600	12	
	cis-1,2-Dichloroethene	6,051	66		4,800	10	
	Vinyl Chloride	2,035	<10		800	<1.0	
Week 8		Influent	CON Effluent	PL Effluent	Influent	CON Effluent	PL Effluent
	Tetrachloroethene	26,689	120	1,810	21,000	120	R
	Trichloroethene	6,416	25	113	5,100	23	R
	cis-1,2-Dichloroethene	6,351	265	1,140	5,300	260	R
	Vinyl Chloride	2,138	30	224	1,700	29	R

Notes:

* - Test America results for samples collected on 16 January 2013 were over range and not reported, baseline influent was re-sampled on 24 January 2013 (Week 1) and SiREM influent results from Week 1 are listed for comparison.

µg/L - micrograms per liter

< - compound not detected, the associated value is the quantitation limit

NA - not available

cVOC - chlorinated volatile organic compounds

CON - Connelly

PL - Peerless

R - Results from Test America are rejected because of a dilution error during analysis

TABLE 6a
CALCULATED cVOC HALF-LIFE VALUES
(First-order fit based on non transformed concentration data)
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

Compound	Pore Volume	Influent Concentration (µg/L)	Half-life[a] (hours)	r^2	Conversion (%mol)
Connelly					
Tetrachloroethene	24.3	22,287	2.2	0.972	NA
	30.4	24,897	2.5	0.976	NA
	36.8	23,366	2.5	0.983	NA
	50.3	26,689	2.8	0.991	NA
	63.9	25,969	4.0	0.994	NA
Trichoroethene					PCE=>TCE
	24.3	5,651	0.6	0.986	0%
	30.4	5,836	1.0	0.977	0%
	36.8	5,640	1.3	0.986	0%
	50.3	6,416	1.9	0.995	0%
	63.9	6,284	2.6	0.997	0%
cis 1,2-Dichloroethene					TCE=>cDCE
	24.3	5,917	0.4	0.997	1%
	30.4	6,051	0.8	0.974	1%
	36.8	6,002	1.3	0.934	1%
	50.3	6,351	3.3	0.969	1%
	63.9	6,247	3.7	0.993	
Vinyl Chloride					cDCE=>VC
	24.3	1,041	0.3	0.999	1%
	30.4	2,035	0.5	0.997	1%
	36.8	1,939	0.7	0.987	1%
	50.3	2,138	1.7	0.986	1%
	63.9	944	2.4	0.996	1%
Peerless					
Tetrachloroethene	27.1	22,630	2.6	0.767	NA
	33.7	24,897	5.6	0.960	NA
	40.4	23,366	5.6	0.948	NA
	53.8	26,689	5.9	0.999	NA
Trichoroethene					PCE=>TCE
	27.1	5,844	3.1	0.9	0%
	33.7	5,836	3.3	0.951	0%
	40.4	5,640	3.0	0.969	0%
	53.8	6,416	3.7	0.999	0%
cis 1,2-Dichloroethene					TCE=>cDCE
	27.1	6,077	5.4	0.8	1%
	33.7	6,051	7.2	0.800	1%
	40.4	6,002	7.4	0.808	1%
	53.8	6,351	8.9	0.998	1%
Vinyl Chloride					cDCE=>VC
	27.1	1,065	1.2	0.8	1%
	33.7	2,035	1.3	0.802	1%
	40.4	1,939	1.9	0.778	1%
	53.8	2,138	6.2	0.997	1%

Notes:
[a] Half-life calculated based on test temperature of 22 °C; µg/L - micrograms per liter
cVOC - chlorinated volatile organic compound; r2 - coefficient of determination
mol - mole; NA - not applicable; % - percent
Half-lives for Peerless at 53.8 pore volumes were based on two port samples

TABLE 6b
CALCULATED cVOC HALF-LIFE VALUES
(First-order fit based on linear regression of Log-transformed concentration data)
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

Compound	Pore Volume	Influent Concentration (µg/L)	Half-life[a] (hours)	r^2
CONNELLY				
Tetrachloroethene	24.3	22,287	2.9	0.977
	30.4	24,897	2.9	0.989
	36.8	23,366	2.8	0.946
	50.3	26,689	2.8	0.950
	63.9	25,969	3.4	0.964
Trichoroethene	24.3	5,651	3.4	0.905
	30.4	5,836	3.1	0.962
	36.8	5,640	3.0	0.917
	50.3	6,416	2.8	0.933
	63.9	6,284	3.2	0.945
cis 1,2-Dichloroethene	24.3	5,917	3.6	0.781
	30.4	6,051	4.4	0.879
	36.8	6,002	4.3	0.928
	50.3	6,351	5.1	0.928
	63.9	6,247	4.8	0.931
Vinyl Chloride	24.3	1,041	0.4	0.972
	30.4	2,035	2.5	0.778
	36.8	1,939	2.9	0.904
	50.3	2,138	4.0	0.933
	63.9	944	4.0	0.926
PEERLESS				
Tetrachloroethene	27.1	22,630	6.9	0.967
	33.7	24,897	6.8	0.979
	40.4	23,366	7.1	0.968
	53.8	26,689	6.2	0.975
Trichoroethene	27.1	5,844	5.0	0.960
	33.7	5,836	4.8	0.976
	40.4	5,640	4.5	0.974
	53.8	6,416	4.1	0.969
cis 1,2-Dichloroethene	27.1	6,077	8.8	0.916
	33.7	6,051	10.6	0.904
	40.4	6,002	10.7	0.897
	53.8	6,351	9.6	0.962
Vinyl Chloride	27.1	1,065	1.3	0.860
	33.7	2,035	5.8	0.753
	40.4	1,939	7.9	0.743
	53.8	2,138	7.2	0.930

Notes:

[a] Half-life calculated based on test temperature of 22°C

µg/L - micrograms per liter

cVOC - chlorinated volatile organic compound

r^2 - coefficient of determination

Half-lives for Peerless at 53.8 pore volumes were based on two port samples

TABLE 7
RESIDENCE TIME CALCULATIONS FOR PRB DESIGN (CONNELLY ZVI)
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

Compound	Target Level [b] (µg/L)	Field Anticipated Half-lives [c] (hrs)	Anticipated Influent Concentration[a] (µg/L)	
			Compliance Boundary Kame Sand	Compliance Boundary Ablation Till
Tetrachloroethene	5	9.1	33,000	24,000
Trichloroethene	5	8.5	2,100	1,600
cis-1,2-Dichloroethene	70	13.0	2,200	2,600
Vinyl Chloride	2	10.9	400	430
Residence time (hrs)			***116***	***112***

Notes:

PRB -permeable reactive barrier
µg/L - micrograms per liter
[a] Provided by XDD
[b] US EPA Federal Drinking Water Maximum Contaminant Levels (MCLs) assumed
[c] Laboratory values at end of test (Table 6b) and corrected by a factor of 2.7 to simulate a temperature of 10°C (50°F)

TABLE 8
WATER SAMPLE ORP AND pH RESULTS
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

Sample Location		Influent	Port A	Port B	Port C	Port D	Port E	Port F	Port G	Effluent
Column Distance (feet)		**0.00**	**0.08**	**0.16**	**0.33**	**0.49**	**0.66**	**0.98**	**1.31**	**1.64**
Residence Time (hours)		**0.0**	**1.2**	**2.3**	**4.8**	**7.2**	**9.7**	**14.3**	**19.2**	**24.0**
Analyte	PV	Instrument Readings								
CONNELLY										
pH	0.0	6.6	--	--	--	--	--	--	--	--
	5.3	6.5	7.6	7.4	7.2	8.2	7.9	6.5	6.6	6.6
	12.0	7.4	7.8	8.2	7.9	8.2	7.9	8.4	8.1	7.8
	18.5	7.2	6.6	7.6	8.6	8.9	8.7	7.6	8.7	8.4
	24.3	7.3	7.7	8.2	8.5	8.9	8.5	9.2	8.9	8.4
	30.4	7.4	7.5	8.0	8.7	8.9	8.8	8.5	9.0	8.6
	36.8	7.4	7.6	7.9	9.0	8.2	9.1	9.1	9.4	8.9
	50.3	7.2	7.2	7.4	8.3	8.4	8.4	8.8	8.8	8.6
	63.9	7.5	7.5	7.6	8.4	8.4	8.1	6.1	7.0	9.3
ORP (mV)	0.0	106	--	--	--	--	--	--	--	--
	5.3	0	-93	-150	-74	-57	-37	-5	-67	-17
	12.0	47	-290	-118	-68	-117	-115	-14	-13	80
	18.5	128	-222	-140	-101	-90	-134	-34	-33	-22
	24.3	63	-197	-276	-281	-275	-211	-4	17	160
	30.4	81	-241	-225	-247	-175	-283	-185	-134	-18
	36.8	101	-233	-214	-203	-252	-243	-156	-128	37
	50.3	82	-150	-122	-22	13	18	31	105	22
	63.9	89	-150	-132	98	88	101	125	51	70
PEERLESS										
pH	0.0	6.6	--	--	--	--	--	--	--	--
	7.2	6.8	7.4	6.7	7.5	7.4	8.0	8.2	8.4	7.9
	14.1	6.9	7.2	7.0	7.7	7.9	7.2	8.2	8.5	8.8
	20.9	7.4	7.1	7.6	7.2	7.3	7.9	7.9	8.7	8.6
	27.1	7.3	7.2	7.3	7.3	8.0	8.4	8.8	8.9	8.9
	33.7	7.5	7.8	7.7	8.0	7.9	8.1	8.8	8.8	8.6
	40.4	7.5	7.8	7.8	8.0	9.1	8.5	9.0	8.7	9.3
	53.8	7.3	--	--	--	--	--	7.6	--	8.2
ORP (mV)	0.0	106	--	--	--	--	--	--	--	--
	7.2	10	-283	-380	-377	-266	-219	-199	-195	-200
	14.1	15	-268	-364	-342	-261	-188	-231	-192	-283
	20.9	77	-219	-291	-360	-262	-273	-303	-281	-164
	27.1	50	-240	-277	-340	-402	-466	-405	-423	-310
	33.7	71	-382	-385	-369	-357	-375	-345	-275	-286
	40.4	57	-168	-261	-291	-345	-353	-370	-342	-282
	53.8	93	--	--	--	--	--	-99	--	-125

Notes:
mV - millivolts
ORP - Oxidation Reduction Potential
PV - pore volumes
-- - sample not collected

TABLE 9
WATER SAMPLE ANION RESULTS
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

Sample Location		Influent	Port A	Port B	Port C	Port D	Port E	Port F	Port G	Effluent
Column Distance (feet)		**0.00**	**0.08**	**0.16**	**0.33**	**0.49**	**0.66**	**0.98**	**1.31**	**1.64**
Residence Time (hours)		**0.00**	**1.2**	**2.3**	**4.8**	**7.2**	**9.7**	**14.3**	**19.2**	**24.0**
Analyte	PV	Concentration (mg/L)								
CONNELLY										
Chloride	5.3	13	20	25	32	32	40	37	43	50
	11.9	17	28	30	33	36	33	42	45	53
	24.3	14	20	22	29	28	29	32	34	36
	50.3	20	23	27	41	40	38	45	47	49
Nitrite-Nitrogen	5.3	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
	11.9	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	0.09	0.09
	24.3	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
	50.3	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
Nitrate-Nitrogen	5.3	0.12	0.27	0.13	0.28	0.12	0.40	0.10	0.19	0.13
	11.9	0.13	0.15	0.10	0.18	0.25	0.13	<0.09	0.15	0.28
	24.3	0.13	0.09	0.11	<0.09	<0.09	<0.09	0.09	0.17	0.11
	50.3	0.27	<0.09	0.09	0.11	0.09	0.11	<0.09	0.15	0.14
Sulfate	5.3	5.7	6.0	7.6	11	17	18	28	31	21
	11.9	6.9	7.0	7.3	8.1	12	9.0	29	39	36
	24.3	7.0	5.6	4.8	3.5	2.7	2.0	3.2	15	13
	50.3	14	4.3	1.6	1.2	0.86	0.80	0.77	0.99	1.2
Phosphate	5.3	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
	11.9	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
	24.3	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
	50.3	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
PEERLESS										
Chloride	7.2	12	15	17	19	20	23	23	24	41
	14.1	18	20	21	23	23	26	27	28	32
	27.1	15	16	20	18	18	20	22	22	27
	53.8	14	- -	- -	- -	- -	- -	69	- -	65
Nitrite-Nitrogen	7.2	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
	14.1	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
	27.1	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
	53.8	<0.09	- -	- -	- -	- -	- -	<0.09	- -	<0.09
Nitrate-Nitrogen	7.2	<0.09	<0.09	0.10	<0.09	0.11	<0.09	<0.09	0.09	0.10
	14.1	0.19	0.14	0.16	0.13	0.13	0.12	0.13	0.24	0.11
	27.1	0.23	0.10	<0.09	<0.09	<0.09	0.09	<0.09	<0.09	0.17
	53.8	0.18	- -	- -	- -	- -	- -	0.49	- -	0.27
Sulfate	7.2	5.2	5.3	5.8	6.1	6.1	8.7	10	8.6	49
	14.1	14	6.7	6.6	6.8	7.1	7.1	8.0	9.4	14
	27.1	13	5.7	5.6	5.2	4.6	4.0	4.2	3.7	18
	53.8	9.0	- -	- -	- -	- -	- -	1.2	- -	2.1
Phosphate	7.2	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
	14.1	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
	27.1	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
	53.8	<0.07	- -	- -	- -	- -	- -	<0.07	- -	<0.07

Notes:
mg/L - milligrams per liter
PV - pore volumes
-- - sample not collected
< - compount not detected, the associated value is the quantitation limit

TABLE 10
WATER SAMPLE CATION, ALKALINITY, TDS AND METALS RESULTS
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

Analyte	Reporting Limit (µg/L)	Baseline		Week 1		Week 4		Week 8		
		Baseline (1)	Baseline (2)	PL Effluent	CON Effluent	Influent	CON Effluent	Influent	PL Effluent	CON Effluent
	Concentration (µg/L)									
Calcium	5,000	100,000	108,000	17,700	6,150	--	--	108,000	10,900	10,800
Iron	200	139	141	948	2,040	--	--	200	109	200
Magnesium	5,000	43,800	47,200	25,700	5,230	--	--	46,700	31,600	28,900
Manganese	15	973	1,040	366	582	--	--	528	58	70
Silicon	100	8,910	9,480	895	239	--	--	9,170	801	302
Potassium	5,000	12,100	13,000	14,400	12,700	--	--	12,900	12,600	12,400
Alkalinity	5,000	160,000	321,000	130,000	<5000	--	--	275,000	97,200	92,000
Silver	2	0.014 J	<2.0	<2.0	<2.0	0.015 J	<2	<2.0	<2.0	<2.0
Arsenic	2	0.36 J	0.27 J	1.7 J	1.5 J	0.29 J	0.59 J	0.50 J	0.38 J	0.29 J
Beryllium	2	<2.0	x	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Cadmium	2	<2.0	<2.0	<2.0	<2.0	0.054JB	0.079JB	<2.0	<2.0	<2.0
Chromium	4	0.28 JB	0.72 JB	7	<4	0.22 JB	0.42 JB	0.20 JB	0.39 JB	0.88 JB
Copper	20	4.1 J	2.2 J	3.4 JB	1.6 JB	10 JB	0.52 JB	2.3 J	1.0 J	0.81 J
Nickel	20	54.1	54	21	3.7 J	55	8.5 J	62	23	18.1 J
Lead	2	0.084 JB	0.065 JB	0.42 J	0.033 J	2.7 B	0.088 JB	0.18 JB	0.077 JB	0.042 JB
Antimony	20	<20	<20	0.34J	<20	<20	<20	<20	<20	<20
Selenium	2	0.33 J	0.41 J	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0.34 J
Mercury	0.2	<0.2	<0.2	<0.2	0.061 JB	<0.2	<0.2	0.089 JB	0.081 JB	0.11 JB
Thallium	2.0	<2.0	<2.0	<2.0	<2.0	0.086J	<2.0	0.15J	<2.0	<2.0
Zinc	20	0.78 J	<20	4.4 JB	2.3 JB	5.7 J	<20	2.5 J	<20	<20
Total Dissolved Solids	5,000	425,000	446,000	169,000	153,000	489,000	236,000	458,000	175,000	153,000

Notes:

µg/L - micrograms per liter

< - compound not detected, the associated value is the reporting limit

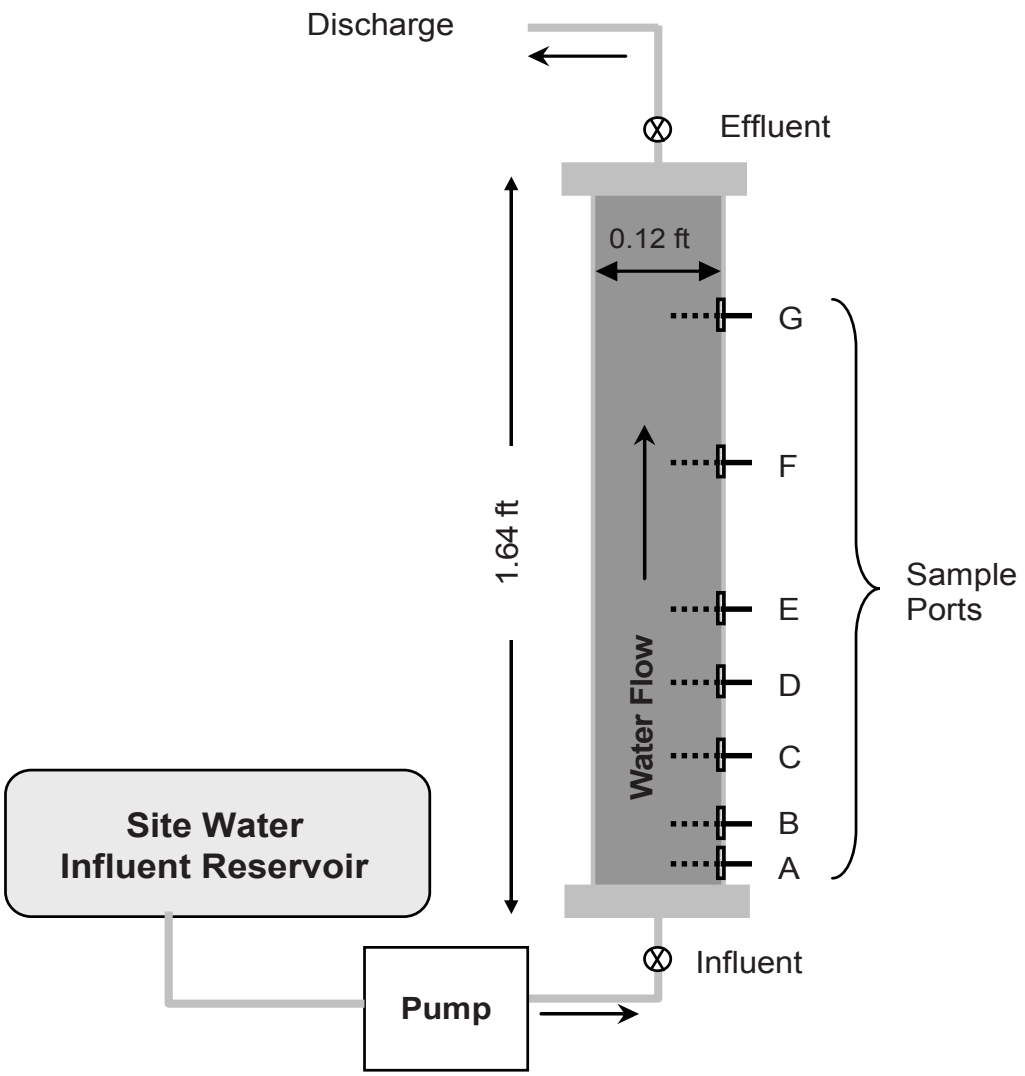
-- - sample not collected

CON - Connelly

PL - Peerless

TDS - total dissolved solids

FIGURES



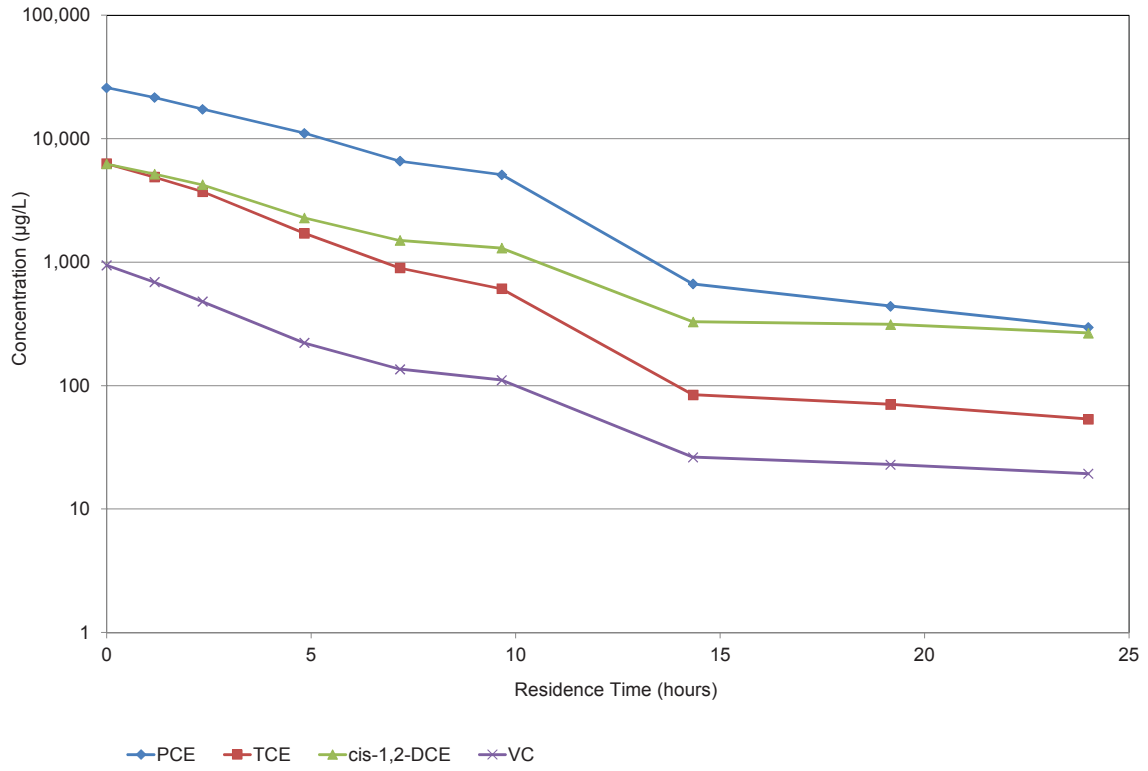
Notes:
ft - feet

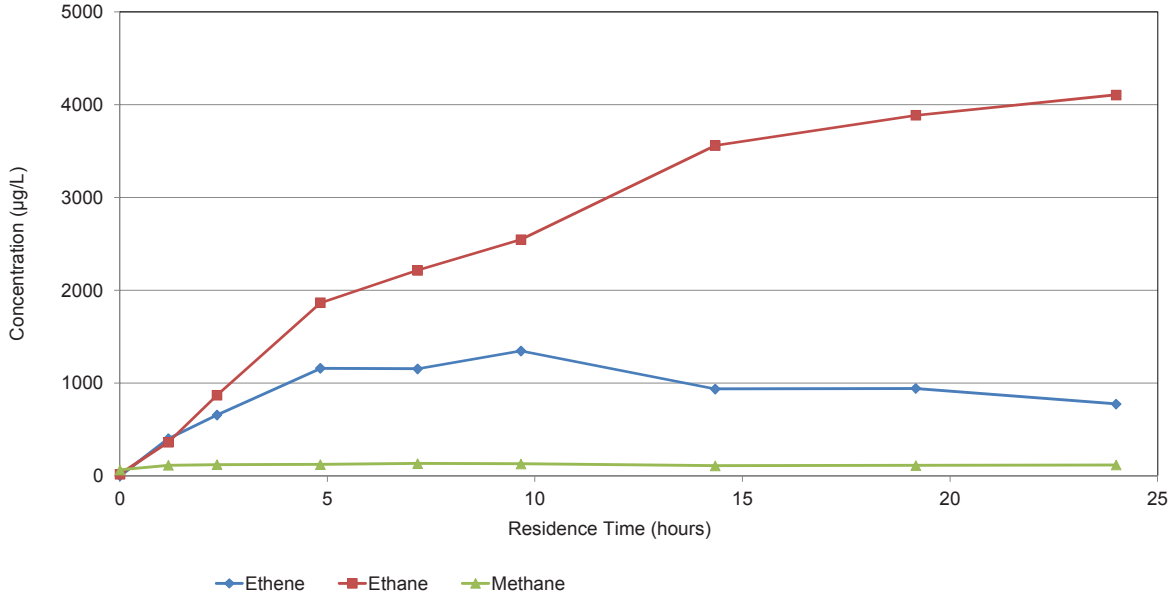
Schematic of Column Study Set Up
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

SiREM

April 2013

Figure: **1**





Connelly ZVI Column Water cVOC and DHG Concentrations Versus Residence Time at End of Study

Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

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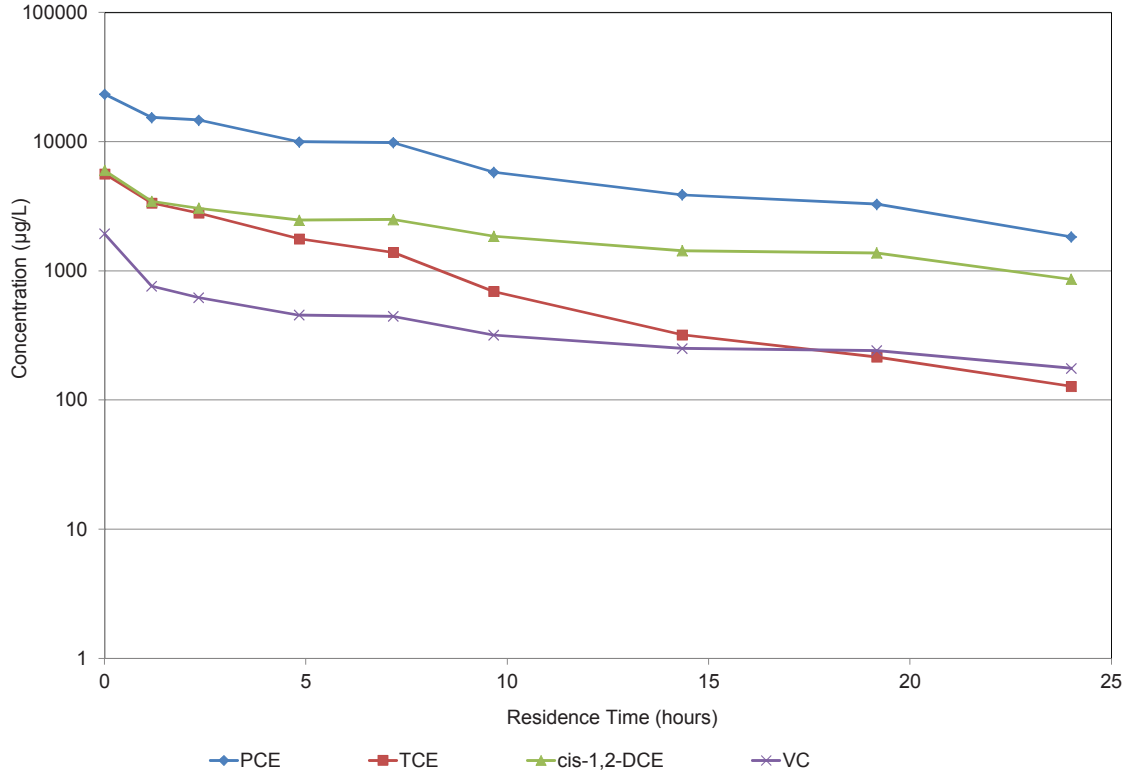
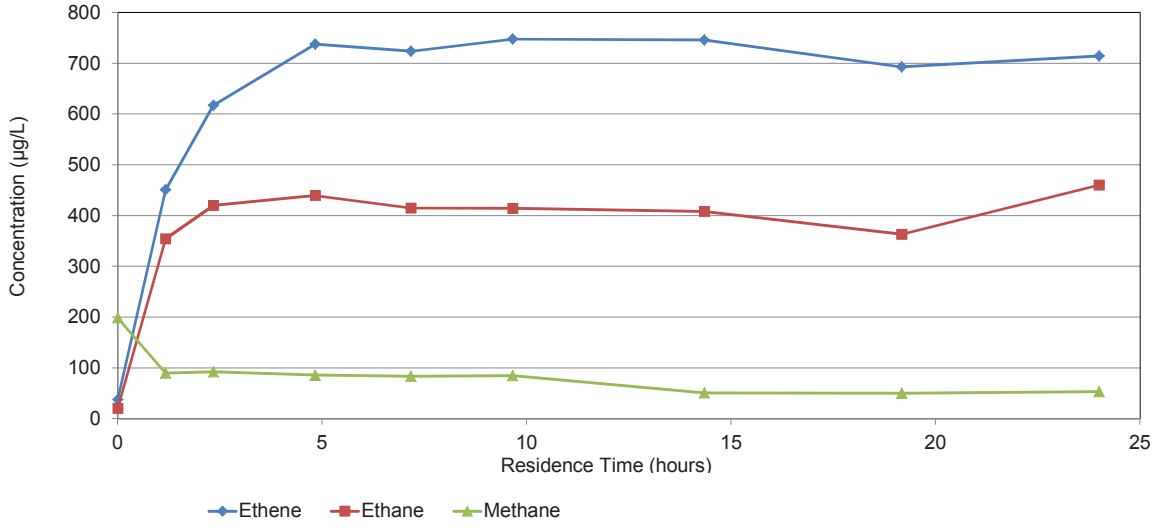
Figure: **2**

cVOC - chlorinated volatile organic compound
DHG - dissolved hydrocarbon gases





cVOC - chlorinated volatile organic compound
DHG - dissolved hydrocarbon gases

Peerless ZVI Column Water cVOC and DHG
Concentrations Versus Residence Time at End of Study
Burgess Brothers Superfund Site, Woodford and Bennington, Vermon

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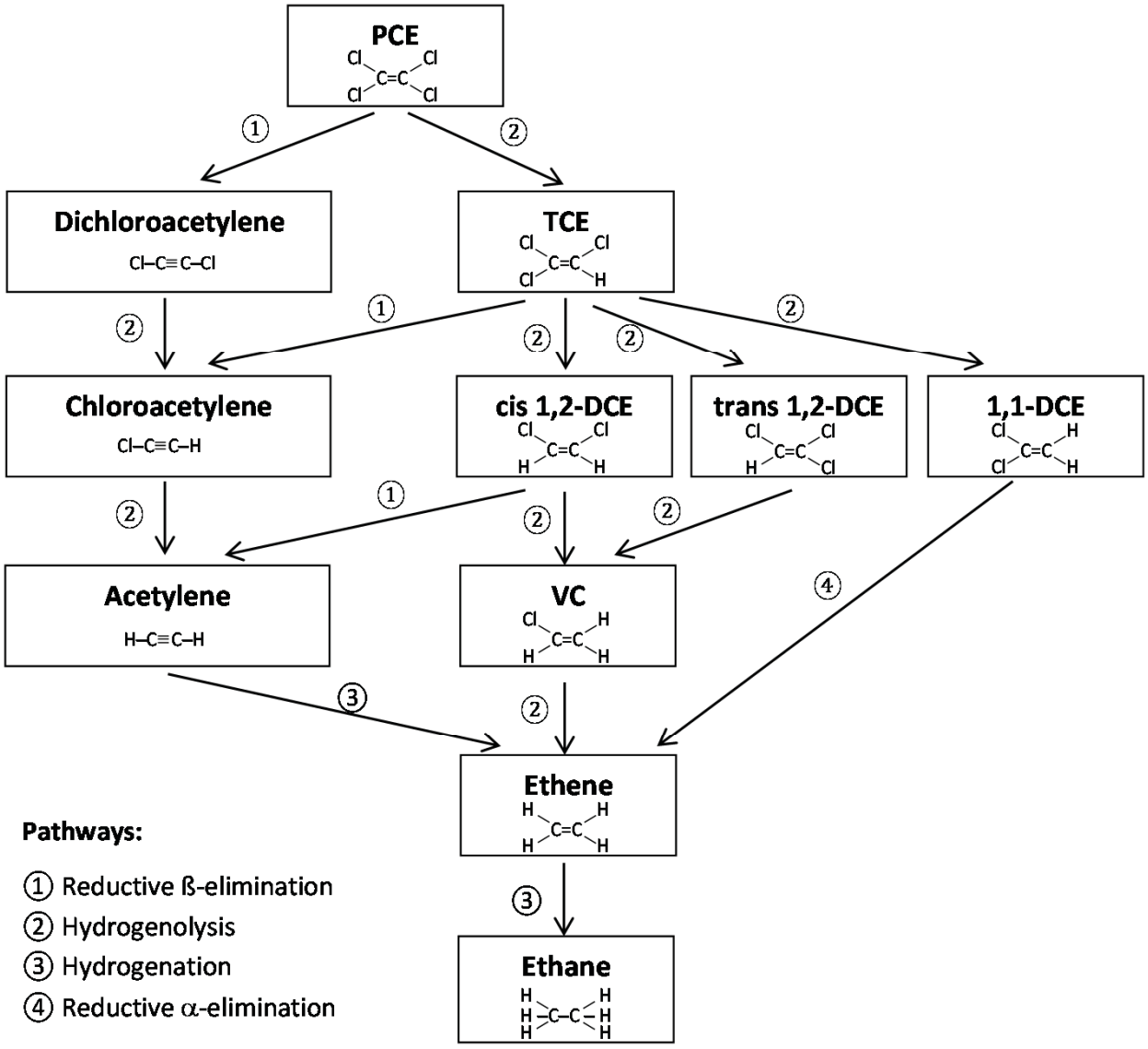
April 2013

Figure: **3**



(modified from Arnold and Roberts, 2000)

Chlorinated Ethene Degradation Pathways with ZVI

Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

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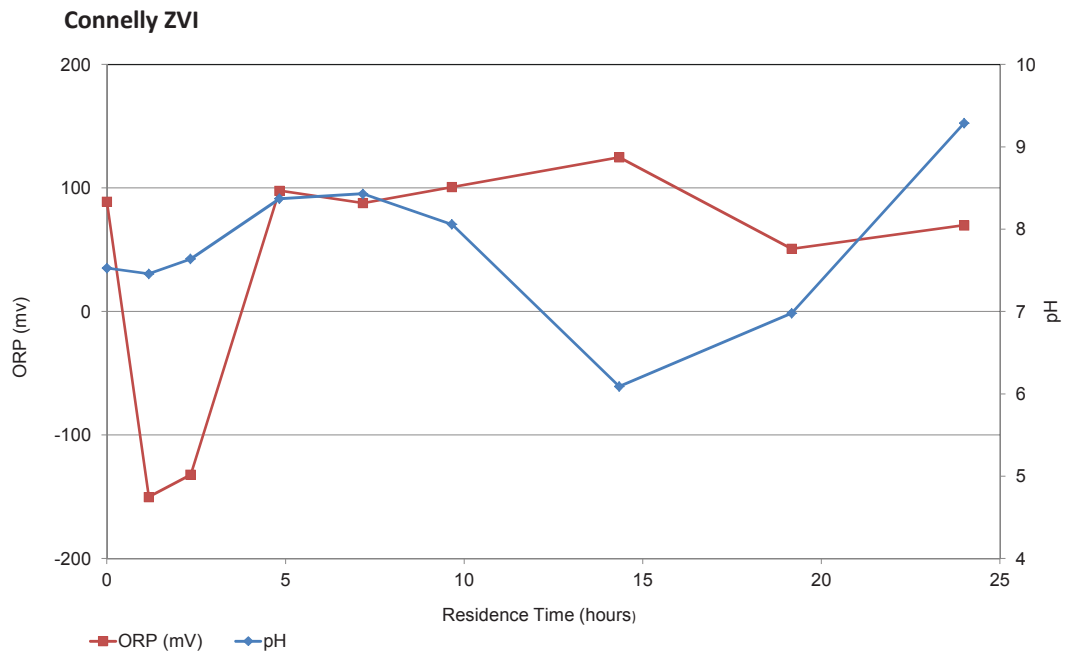
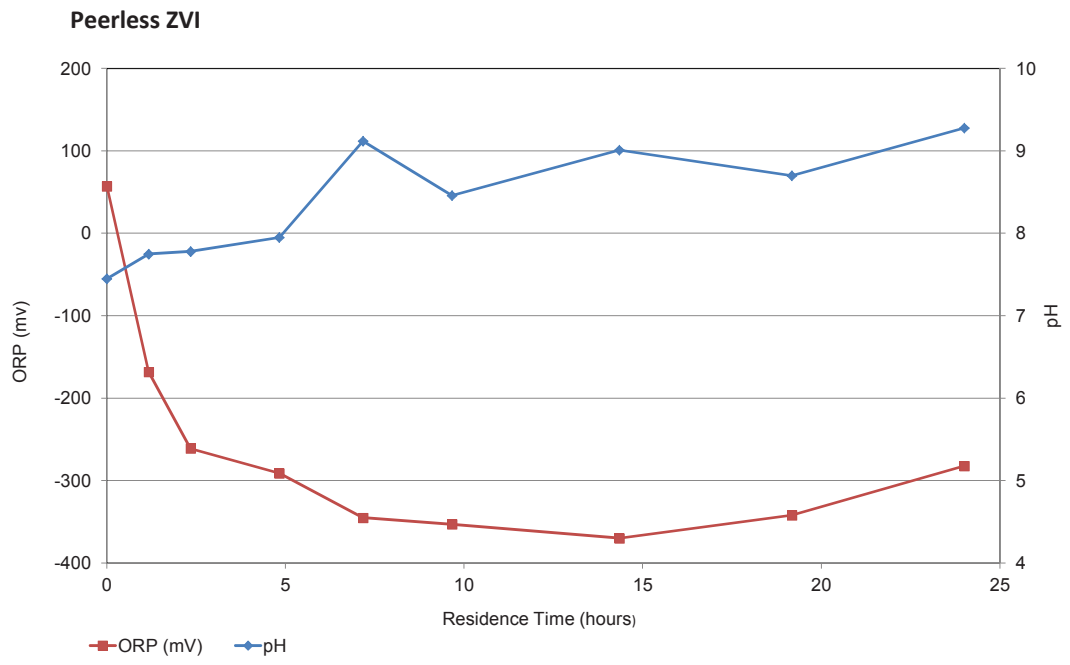
April 2013

Figure: **4**





mV - millivolts
ORP - oxidation reduction potential

ZVI Column Water ORP and pH Values
Versus Residence Time at End of Study
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont

SiREM

April 2013

Figure: **5**

APPENDIX D
Geotechnical Data

GeoTesting EXPRESS

Technologies to manage risk for infrastructure

Atlanta
Boston
Chicago
New York
San Francisco

www.geotesting.com

Transmittal

TO:

Natalie Pommersheim

Environmental Partners Group

1900 Crown Colony Drive, Suite 402

Quincy, MA 02169

DATE: 1/29/2013	GTX NO: 12185
RE: Burgess Brothers Pre-Design Investigation	

COPIES	DATE	DESCRIPTION
	1/29/2013	**October – December 2012 Laboratory Test Report**

REMARKS:

SIGNED: Joe Tomei, Laboratory Manager

CC:

APPROVED BY: Nancy Hubbard, Project Manager

GeoTesting
EXPRESS

Technologies to manage risk
for infrastructure

Atlanta
Boston
Chicago
New York
San Francisco

www.geotesting.com

January 29, 2013

Natalie Pommersheim
Environmental Partners Group
1900 Crown Colony Drive, Suite 402
Quincy, MA 02169

RE: Burgess Brothers Pre-Design Investigation, Bennington, VT (GTX-12185)

Dear Natalie:

Enclosed are the test results you requested for the above referenced project. GeoTesting Express, Inc. (GTX) received 17 samples from you between 8/29/2012 and 9/25/2012. These samples were labeled as follows:

Boring	Sample	Depth
ML-3	ML-3-PD-GT1	27-30 ft.
PZ-1	PZ-1-PD-GT1	Kame Sand
PZ-2	PZ-2-PD-GT1	4-10 ft.
PZ-2	PZ-2-PD-GT2	15-23 ft.
PZ-2	PZ-2-PD-GT3	30-35 ft.
PZ-3	PZ-3-PD-GT1	9-18 ft.
PZ-5	PZ-5-PD-GT1	3.5-11.5 ft.
PZ-5/6	PZ-5/6-PD-GT1	13-21.5/16-17 ft.
PZ-5/6	PZ-5/6-PD-GT2	21-25/17-18 ft.
PZ-7	PZ-7-PD-GT1	2-4 ft.
PZ-7	PZ-7-PD-GT2	4-10 ft.
PZ-7D	PZ-7D-PD-GT1	30-35 ft.
PZ-9	PZ-9-PD-GT1	5-20 ft.
PZ-9	PZ-9-PD-GT2	23-25 ft.
PZ-10	PZ-10-PD-GT1	5-7 ft.
PZ-10	PZ-10-PD-GT2	13-18 ft.
PZ-10	PZ-10-PD-GT3	27-30 ft.

GTX performed the following tests on these samples:

5 ASTM D 2216 - Moisture Content
5 ASTM D 2487 - Soil Classification
6 ASTM D 1557 - Modified Proctors
5 ASTM D 422 - Combined Gradation Analyses
5 ASTM D 4318 - Atterberg Limits
5 ASTM D 7263 - Density (Unit Weight) of Soil Specimens
6 ASTM D 3080 - Three-Point Direct Shear Test Series

All direct shear test specimens were remolded using moderate effort at the moisture content specified by you. The moisture contents used for each sample are listed on the individual test reports.

The results presented in this report apply only to the items tested. This report shall not be reproduced except in full, without written approval from GeoTesting Express. The remainder of these samples were returned to you on 01/18/2013 for proper disposal. Please call me if you have any questions or require additional information. Thank you for allowing GeoTesting Express the opportunity of providing you with testing services. We look forward to working with you again in the future.

Respectfully yours,

Joe Tomei
Laboratory Manager

Atlanta
Boston
Chicago
New York
San Francisco

www.geotesting.com

GeoTesting EXPRESS

Technologies to manage risk for infrastructure

Geotechnical Test Report

1/29/2013

GTX-12185
Burgess Brothers Pre-Design Investigation

Bennington, VT

Client Project No.: 106-1203.00

Prepared for:

Environmental Partners Group

Client:	Environmental Partners Group				
Project:	Burgess Brothers Pre-Design Investigation				
Location:	Bennington, VT			Project No:	GTX-12185
Boring ID: ---		Sample Type: ---		Tested By:	jek
Sample ID:---		Test Date:	10/17/12	Checked By:	jdt
Depth : ---		Sample Id: ---			

Moisture Content of Soil - ASTM D 2216-05

Boring ID	Sample ID	Depth	Description	Moisture Content,%
PZ-1	PZ-1-PD-GT1	Kame Sand	Moist, yellowish brown sandy silt	7.8
PZ-5/6	PZ-5/6-PD-GT1	13-21.5/16-17 ft.	Moist, light yellowish brown silty sand with gravel	9.5
PZ-7	PZ-7-PD-GT1	2-4 ft.	Moist, dark yellowish brown silty sand	14
PZ-9	PZ-9-PD-GT2	23-25 ft.	Moist, light olive brown silty sand with gravel	8.7
PZ-10	PZ-10-PD-GT1	5-7 ft.	Moist, dark olive brown silty gravel with sand	14

Notes: Temperature of Drying : 110º Celsius

Client:	Environmental Partners Group		
Project:	Burgess Brothers Pre-Design Investigation		
Location:	Bennington, VT	Project No:	GTX-12185
Boring ID: ---	Sample Type: ---	Tested By:	cam
Sample ID:---	Test Date: 10/17/12	Checked By:	jdt
Depth : ---	Test Id: 250390		

USCS Classification - ASTM D 2487-06

Boring ID	Sample ID	Depth	Group Name	Group Symbol	Gravel, %	Sand, %	Fines, %
PZ-1	PZ-1-PD-GT1	Kame Sand	Sandy silt	ML	7.5	38.8	53.7
PZ-5/6	PZ-5/6-PD-GT1	13-21.5/16-17 ft.	Silty sand with gravel	SM	26.0	34.3	39.7
PZ-7	PZ-7-PD-GT1	2-4 ft.	Silty sand	SM	10.8	42.0	47.2
PZ-9	PZ-9-PD-GT2	23-25 ft.	Silty sand with gravel	SM	30.6	53.0	16.4
PZ-10	PZ-10-PD-GT1	5-7 ft.	Silty gravel with sand	GM	45.0	37.7	17.3

Remarks: Grain Size analysis performed by ASTM D422, results enclosed
Atterbeg Limits performed by ASTM 4318, results enclosed

GeoTesting EXPRESS

Client:	Environmental Partners Group
Project Name:	Burgess Brother Pre-Design Investigation
Project Location:	Bennington, VT
GTX #:	12185
Test Date:	10/17/12
Tested By:	jek
Checked By:	jdt

Density (Unit Weight) of Soil by ASTM D 7263

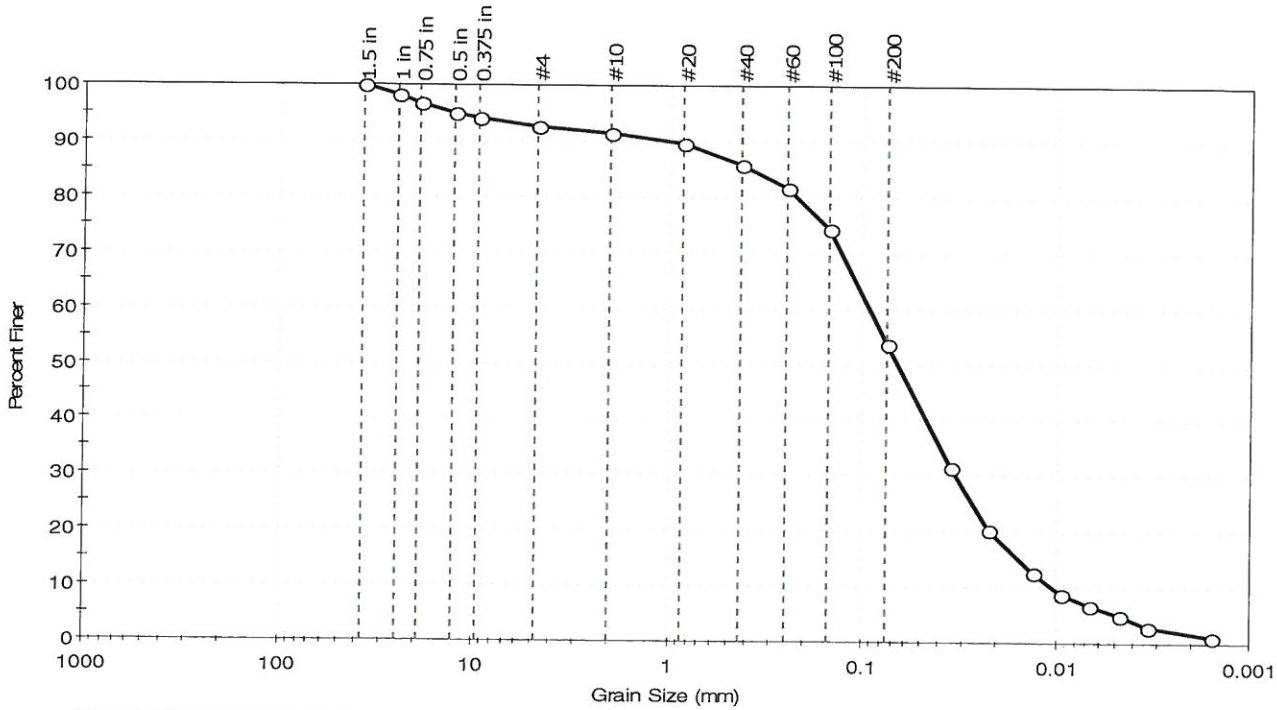
Boring ID	Sample ID	Depth, ft	Visual Description	Bulk Density, lb/ft^3	Moisture Content, %	Dry Density, lb/ft^3
PZ-1	PZ-1-PD-GT1	Kame Sand	Moist, yellowish brown sandy silt	100	7.8	92.4
PZ-5/6	PZ-5/6-PD-GT1	13-21.5/16-17	Moist, light yellowish brown silty sand with gravel	141	9.5	129
PZ-7	PZ-7-PD-GT1	2-4	Moist, dark yellowish brown silty sand	114	14.0	100
PZ-9	PZ-9-PD-GT2	23-25	Moist, light olive brown silty sand with gravel	122	8.7	113
PZ-10	PZ-10-PD-GT1	5-7	Moist, dark olive brown silty gravel with sand	133	14.0	117

Notes: Density determined on disturbed samples by hand compacting into a container of known volume, measuring mass of soil and calculating.

Moisture content determined bv ASTM D 2216 at 110° C

Client:	Environmental Partners Group		
Project:	Burgess Brothers Pre-Design Investigation		
Location:	Bennington, VT	Project No:	GTX-12185
Boring ID: PZ-1	Sample Type: bucket	Tested By:	jbr
Sample ID:PZ-1-PD-GT1	Test Date: 09/28/12	Checked By:	jdt
Depth : Kame Sand	Test Id: 250386		
Test Comment:	---		
Sample Description:	Moist, yellowish brown sandy silt		
Sample Comment:	---		

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	7.5	38.8	53.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	98		
0.75 in	19.00	97		
0.5 in	12.70	95		
0.375 in	9.50	94		
#4	4.75	92		
#10	2.00	91		
#20	0.85	90		
#40	0.42	86		
#60	0.25	82		
#100	0.15	74		
#200	0.075	54		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0347	32		
---	0.0222	20		
---	0.0132	13		
---	0.0094	9		
---	0.0067	7		
---	0.0047	5		
---	0.0034	3		
---	0.0016	1		

Coefficients

D_{85} = 0.3768 mm D_{30} = 0.0325 mm
D_{60} = 0.0928 mm D_{15} = 0.0155 mm
D_{50} = 0.0659 mm D_{10} = 0.0105 mm
C_u = N/A C_c = N/A

Classification

ASTM Sandy silt (ML)

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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Client:	Environmental Partners Group		
Project:	Burgess Brothers Pre-Design Investigation		
Location:	Bennington, VT	Project No:	GTX-12185
Boring ID: PZ-1	Sample Type: bucket	Tested By:	cam
Sample ID:PZ-1-PD-GT1	Test Date: 09/27/12	Checked By:	jdt
Depth : Kame Sand	Test Id: 250381		
Test Comment:	---		
Sample Description:	Moist, yellowish brown sandy silt		
Sample Comment:	---		

Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	PZ-1-PD-GT1	PZ-1	Kame Sand	8	n/a	n/a	n/a	n/a	Sandy silt (ML)

14% Retained on #40 Sieve

Dry Strength: MEDIUM

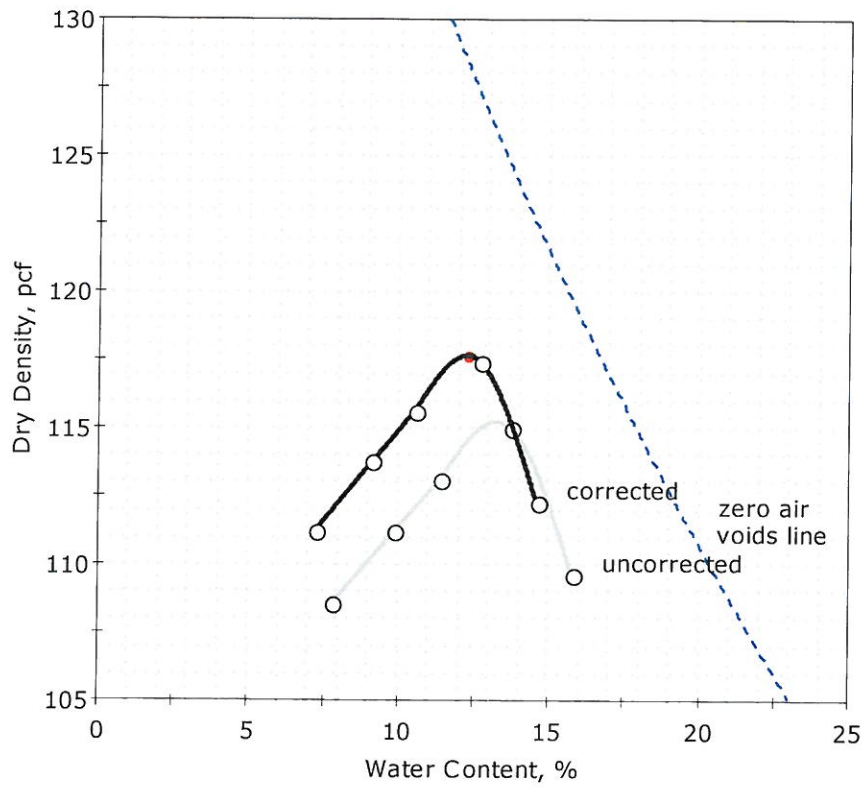
Dilentancy: RAPID

Toughness: n/a

The sample was determined to be Non-Plastic

Client:	Environmental Partners Group		
Project:	Burgess Brothers Pre-Design Investigation		
Location:	Bennington, VT	Project No:	GTX-12185
Boring ID: PZ-1	Sample Type: bucket	Tested By:	cwd
Sample ID:PZ-1-PD-GT1	Test Date: 09/28/12	Checked By:	jdt
Depth : Kame Sand	Test Id: 250402		
Test Comment:	material re-used for compaction		
Sample Description:	Moist, yellowish brown sandy silt		
Sample Comment:	---		

Compaction Report - ASTM D 1557



Data Points	Point 1	Point 2	Point 3	Point 4	Point 5
Dry density, pcf	108.5	111.2	113.1	115.0	109.6
Moisture Content, %	7.8	9.9	11.4	13.7	15.8

Method : A

Preparation : WET

As received Moisture :

Rammer : Manual

Zero voids line based on assumed specific gravity of 2.75

Maximum Dry Density= 115.0 pcf
Optimum Moisture= 13.0 %

Oversize Correction (7.5% > #4 Sieve)
Corrected Maximum Dry Density= 117.5 pcf
Corrected Optimum Moisture= 12.5 %
Assumed Average Bulk Specific Gravity = 2.55

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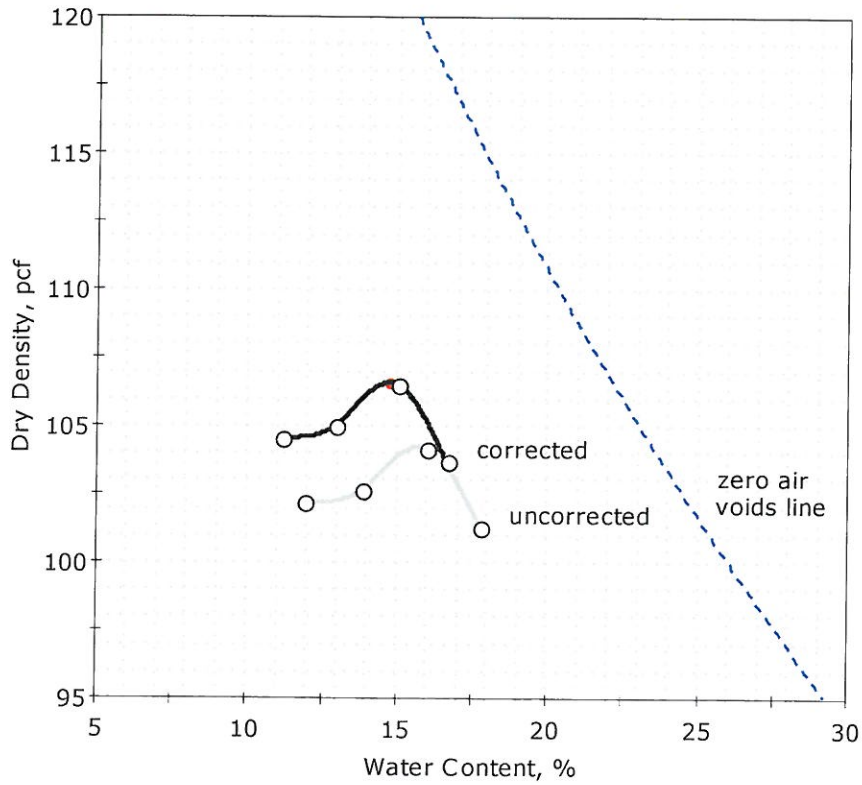
Client:	Environmental Partners Group		
Project:	Burgess Brothers Pre-Design Investigation		
Location:	Bennington, VT	Project No:	GTX-12185
Boring ID: PZ-2	Sample Type: bucket	Tested By:	cwd
Sample ID:PZ-2-PD-GT1	Test Date: 10/01/12	Checked By:	jdt
Depth : 4-10 ft.	Test Id: 248474		
Test Comment:	---		
Sample Description:	Moist, light olive brown silty sand		
Sample Comment:	---		

Compaction Report - ASTM D 1557



Data Points	Point 1	Point 2	Point 3	Point 4
Dry density, pcf	102.2	102.6	104.2	101.3
Moisture Content, %	11.9	13.8	16.0	17.8

Method : A

Preparation : WET

As received Moisture :

Rammer : Manual

Zero voids line based on assumed specific gravity of 2.75

Maximum Dry Density= 104.0 pcf

Optimum Moisture= 15.5 %

Oversize Correction (6.4% > #4 Sieve)

Corrected Maximum Dry Density= 106.5 pcf

Corrected Optimum Moisture= 14.5 %

Assumed Average Bulk Specific Gravity = 2.55

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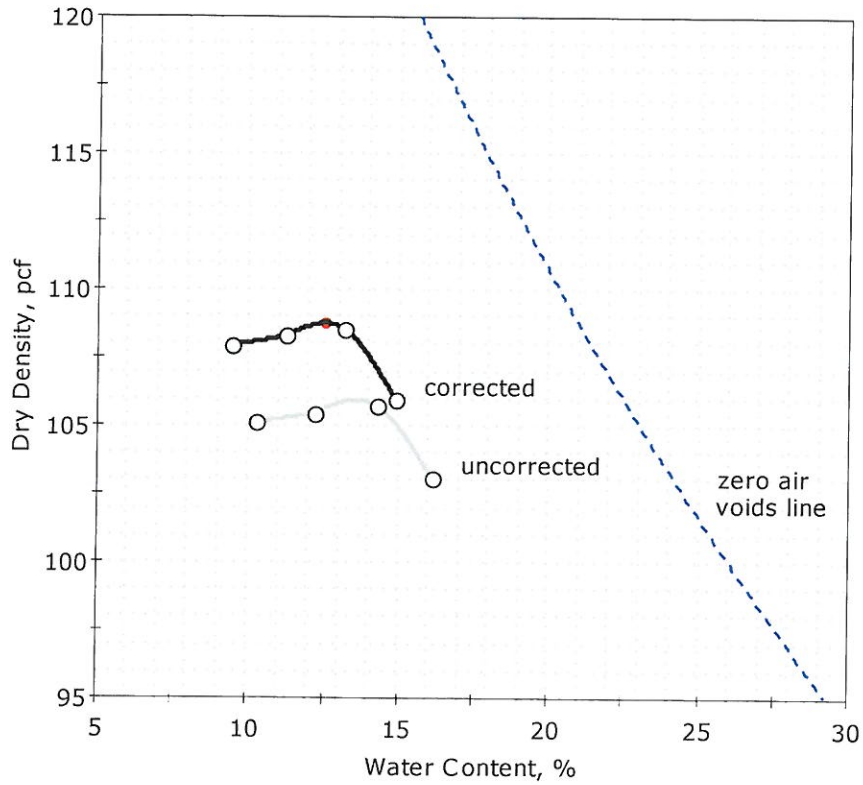
Client:	Environmental Partners Group		
Project:	Burgess Brothers Pre-Design Investigation		
Location:	Bennington, VT	Project No:	GTX-12185
Boring ID: PZ-5	Sample Type: bucket	Tested By:	cwd
Sample ID:PZ-5-PD-GT1	Test Date: 10/17/12	Checked By:	jdt
Depth : 3.5-11.5 ft.	Test Id: 248478		
Test Comment:	---		
Sample Description:	Moist, light olive brown silty sand		
Sample Comment:	---		

Compaction Report - ASTM D 1557



Data Points	Point 1	Point 2	Point 3	Point 4
Dry density, pcf	105.1	105.5	105.7	103.1
Moisture Content, %	10.2	12.2	14.2	16.1

Method : A

Preparation : WET

As received Moisture :

Rammer : Manual

Zero voids line based on assumed specific gravity of 2.75

Maximum Dry Density= 106.0 pcf
Optimum Moisture= 13.5 %

Oversize Correction (7.8% > #4 Sieve)
Corrected Maximum Dry Density= 109.0 pcf
Corrected Optimum Moisture= 12.5 %
Assumed Average Bulk Specific Gravity = 2.55

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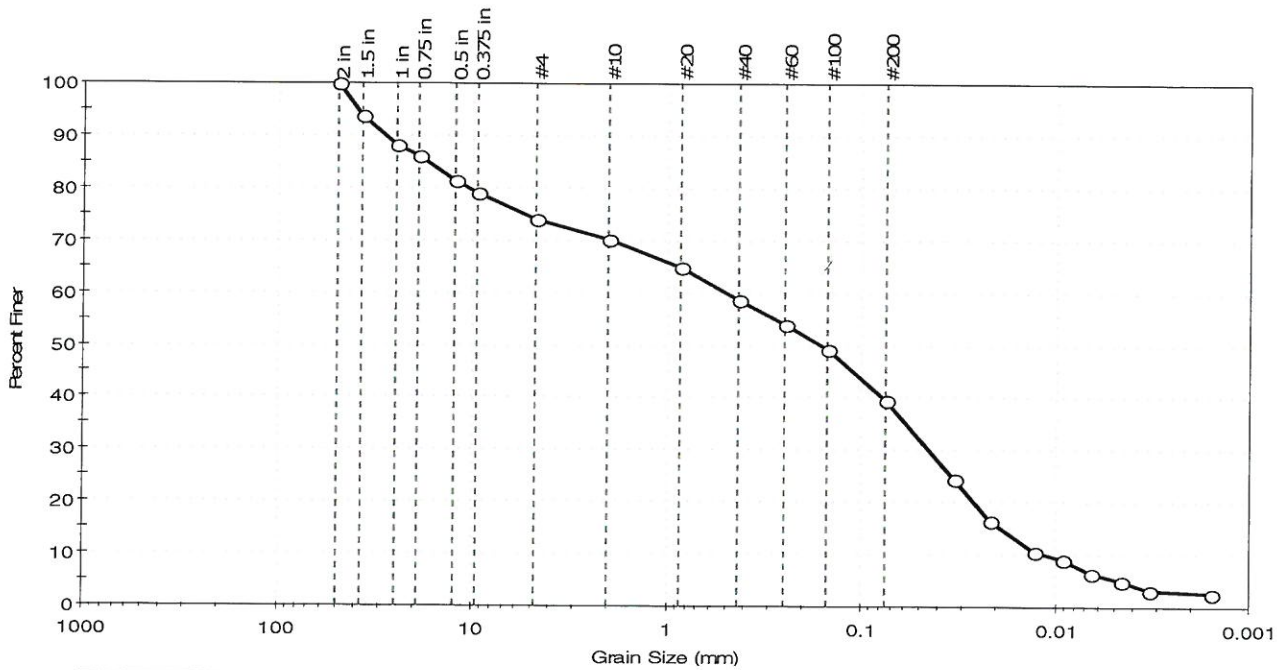
Client:	Environmental Partners Group		
Project:	Burgess Brothers Pre-Design Investigation		
Location:	Bennington, VT	Project No:	GTX-12185
Boring ID: PZ-5/6	Sample Type: bucket	Tested By:	jbr
Sample ID:PZ-5/6-PD-GT1	Test Date: 09/27/12	Checked By:	jdt
Depth : 13-21.5/16-17 ft.	Test Id: 250382		
Test Comment:	---		
Sample Description:	Moist, light yellowish brown silty sand with gravel		
Sample Comment:	---		

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	26.0	34.3	39.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
2 in	50.00	100		
1.5 in	37.50	94		
1 in	25.00	88		
0.75 in	19.00	86		
0.5 in	12.50	82		
0.375 in	9.50	79		
#4	4.75	74		
#10	2.00	70		
#20	0.85	65		
#40	0.42	59		
#60	0.25	54		
#100	0.15	49		
#200	0.075	40		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0331	24		
---	0.0217	16		
---	0.0129	10		
---	0.0092	9		
---	0.0066	7		
---	0.0047	5		
---	0.0033	3		
---	0.0016	3		

Coefficients

D_{85} = 17.2467 mm	D_{30} = 0.0448 mm
D_{60} = 0.4926 mm	D_{15} = 0.0191 mm
D_{50} = 0.1611 mm	D_{10} = 0.0115 mm
C_u = N/A	C_c = N/A

Classification

ASTM Silty sand with gravel (SM)

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Client:	Environmental Partners Group		
Project:	Burgess Brothers Pre-Design Investigation		
Location:	Bennington, VT	Project No:	GTX-12185
Boring ID: PZ-5/6	Sample Type: bucket	Tested By:	cam
Sample ID:PZ-5/6-PD-GT1	Test Date: 09/27/12	Checked By:	jdt
Depth : 13-21.5/16-17 ft.	Test Id: 250377		
Test Comment: ---			
Sample Description: Moist, light yellowish brown silty sand with gravel			
Sample Comment: ---			

Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	PZ-5/6-PD-GT1	PZ-5/6	-21.5/16-ft.	9	n/a	n/a	n/a	n/a	Silty sand with gravel (SM)

43% Retained on #40 Sieve

Dry Strength: HIGH

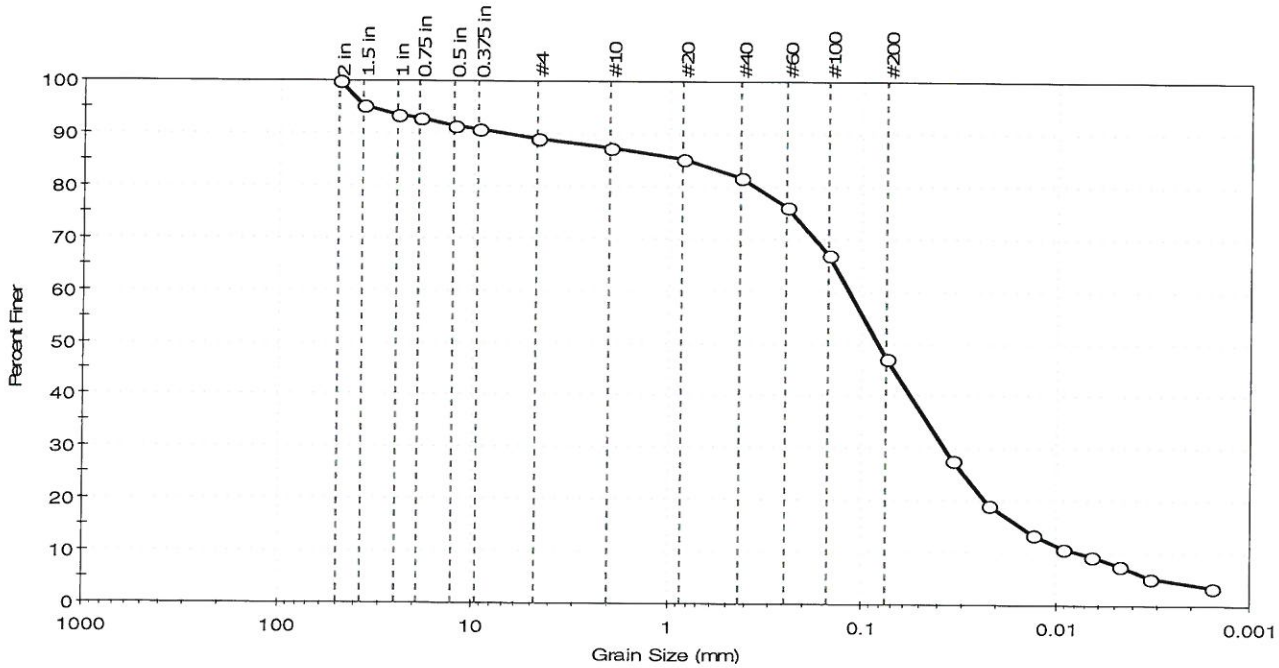
Dilentancy: RAPID

Toughness: n/a

The sample was determined to be Non-Plastic

Client:	Environmental Partners Group		
Project:	Burgess Brothers Pre-Design Investigation		
Location:	Bennington, VT	Project No:	GTX-12185
Boring ID: PZ-7	Sample Type: bucket	Tested By:	jbr
Sample ID:PZ-7-PD-GT1	Test Date: 09/28/12	Checked By:	jdt
Depth : 2-4 ft.	Test Id: 250383		
Test Comment:	---		
Sample Description:	Moist, dark yellowish brown silty sand		
Sample Comment:	---		

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	10.8	42.0	47.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
2 in	50.00	100		
1.5 in	37.50	95		
1 in	25.00	94		
0.75 in	19.00	93		
0.5 in	12.70	91		
0.375 in	9.50	91		
#4	4.75	89		
#10	2.00	87		
#20	0.85	85		
#40	0.42	82		
#60	0.25	76		
#100	0.15	67		
#200	0.075	47		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0345	28		
---	0.0221	19		
---	0.0131	13		
---	0.0093	11		
---	0.0066	9		
---	0.0047	8		
---	0.0033	5		
---	0.0016	3		

Coefficients

D_{85} = 0.8154 mm	D_{30} = 0.0379 mm
D_{60} = 0.1171 mm	D_{15} = 0.0150 mm
D_{50} = 0.0826 mm	D_{10} = 0.0076 mm
C_u = N/A	C_c = N/A

Classification

ASTM Silty sand (SM)

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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Client:	Environmental Partners Group		
Project:	Burgess Brothers Pre-Design Investigation		
Location:	Bennington, VT	Project No:	GTX-12185
Boring ID: PZ-7	Sample Type: bucket	Tested By:	cam
Sample ID:PZ-7-PD-GT1	Test Date: 09/27/12	Checked By:	jdt
Depth : 2-4 ft.	Test Id: 250378		
Test Comment:	---		
Sample Description:	Moist, dark yellowish brown silty sand		
Sample Comment:	---		

Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	PZ-7-PD-GT1	PZ-7	2-4 ft.	14	n/a	n/a	n/a	n/a	Silty sand (SM)

19% Retained on #40 Sieve

Dry Strength: HIGH

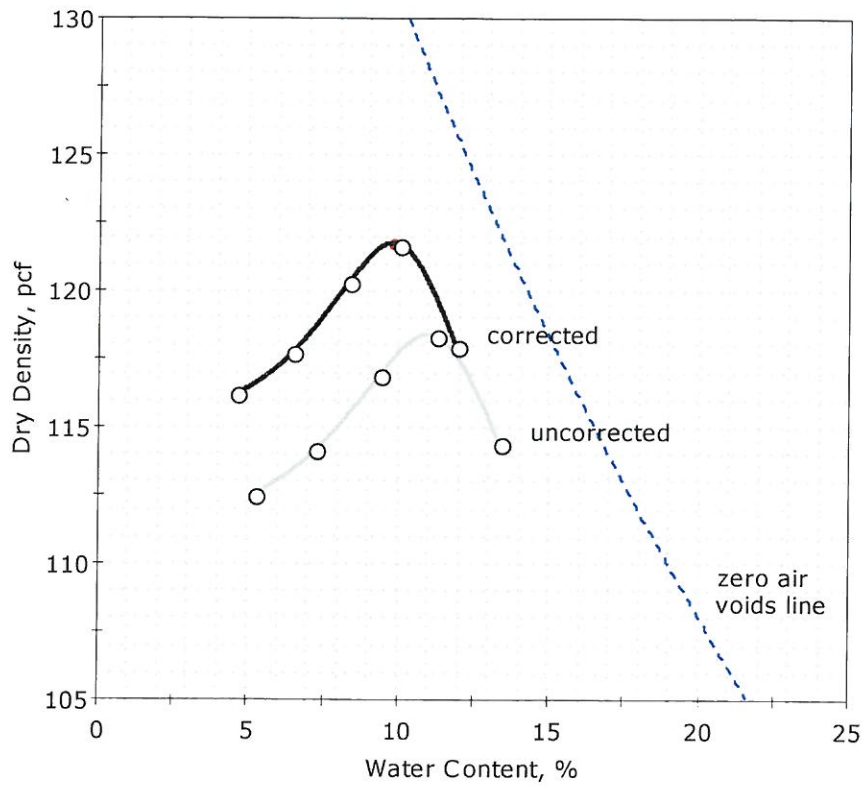
Dilentancy: RAPID

Toughness: n/a

The sample was determined to be Non-Plastic

Client:	Environmental Partners Group		
Project:	Burgess Brothers Pre-Design Investigation		
Location:	Bennington, VT	Project No:	GTX-12185
Boring ID: PZ-7	Sample Type: bucket	Tested By:	cwd
Sample ID:PZ-7-PD-GT1	Test Date: 10/01/12	Checked By:	jdt
Depth : 2-4 ft.	Test Id: 250403		
Test Comment:	material re-used for compaction		
Sample Description:	Moist, dark yellowish brown silty sand		
Sample Comment:	---		

Compaction Report - ASTM D 1557



Data Points	Point 1	Point 2	Point 3	Point 4	Point 5
Dry density, pcf	112.5	114.2	116.9	118.3	114.4
Moisture Content, %	5.2	7.3	9.4	11.2	13.4

Method : A

Preparation : WET

As received Moisture :

Rammer : Manual

Zero voids line based on assumed specific gravity of 2.65

Maximum Dry Density=	118.5 pcf
Optimum Moisture=	11.0 %
Oversize Correction	(10.8% > #4 Sieve)
Corrected Maximum Dry Density=	122.0 pcf
Corrected Optimum Moisture=	10.0 %
Assumed Average Bulk Specific Gravity =	2.55

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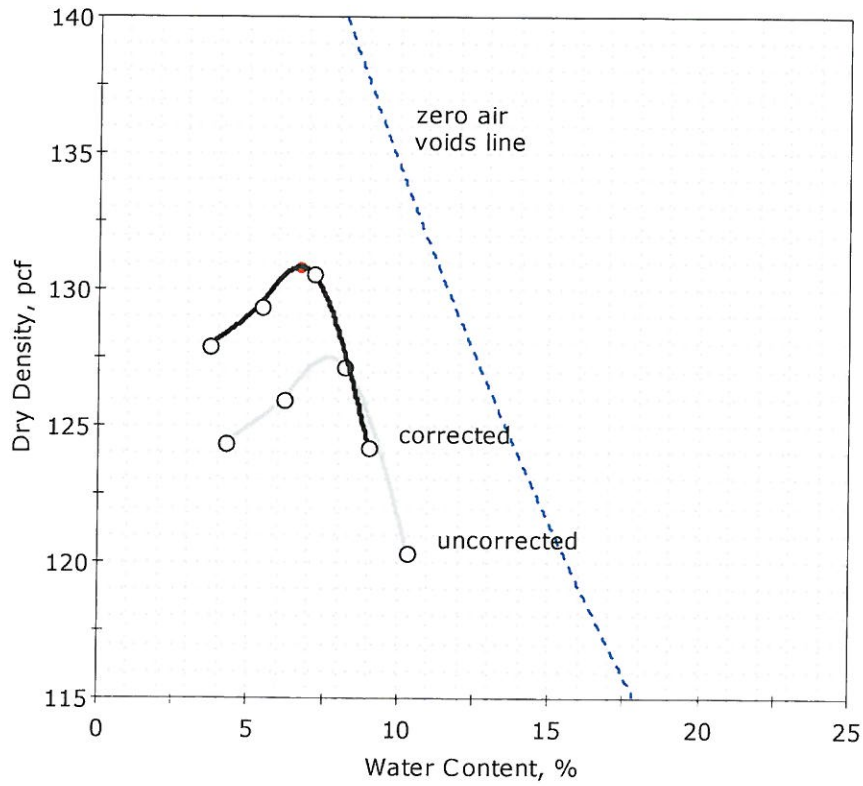
Client:	Environmental Partners Group		
Project:	Burgess Brothers Pre-Design Investigation		
Location:	Bennington, VT	Project No:	GTX-12185
Boring ID: PZ-7	Sample Type: bucket	Tested By:	cwd
Sample ID:PZ-7-PD-GT2	Test Date: 10/02/12	Checked By:	jdt
Depth : 4-10 ft.	Test Id: 248480		
Test Comment:	---		
Sample Description:	Moist, light yellowish brown sandy silt with gravel		
Sample Comment:	---		

Compaction Report - ASTM D 1557



Data Points	Point 1	Point 2	Point 3	Point 4
Dry density, pcf	124.4	126.0	127.2	120.4
Moisture Content, %	4.2	6.1	8.2	10.3

Method : B

Preparation : WET

As received Moisture :

Rammer : Manual

Zero voids line based on assumed specific gravity of 2.75

Maximum Dry Density= 127.5 pcf
Optimum Moisture= 7.5 %

Oversize Correction (12.8% > 3/8 inch Sieve)
Corrected Maximum Dry Density= 131.0 pcf
Corrected Optimum Moisture= 6.5 %
Assumed Average Bulk Specific Gravity = 2.55

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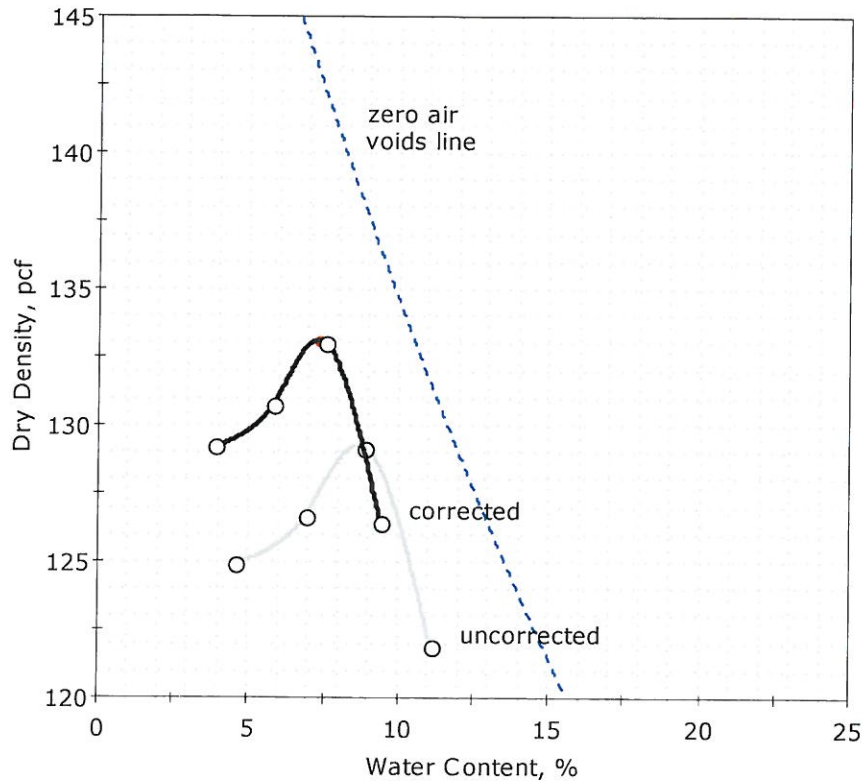
Client:	Environmental Partners Group		
Project:	Burgess Brothers Pre-Design Investigation		
Location:	Bennington, VT	Project No:	GTX-12185
Boring ID: PZ-9	Sample Type: bucket	Tested By:	cwd
Sample ID:PZ-9-PD-GT1	Test Date: 10/03/12	Checked By:	jdt
Depth : 5-20 ft.	Test Id: 248482		
Test Comment:	---		
Sample Description:	Moist, light yellowish brown sandy silt with gravel		
Sample Comment:	---		

Compaction Report - ASTM D 1557



Data Points	Point 1	Point 2	Point 3	Point 4
Dry density, pcf	124.9	126.6	129.2	121.9
Moisture Content, %	4.5	6.9	8.9	11.1

Method : A

Preparation : WET

As received Moisture :

Rammer : Manual

Zero voids line based on assumed specific gravity of 2.75

Maximum Dry Density= 129.5 pcf
Optimum Moisture= 8.5 %

Oversize Correction (15.4% > #4 Sieve)
Corrected Maximum Dry Density= 133.0 pcf
Corrected Optimum Moisture= 7.5 %
Assumed Average Bulk Specific Gravity = 2.55

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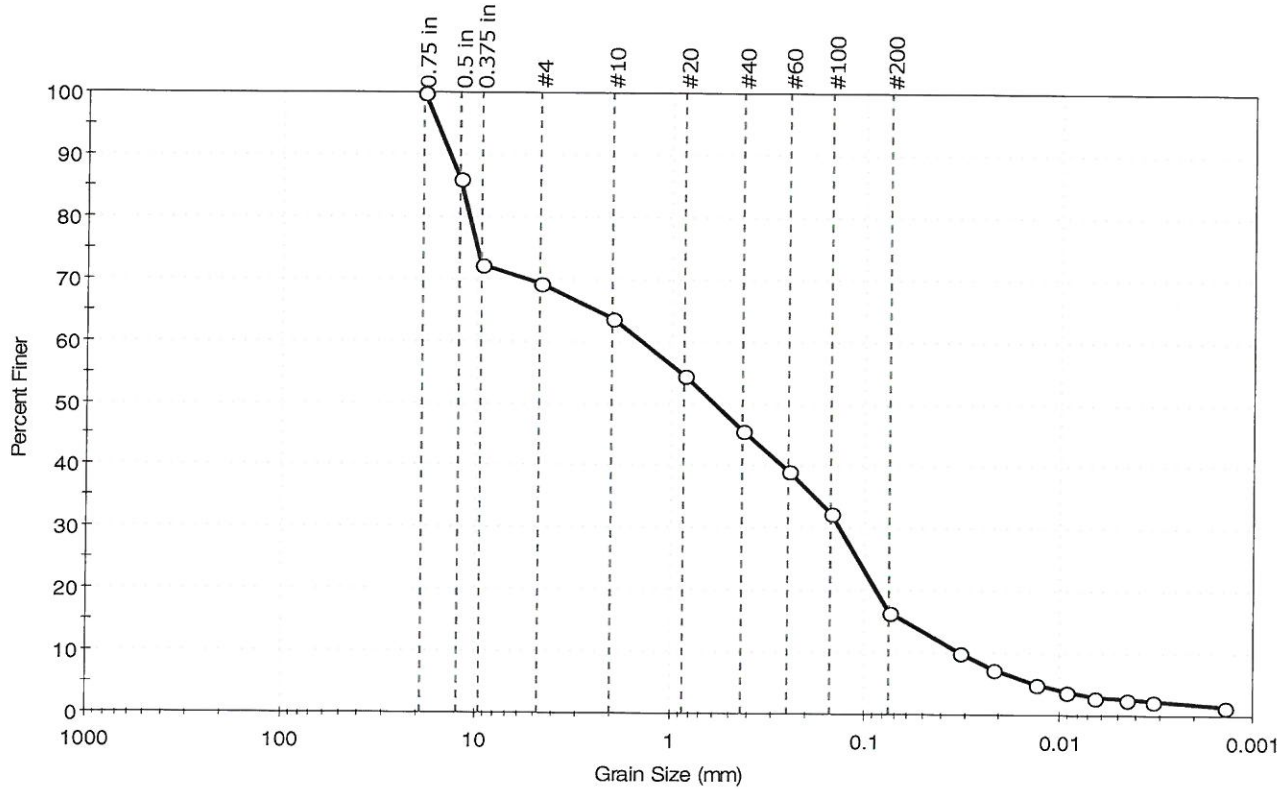
Client:	Environmental Partners Group		
Project:	Burgess Brothers Pre-Design Investigation		
Location:	Bennington, VT	Project No:	GTX-12185
Boring ID: PZ-9	Sample Type: bucket	Tested By:	jbr
Sample ID:PZ-9-PD-GT2	Test Date: 09/27/12	Checked By:	jdt
Depth : 23-25 ft.	Test Id: 250384		
Test Comment:	---		
Sample Description:	Moist, light olive brown silty sand with gravel		
Sample Comment:	---		

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	30.6	53.0	16.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	86		
0.375 in	9.50	72		
#4	4.75	69		
#10	2.00	64		
#20	0.85	55		
#40	0.42	46		
#60	0.25	39		
#100	0.15	32		
#200	0.075	16		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0327	10		
---	0.0218	7		
---	0.0130	5		
---	0.0091	4		
---	0.0066	3		
---	0.0045	3		
---	0.0033	2		
---	0.0014	2		

Coefficients

D_{85} = 12.2311 mm	D_{30} = 0.1354 mm
D_{60} = 1.4167 mm	D_{15} = 0.0626 mm
D_{50} = 0.5914 mm	D_{10} = 0.0325 mm
C_u = N/A	C_c = N/A

Classification

ASTM Silty sand with gravel (SM)

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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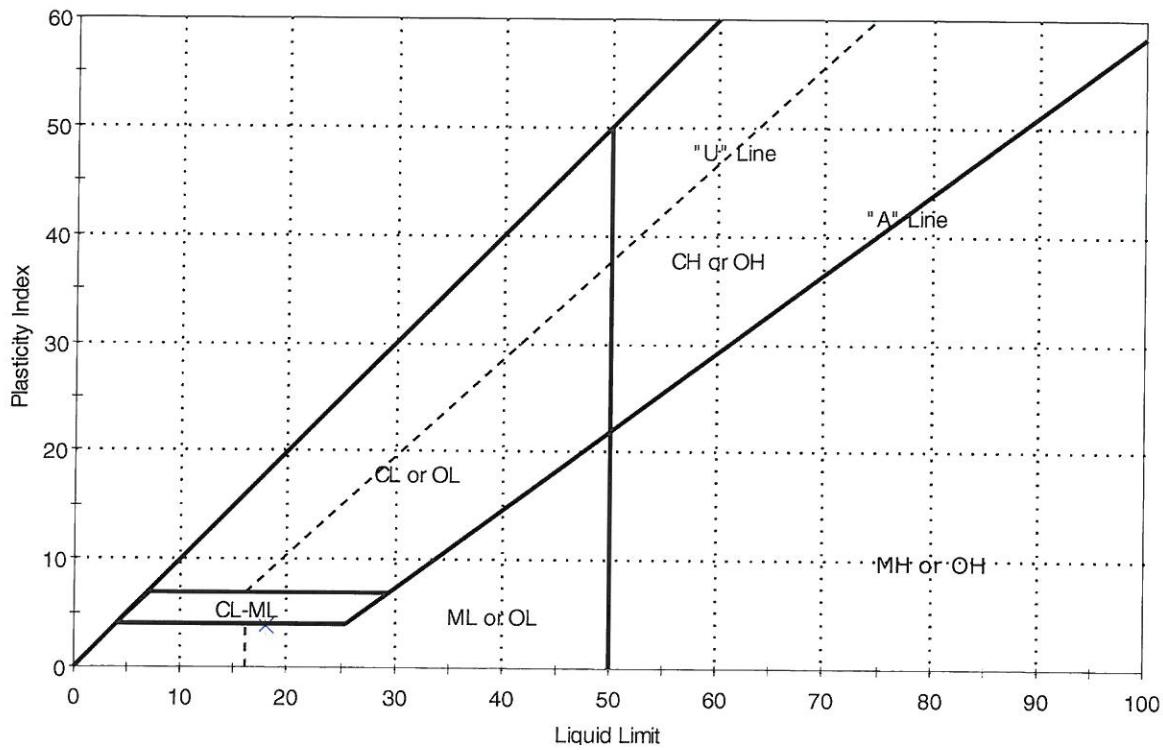
Client:	Environmental Partners Group		
Project:	Burgess Brothers Pre-Design Investigation		
Location:	Bennington, VT	Project No:	GTX-12185
Boring ID: PZ-9	Sample Type: bucket	Tested By:	cam
Sample ID:PZ-9-PD-GT2	Test Date: 09/27/12	Checked By:	jdt
Depth : 23-25 ft.	Test Id: 250379		
Test Comment:	---		
Sample Description:	Moist, light olive brown silty sand with gravel		
Sample Comment:	---		

Atterberg Limits - ASTM D 4318-05



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	PZ-9-PD-GT2	PZ-9	23-25 ft.	9	18	14	4	-1	Silty sand with gravel (SM)

Sample Prepared using the WET method

54% Retained on #40 Sieve

Dry Strength: HIGH

Dilentancy: SLOW

Toughness: LOW

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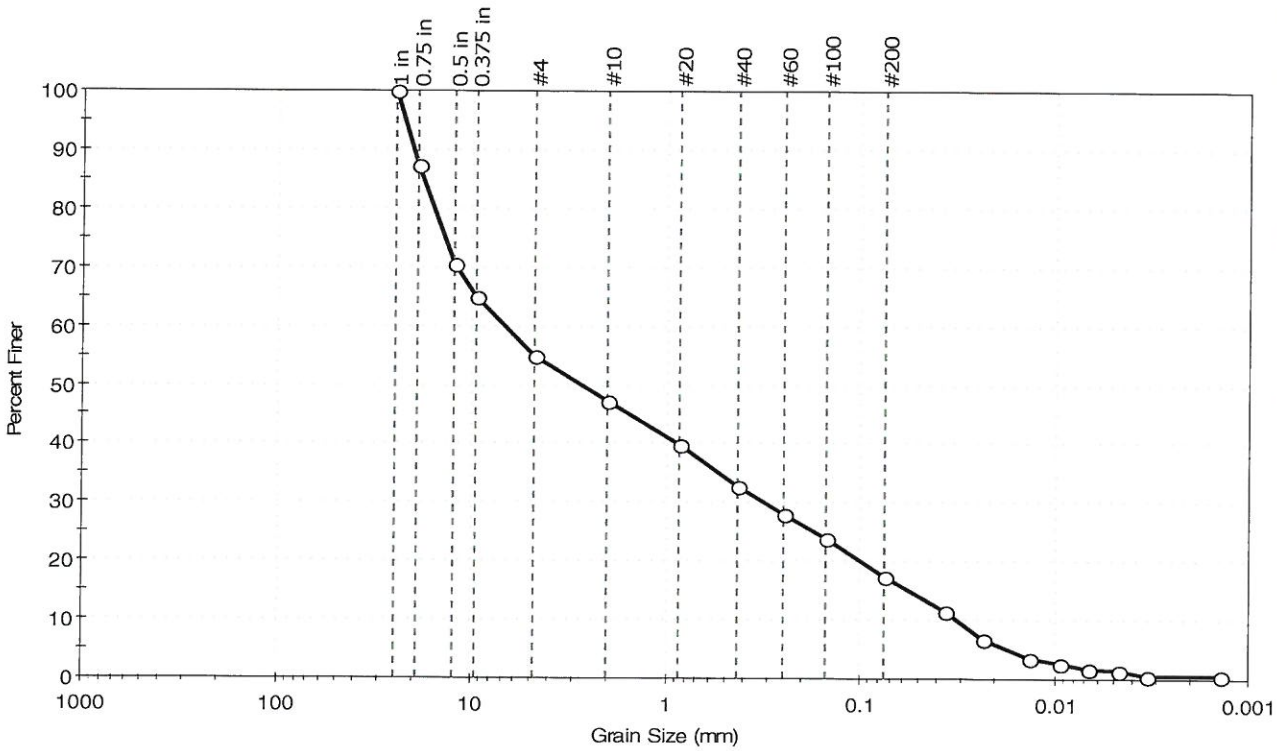
Client:	Environmental Partners Group		
Project:	Burgess Brothers Pre-Design Investigation		
Location:	Bennington, VT	Project No:	GTX-12185
Boring ID: PZ-10	Sample Type: bucket	Tested By:	jbr
Sample ID:PZ-10-PD-GT1	Test Date: 09/27/12	Checked By:	jdt
Depth : 5-7 ft.	Test Id: 250385		
Test Comment:	---		
Sample Description:	Moist, dark olive brown silty gravel with sand		
Sample Comment:	---		

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	45.0	37.7	17.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	87		
0.5 in	12.50	70		
0.375 in	9.50	65		
#4	4.75	55		
#10	2.00	47		
#20	0.85	40		
#40	0.42	33		
#60	0.25	28		
#100	0.15	24		
#200	0.075	17		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0363	11		
---	0.0231	7		
---	0.0133	4		
---	0.0094	3		
---	0.0067	2		
---	0.0047	2		
---	0.0034	1		
---	0.0014	1		

Coefficients

D_{85} = 17.9223 mm	D_{30} = 0.3108 mm
D_{60} = 6.7302 mm	D_{15} = 0.0564 mm
D_{50} = 2.7460 mm	D_{10} = 0.0316 mm
C_u = N/A	C_c = N/A

Classification

ASTM Silty gravel with sand (GM)

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

printed 10/17/2012 11:48:45 AM

Client:	Environmental Partners Group		
Project:	Burgess Brothers Pre-Design Investigation		
Location:	Bennington, VT	Project No:	GTX-12185
Boring ID: PZ-10	Sample Type: bucket	Tested By:	cam
Sample ID:PZ-10-PD-GT1	Test Date: 09/27/12	Checked By:	jdt
Depth : 5-7 ft.	Test Id: 250380		
Test Comment:	---		
Sample Description:	Moist, dark olive brown silty gravel with sand		
Sample Comment:	---		

Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	PZ-10-PD-GT1	PZ-10	5-7 ft.	14	n/a	n/a	n/a	n/a	Silty gravel with sand (GM)

67% Retained on #40 Sieve

Dry Strength: HIGH

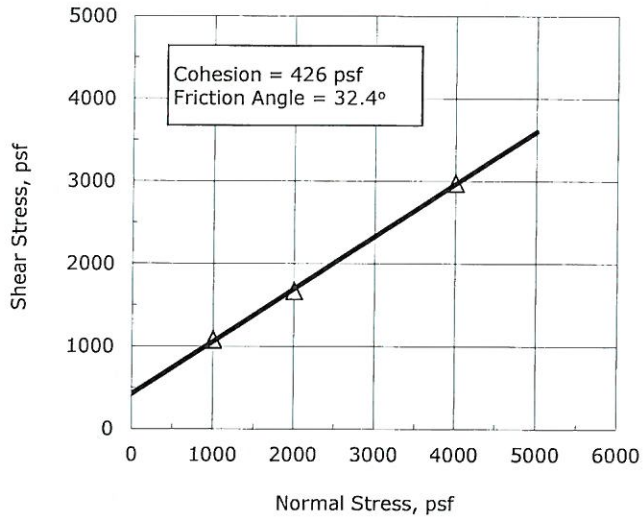
Dilentancy: RAPID

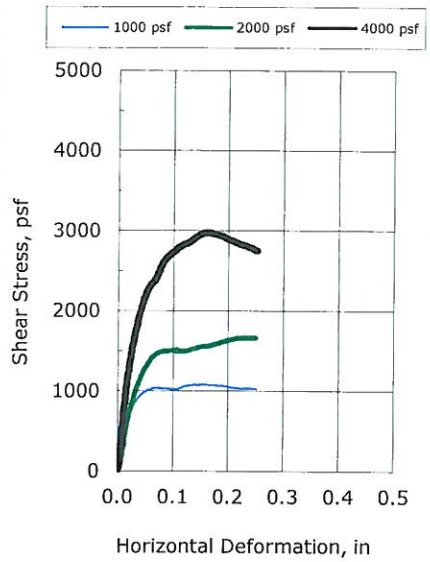
Toughness: n/a

The sample was determined to be Non-Plastic

Client:	Environmental Partners Group
Project Name:	Burgess Brothers Pre-Design Investigation
Project Location:	Bennington, VT
GTX #:	12185
Test Date:	10/18/12
Tested By:	md
Checked By:	jdt
Boring ID:	PZ-2
Sample ID:	PZ-2-PD-GT1
Depth, ft:	4-10
Visual Description:	Moist, light olive brown silty sand

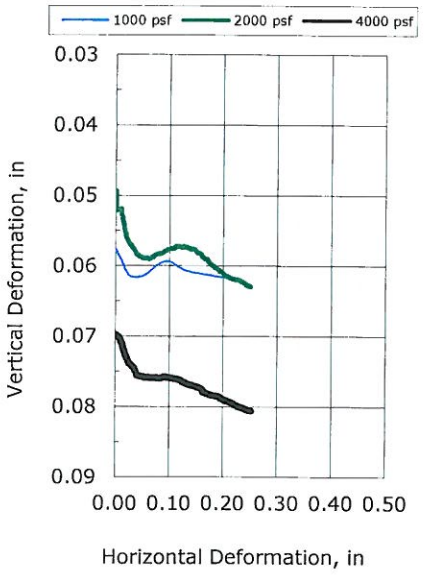
Direct Shear Test of Soils Under Consolidated Drained Conditions by ASTM D 3080





Test No.:	DS-1	DS-2	DS-3
Initial Diameter, in:	2.5	2.5	2.5
Initial Height, in:	1.0	1.0	1.0
Initial Mass, grams:	142	142	142
Initial Dry Density, pcf:	96.8	96.8	96.8
Initial Moisture Content, %:	14.2	14.2	14.2
Initial Bulk Density, pcf:	111	111	111
Initial Degree of Saturation:	53.0	53.0	53.0
Initial Void Ratio:	0.71	0.71	0.71
Final Dry Density, pcf:	103	103	105
Final Moisture Content, %:	23.0	24.5	23.6
Final Bulk Density, pcf:	127	129	130
Normal Stress, psf:	999	1999	3999
Maximum Shear Stress, psf:	1081	1668	2977
Shear Rate, in/min:	0.001	0.001	0.001

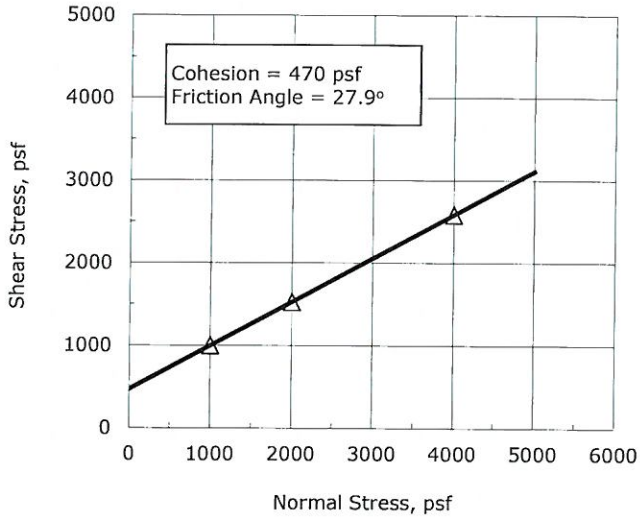
Sample Type:	remolded
Estimated Specific Gravity:	2.65
Liquid Limit:	NP
Plastic Limit:	NP
Plasticity Index:	NP
% Passing #200 sieve:	42.7
Soil Classification:	Silty sand
Group Symbol:	SM

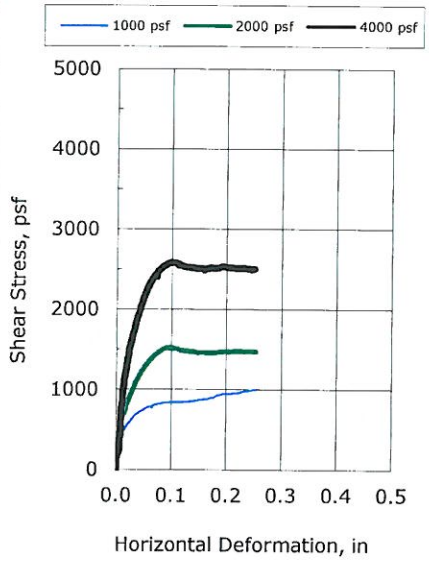


Notes:
Moisture content obtained before shear from sample trimmings
Moisture Content determined by ASTM D 2216
Percent passing #200 sieve determined by ASTM D 422
Atterberg Limit determined by ASTM D 4318
Target Compaction: Moderate Effort at 15% moisture content (values provided by client).
Values for cohesion and friction angle determined from best-fit straight line to the data for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site-specific conditions.
"---" indicates testing required to determine these values was not requested.

Client:	Environmental Partners Group
Project Name:	Burgess Brothers Pre-Design Investigation
Project Location:	Bennington, VT
GTX #:	12185
Test Date:	11/02/12
Tested By:	md
Checked By:	jdt
Boring ID:	PZ-2
Sample ID:	PZ-2-PD-GT2
Depth, ft:	15-23
Visual Description:	Moist, light yellowish brown silty sand with gravel

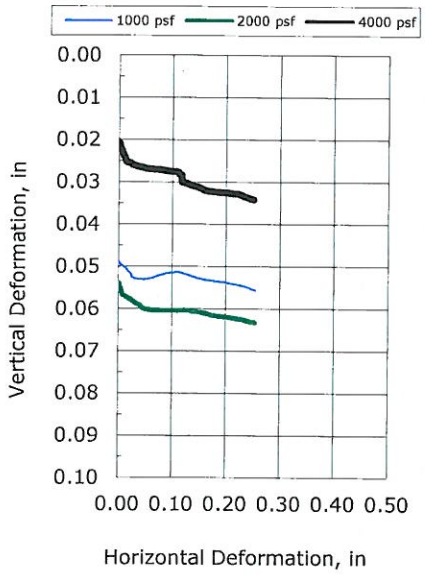
Direct Shear Test of Soils Under Consolidated Drained Conditions by ASTM D 3080





Test No.:	DS-13	DS-14	DS-15
Initial Diameter, in:	2.5	2.5	2.5
Initial Height, in:	1.0	1.0	1.0
Initial Mass, grams:	184	184	184
Initial Dry Density, pcf:	124	124	124
Initial Moisture Content, %:	14.9	14.9	14.9
Initial Bulk Density, pcf:	142	142	142
Initial Degree of Saturation:	99.2	99.2	99.2
Initial Void Ratio:	0.42	0.42	0.42
Final Dry Density, pcf:	131	132	128
Final Moisture Content, %:	13.3	13.6	13.2
Final Bulk Density, pcf:	149	150	145
Normal Stress, psf:	999	1999	3999
Maximum Shear Stress, psf:	999	1525	2585
Shear Rate, in/min:	0.001	0.001	0.001

Sample Type:	remolded
Estimated Specific Gravity:	2.83
Liquid Limit:	NP
Plastic Limit:	NP
Plasticity Index:	NP
% Passing #200 sieve:	45.5
Soil Classification:	Silty sand with gravel
Group Symbol:	SM



Notes:

Moisture content obtained before shear from sample trimmings

Moisture Content determined by ASTM D 2216

Percent passing #200 sieve determined by ASTM D 422

Atterberg Limit determined by ASTM D 4318

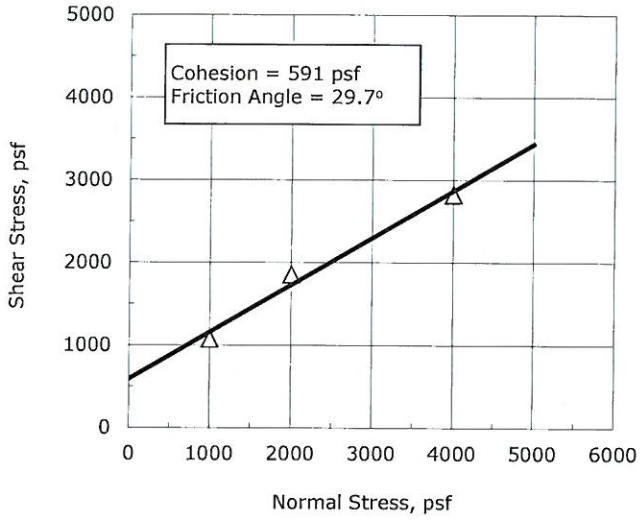
Target Compaction: Moderate Effort at 15% moisture content (values provided by client).

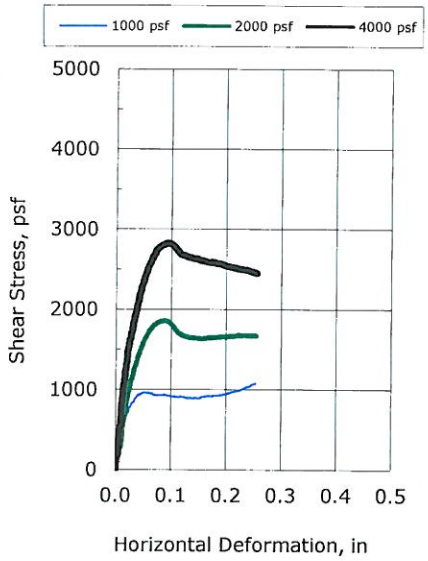
Values for cohesion and friction angle determined from best-fit straight line to the data for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site-specific conditions.

"---" indicates testing required to determine these values was not requested.

Client:	Environmental Partners Group
Project Name:	Burgess Brothers Pre-Design Investigation
Project Location:	Bennington, VT
GTX #:	12185
Test Date:	10/31/12
Tested By:	md
Checked By:	jdt
Boring ID:	PZ-2
Sample ID:	PZ-2-PD-GT3
Depth, ft:	30-35
Visual Description:	Moist, yellowish brown clayey sand with gravel

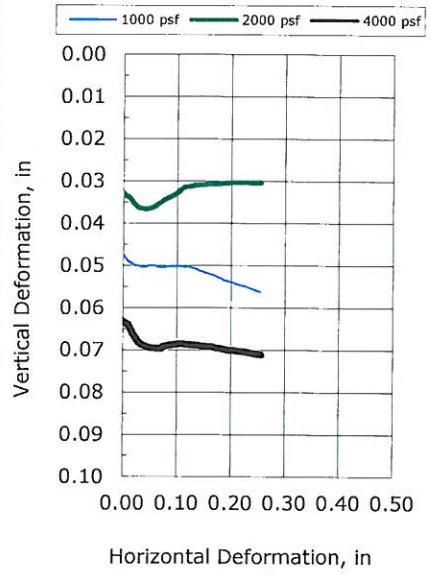
Direct Shear Test of Soils Under Consolidated Drained Conditions by ASTM D 3080





Test No.:	DS-10	DS-11	DS-12
Initial Diameter, in:	2.5	2.5	2.5
Initial Height, in:	1.0	1.0	1.0
Initial Mass, grams:	180	180	180
Initial Dry Density, pcf:	127	127	127
Initial Moisture Content, %:	10.3	10.3	10.3
Initial Bulk Density, pcf:	140	140	140
Initial Degree of Saturation:	83.9	83.9	83.9
Initial Void Ratio:	0.33	0.33	0.33
Final Dry Density, pcf:	134	131	136
Final Moisture Content, %:	12.6	11.9	11.4
Final Bulk Density, pcf:	151	146	152
Normal Stress, psf:	999	2000	3999
Maximum Shear Stress, psf:	1075	1858	2826
Shear Rate, in/min:	0.001	0.001	0.001

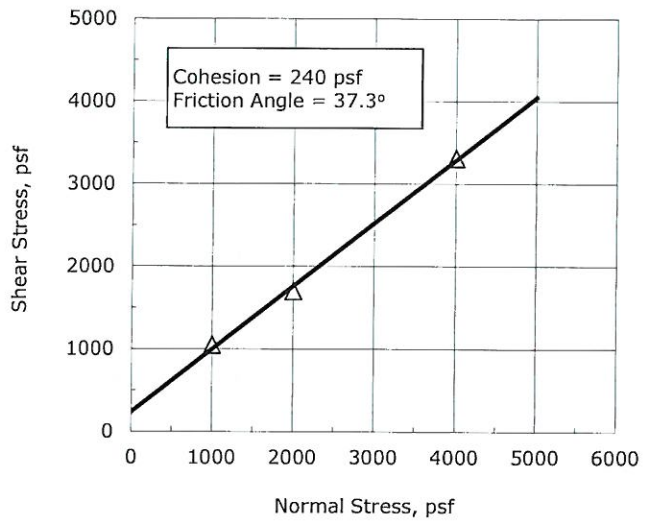
Sample Type:	remolded
Estimated Specific Gravity:	2.70
Liquid Limit:	21
Plastic Limit:	12
Plasticity Index:	9
% Passing #200 sieve:	49.6
Soil Classification:	Clayey sand with gravel
Group Symbol:	SC

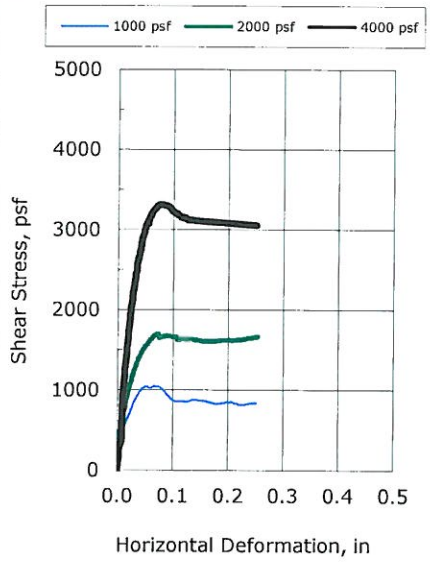


Notes:
Moisture content obtained before shear from sample trimmings
Moisture Content determined by ASTM D 2216
Percent passing #200 sieve determined by ASTM D 422
Atterberg Limit determined by ASTM D 4318
Target Compaction: Moderate Effort at 10% moisture content (values provided by client).
Values for cohesion and friction angle determined from best-fit straight line to the data for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site-specific conditions.
"---" indicates testing required to determine these values was not requested.

Client:	Environmental Partners Group
Project Name:	Burgess Brothers Pre-Design Investigation
Project Location:	Bennington, VT
GTX #:	12185
Test Date:	11/08/12
Tested By:	md
Checked By:	jdt
Boring ID:	PZ-7D
Sample ID:	PZ-7D-PD-GT1
Depth, ft:	30-35
Visual Description:	Moist, olive silty, clayey sand with gravel

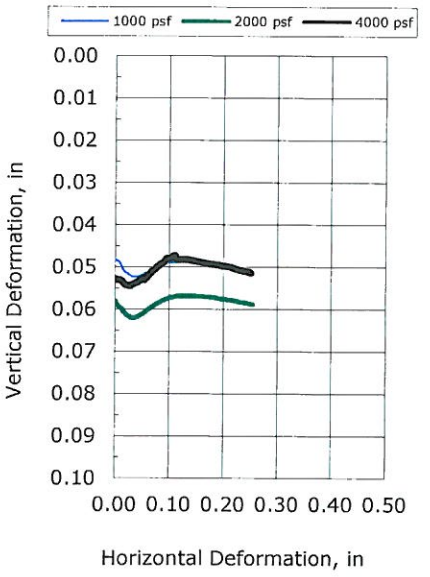
Direct Shear Test of Soils Under Consolidated Drained Conditions by ASTM D 3080





Test No.:	DS-13	DS-14	DS-15
Initial Diameter, in:	2.5	2.5	2.5
Initial Height, in:	1.0	1.0	1.0
Initial Mass, grams:	179	179	179
Initial Dry Density, pcf:	125	125	125
Initial Moisture Content, %:	10.9	10.9	10.9
Initial Bulk Density, pcf:	139	139	139
Initial Degree of Saturation:	85.4	85.4	85.4
Initial Void Ratio:	0.35	0.35	0.35
Final Dry Density, pcf:	132	133	132
Final Moisture Content, %:	12.6	12.2	11.2
Final Bulk Density, pcf:	149	149	147
Normal Stress, psf:	1000	1999	3999
Maximum Shear Stress, psf:	1047	1699	3313
Shear Rate, in/min:	0.001	0.001	0.001

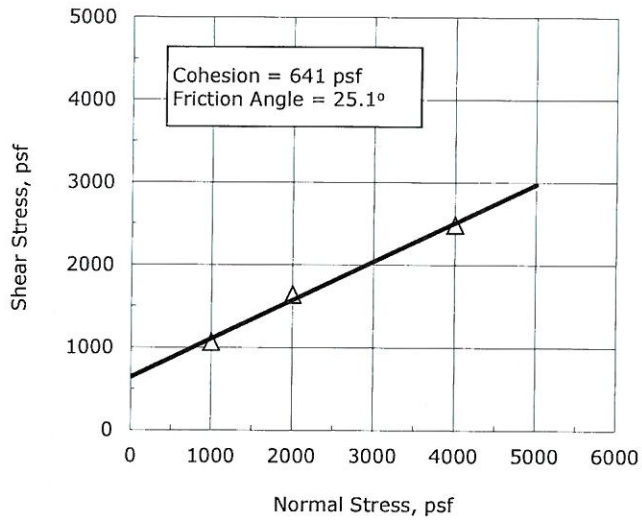
Sample Type:	remolded
Estimated Specific Gravity:	2.70
Liquid Limit:	19
Plastic Limit:	14
Plasticity Index:	5
% Passing #200 sieve:	40.2
Soil Classification:	Silty, clayey sand with gravel
Group Symbol:	SC-SM

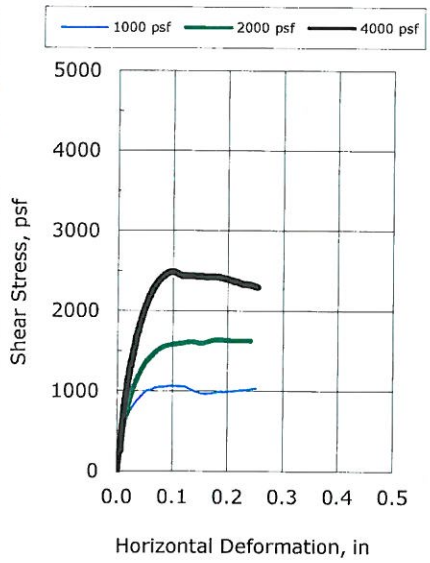


Notes:
Moisture content obtained before shear from sample trimmings
Moisture Content determined by ASTM D 2216
Percent passing #200 sieve determined by ASTM D 422
Atterberg Limit determined by ASTM D 4318
Target Compaction: Moderate Effort at 10% moisture content (values provided by client).
Values for cohesion and friction angle determined from best-fit straight line to the data for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site-specific conditions.
"---" indicates testing required to determine these values was not requested.

Client:	Environmental Partners Group
Project Name:	Burgess Brothers Pre-Design Investigation
Project Location:	Bennington, VT
GTX #:	12185
Test Date:	10/19/12
Tested By:	md
Checked By:	jdt
Boring ID:	PZ-7 & PZ-10 (50/50 mix)
Sample ID:	PZ-7-PD-GT1 & PZ-10-PD-GT1
Depth, ft:	2-4 & 5-7
Visual Description:	Moist, dark yellowish brown silty sand

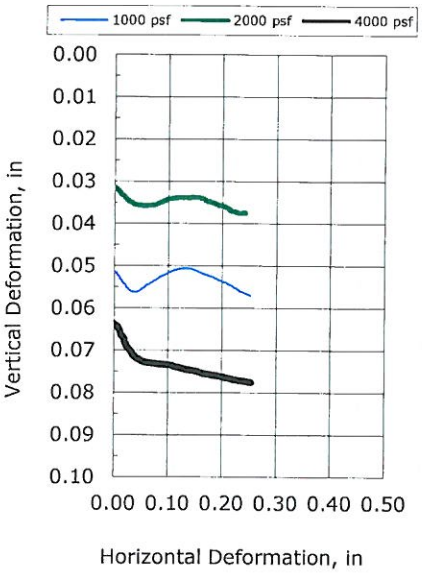
Direct Shear Test of Soils Under Consolidated Drained Conditions by ASTM D 3080





Test No.:	DS-4	DS-5	DS-6
Initial Diameter, in:	2.5	2.5	2.5
Initial Height, in:	1.0	1.0	1.0
Initial Mass, grams:	152	152	152
Initial Dry Density, pcf:	102	102	102
Initial Moisture Content, %:	15.3	15.3	15.4
Initial Bulk Density, pcf:	118	118	118
Initial Degree of Saturation:	66.1	66.1	66.2
Initial Void Ratio:	0.61	0.61	0.62
Final Dry Density, pcf:	109	106	111
Final Moisture Content, %:	17.5	17.6	18.6
Final Bulk Density, pcf:	128	125	132
Normal Stress, psf:	999	2000	3999
Maximum Shear Stress, psf:	1065	1641	2489
Shear Rate, in/min:	0.001	0.001	0.001

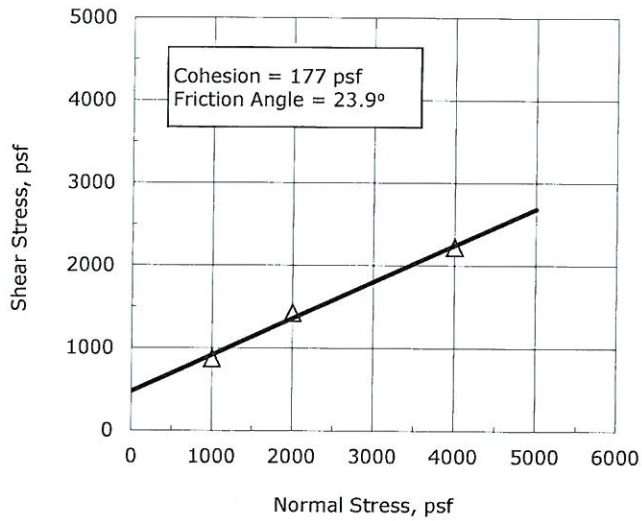
Sample Type:	remolded
Estimated Specific Gravity:	2.65
Liquid Limit:	NP
Plastic Limit:	NP
Plasticity Index:	NP
% Passing #200 sieve:	47.2
Soil Classification:	Silty sand
Group Symbol:	SM

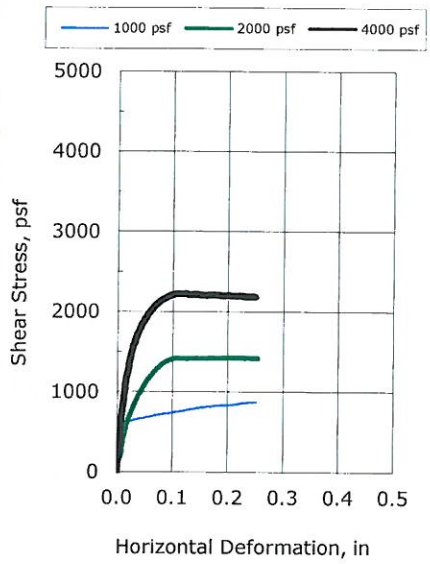


Notes:
Moisture content obtained before shear from sample trimmings
Moisture Content determined by ASTM D 2216
Percent passing #200 sieve determined by ASTM D 422
Atterberg Limit determined by ASTM D 4318
Target Compaction: Moderate Effort at 15% moisture content (values provided by client).
Values for cohesion and friction angle determined from best-fit straight line to the data for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site-specific conditions.
"---" indicates testing required to determine these values was not requested.

Client:	Environmental Partners Group
Project Name:	Burgess Brothers Pre-Design Investigation
Project Location:	Bennington, VT
GTX #:	12185
Test Date:	10/22/12
Tested By:	md
Checked By:	jdt
Boring ID:	PZ-9
Sample ID:	PZ-9-PD-GT1
Depth, ft:	5-20
Visual Description:	Moist, light yellowish brown sandy silt with gravel

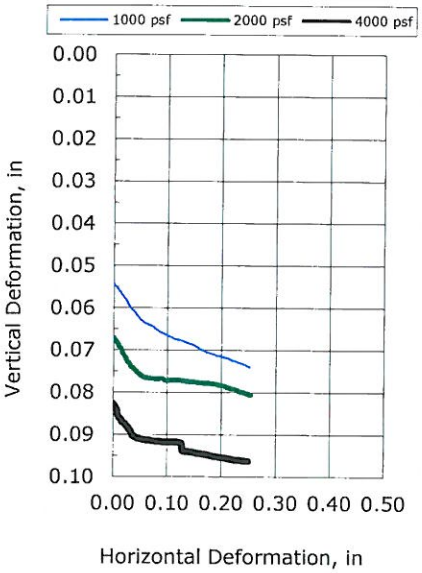
Direct Shear Test of Soils Under Consolidated Drained Conditions by ASTM D 3080





Test No.:	DS-7	DS-8	DS-9
Initial Diameter, in:	2.5	2.5	2.5
Initial Height, in:	1.0	1.0	1.0
Initial Mass, grams:	178	178	178
Initial Dry Density, pcf:	117	117	117
Initial Moisture Content, %:	17.9	17.9	17.9
Initial Bulk Density, pcf:	138	138	138
Initial Degree of Saturation:	99.5	99.5	99.5
Initial Void Ratio:	0.51	0.51	0.51
Final Dry Density, pcf:	127	128	130
Final Moisture Content, %:	15.1	14.2	15.1
Final Bulk Density, pcf:	146	146	150
Normal Stress, psf:	999	1999	3999
Maximum Shear Stress, psf:	875	1426	2223
Shear Rate, in/min:	0.001	0.001	0.001

Sample Type:	remolded
Estimated Specific Gravity:	2.84
Liquid Limit:	NP
Plastic Limit:	NP
Plasticity Index:	NP
% Passing #200 sieve:	56.6
Soil Classification:	Sandy silt with gravel
Group Symbol:	ML



Notes:
Moisture content obtained before shear from sample trimmings
Moisture Content determined by ASTM D 2216
Percent passing #200 sieve determined by ASTM D 422
Atterberg Limit determined by ASTM D 4318
Target Compaction: Moderate Effort at 17% moisture content (values provided by client).
Values for cohesion and friction angle determined from best-fit straight line to the data for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site-specific conditions.
"---" indicates testing required to determine these values was not requested.

GeoTesting EXPRESS

WARRANTY and LIABILITY

GeoTesting Express (GTX) warrants that all tests it performs are run in general accordance with the specified test procedures and accepted industry practice. GTX will correct or repeat any test that does not comply with this warranty. GTX has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material.

GTX may report engineering parameters that require us to interpret the test data. Such parameters are determined using accepted engineering procedures. However, GTX does not warrant that these parameters accurately reflect the true engineering properties of the *in situ* material. Responsibility for interpretation and use of the test data and these parameters for engineering and/or construction purposes rests solely with the user and not with GTX or any of its employees.

GTX's liability will be limited to correcting or repeating a test which fails our warranty. GTX's liability for damages to the Purchaser of testing services for any cause whatsoever shall be limited to the amount GTX received for the testing services. GTX will not be liable for any damages, or for any lost benefits or other consequential damages resulting from the use of these test results, even if GTX has been advised of the possibility of such damages. GTX will not be responsible for any liability of the Purchaser to any third party.

Commonly Used Symbols

A	pore pressure parameter for $\Delta\sigma_1 - \Delta\sigma_3$
B	pore pressure parameter for $\Delta\sigma_3$
CIU	isotropically consolidated undrained triaxial shear test
CR	compression ratio for one dimensional consolidation
C_c	coefficient of curvature, $(D_{30})^2 / (D_{10} \times D_{60})$
C_u	coefficient of uniformity, D_{60}/D_{10}
C_c	compression index for one dimensional consolidation
C_α	coefficient of secondary compression
c_v	coefficient of consolidation
c	cohesion intercept for total stresses
c'	cohesion intercept for effective stresses
D	diameter of specimen
D_{10}	diameter at which 10% of soil is finer
D_{15}	diameter at which 15% of soil is finer
D_{30}	diameter at which 30% of soil is finer
D_{50}	diameter at which 50% of soil is finer
D_{60}	diameter at which 60% of soil is finer
D_{85}	diameter at which 85% of soil is finer
d_{50}	displacement for 50% consolidation
d_{90}	displacement for 90% consolidation
d_{100}	displacement for 100% consolidation
E	Young's modulus
e	void ratio
e_c	void ratio after consolidation
e_o	initial void ratio
G	shear modulus
G_s	specific gravity of soil particles
H	height of specimen
PI	plasticity index
i	gradient
K_o	lateral stress ratio for one dimensional strain
k	permeability
LI	Liquidity Index
m_v	coefficient of volume change
n	porosity
PI	plasticity index
P_c	preconsolidation pressure
p	$(\sigma_1 + \sigma_3) / 2$, $(\sigma_v + \sigma_h) / 2$
p'	$(\sigma'_1 + \sigma'_3) / 2$, $(\sigma'_v + \sigma'_h) / 2$
p'_c	p' at consolidation
Q	quantity of flow
q	$(\sigma_1 - \sigma_3) / 2$
q_f	q at failure
q_o, q_i	initial q
q_c	q at consolidation
S	degree of saturation
SL	shrinkage limit
s_u	undrained shear strength
T	time factor for consolidation
T	temperature
t	time
U, UC	unconfined compression test
UU, Q	unconsolidated undrained triaxial test
u_a	pore gas pressure
u_e	excess pore water pressure
u, u_w	pore water pressure
V	total volume
V_g	volume of gas
V_s	volume of solids
V_v	volume of voids
V_w	volume of water
V_o	initial volume
v	velocity
W	total weight
W_s	weight of solids
W_w	weight of water
w	water content
w_c	water content at consolidation
w_f	final water content
w_l	liquid limit
w_n	natural water content
w_p	plastic limit
w_s	shrinkage limit
w_o, w_i	initial water content
α	slope of q_f versus p_f
α'	slope of q_f versus p_f'
γ_t	total unit weight
γ_d	dry unit weight
γ_s	unit weight of solids
γ_w	unit weight of water
ε	strain
ε_{vol}	volume strain
ε_h, ε_v	horizontal strain, vertical strain
μ	Poisson's ratio, also viscosity
σ	normal stress
σ'	effective normal stress
σ_c, σ'_c	consolidation stress in isotropic stress system
σ_h, σ'_h	horizontal normal stress
σ_v, σ'_v	vertical normal stress
σ_1	major principal stress
σ_2	intermediate principal stress
σ_3	minor principal stress
τ	shear stress
φ	friction angle based on total stresses
φ'	friction angle based on effective stresses
φ'_r	residual friction angle
φ_{ult}	φ for ultimate strength

APPENDIX E
Hydraulic Gradient Azimuth Plots

Figure
Hydraulic Gradient Azimuth at Compliance Boundary and Precipitation Events
PZ-4S, PZ-5S, and PZ-6S

Burgess Brothers Superfund Site
Bennington, Vermont

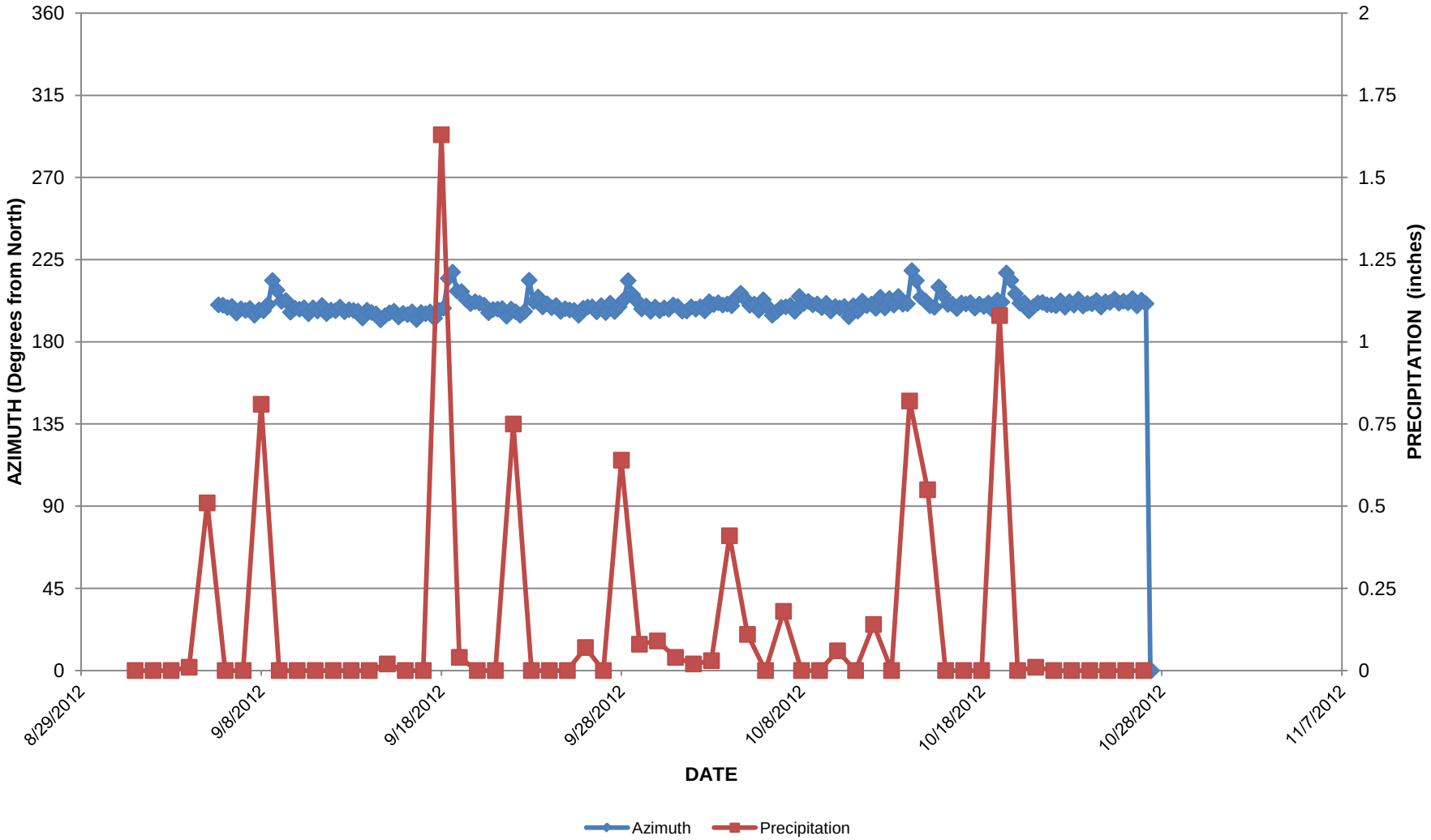


Figure
Hydraulic Gradient at Compliance Boundary and Precipitation Events
PZ-4S, PZ-5S, and PZ-6S

Burgess Brothers Superfund Site
Bennington, Vermont

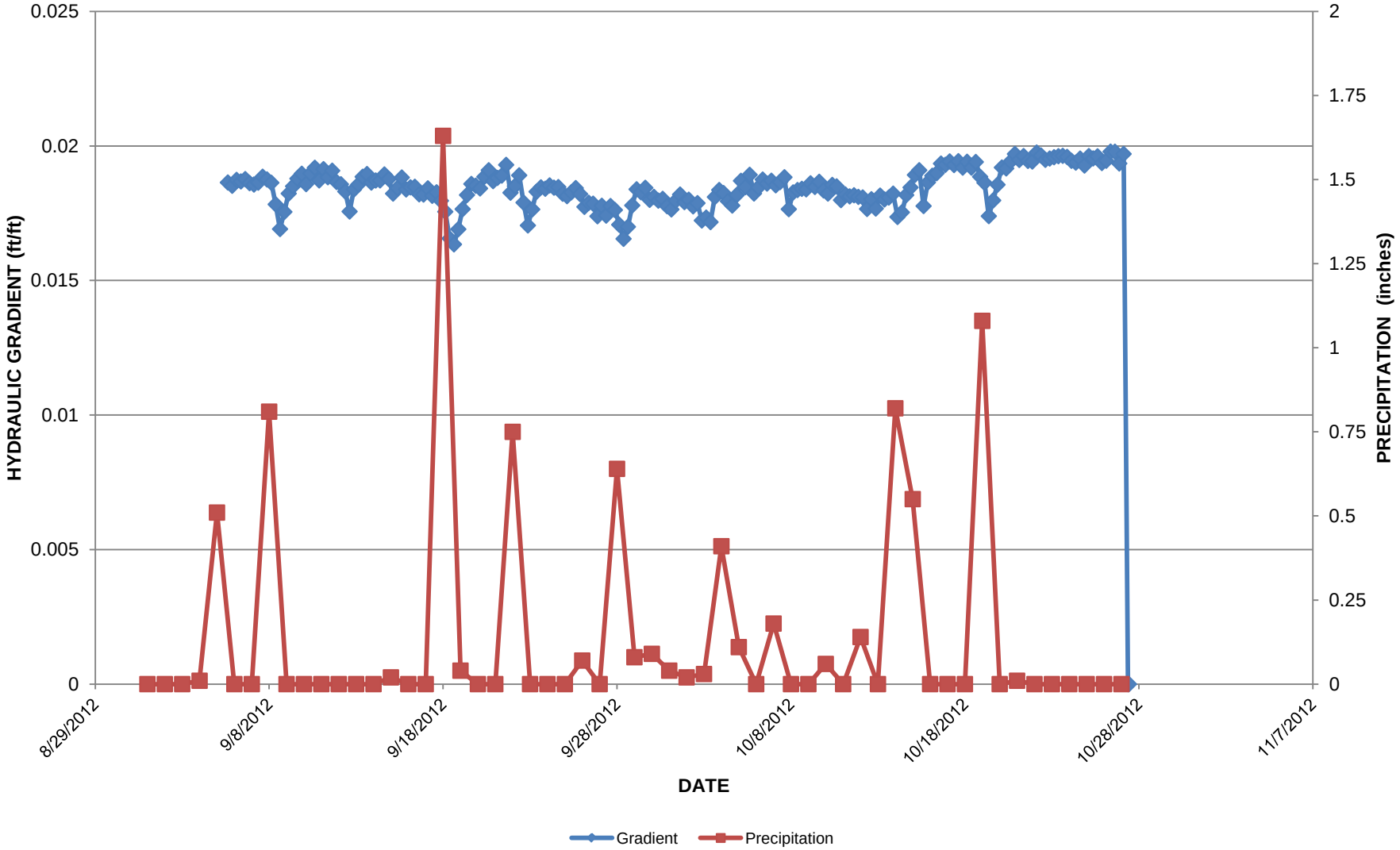


Figure
Hydraulic Gradient Azimuth at Compliance Boundary and Precipitation Events
W32-S1, W-04D, and W25-S1

Burgess Brothers Superfund Site
Bennington, Vermont

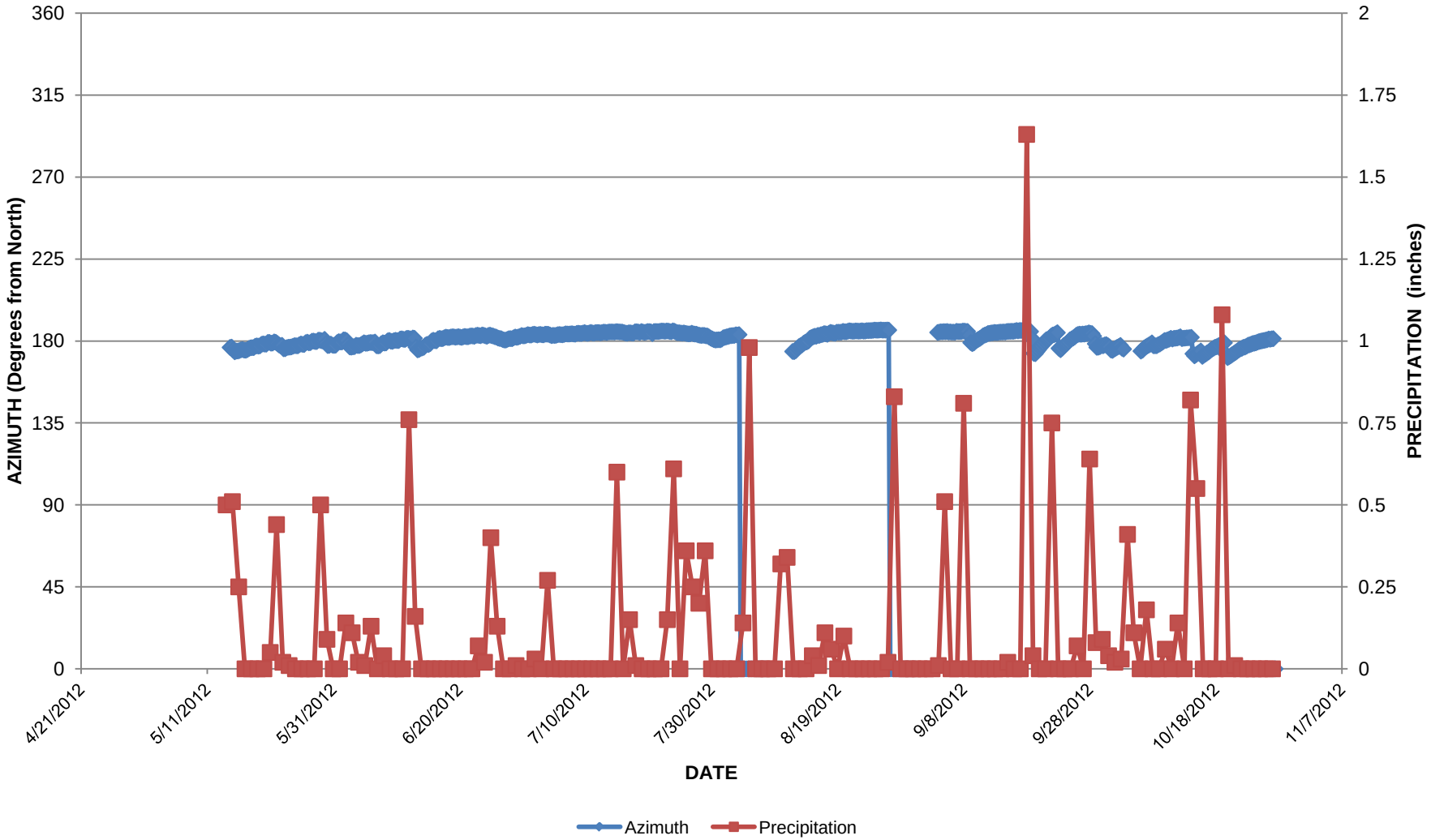


Figure
Hydraulic Gradient at Compliance Boundary and Precipitation Events
W32-S1, W-04D, and W25-S1

Burgess Brothers Superfund Site
Bennington, Vermont

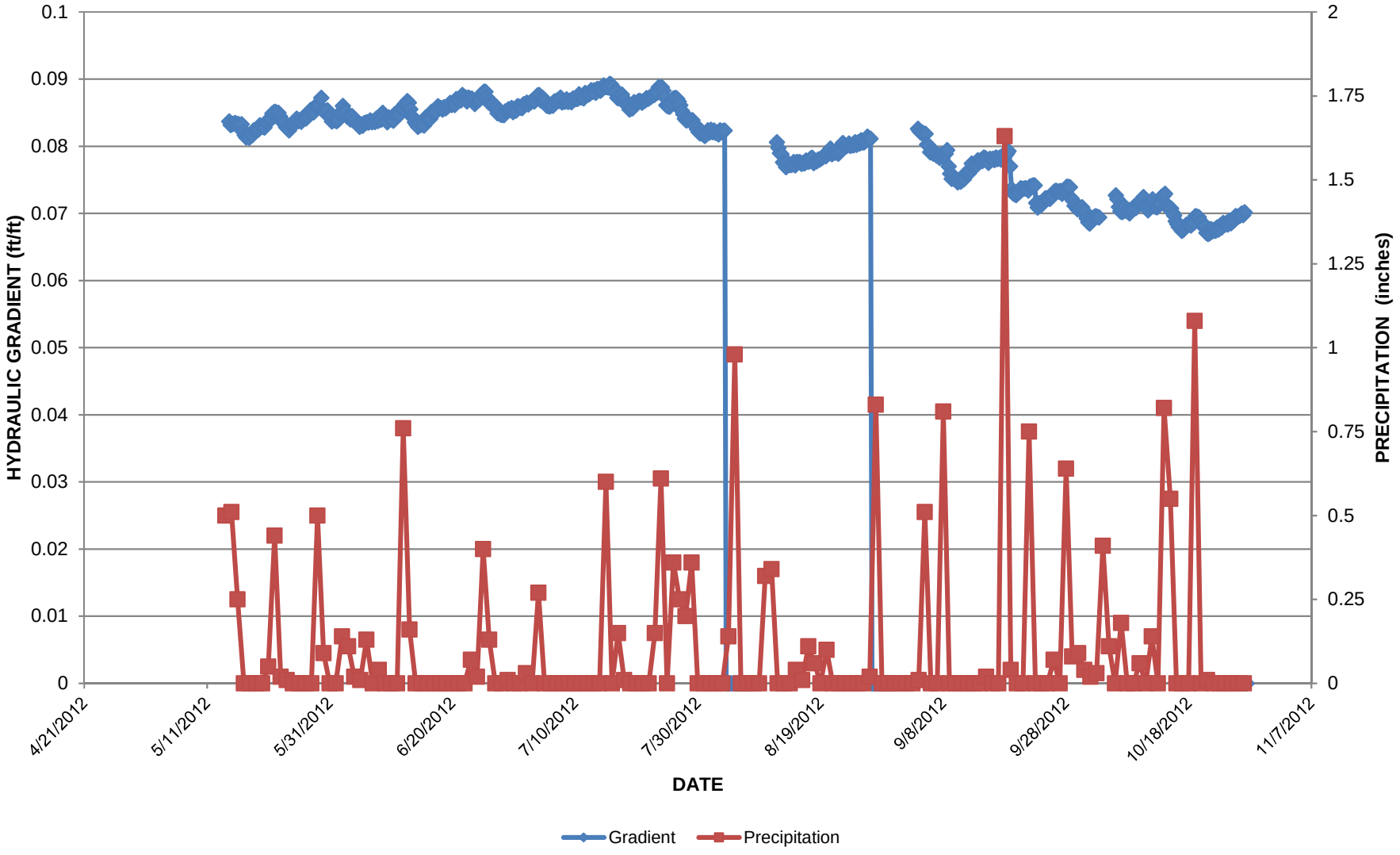


Figure
Hydraulic Gradient Azimuth at Compliance Boundary, and Precipitation Events
PZ-4D, PZ-5D, and PZ-6D

Burgess Brothers Superfund Site
Bennington, Vermont

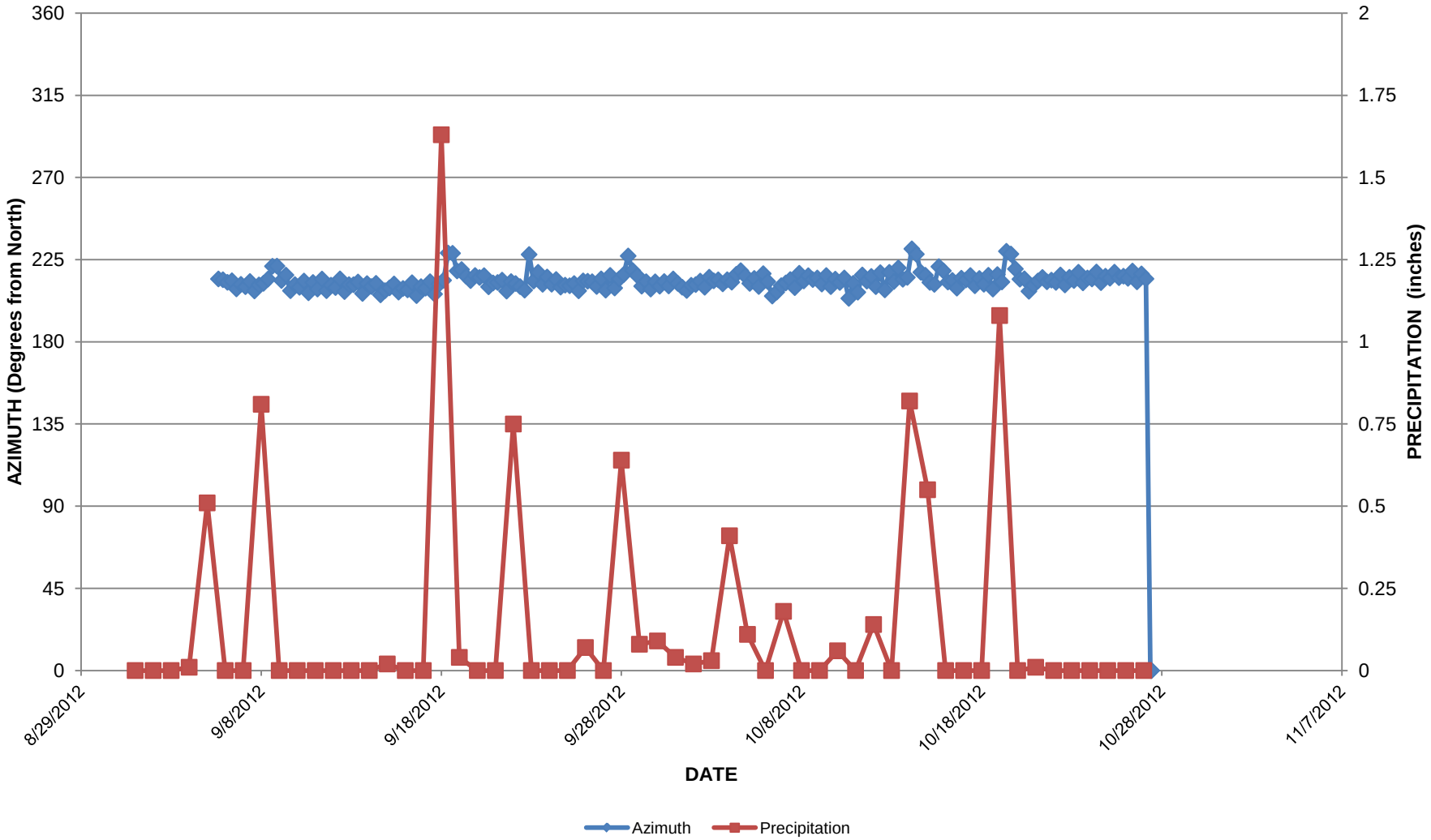


Figure
Hydraulic Gradient at Compliance Boundary and Precipitation Events
PZ-4D, PZ-5D, and PZ-6D

Burgess Brothers Superfund Site
Bennington, Vermont

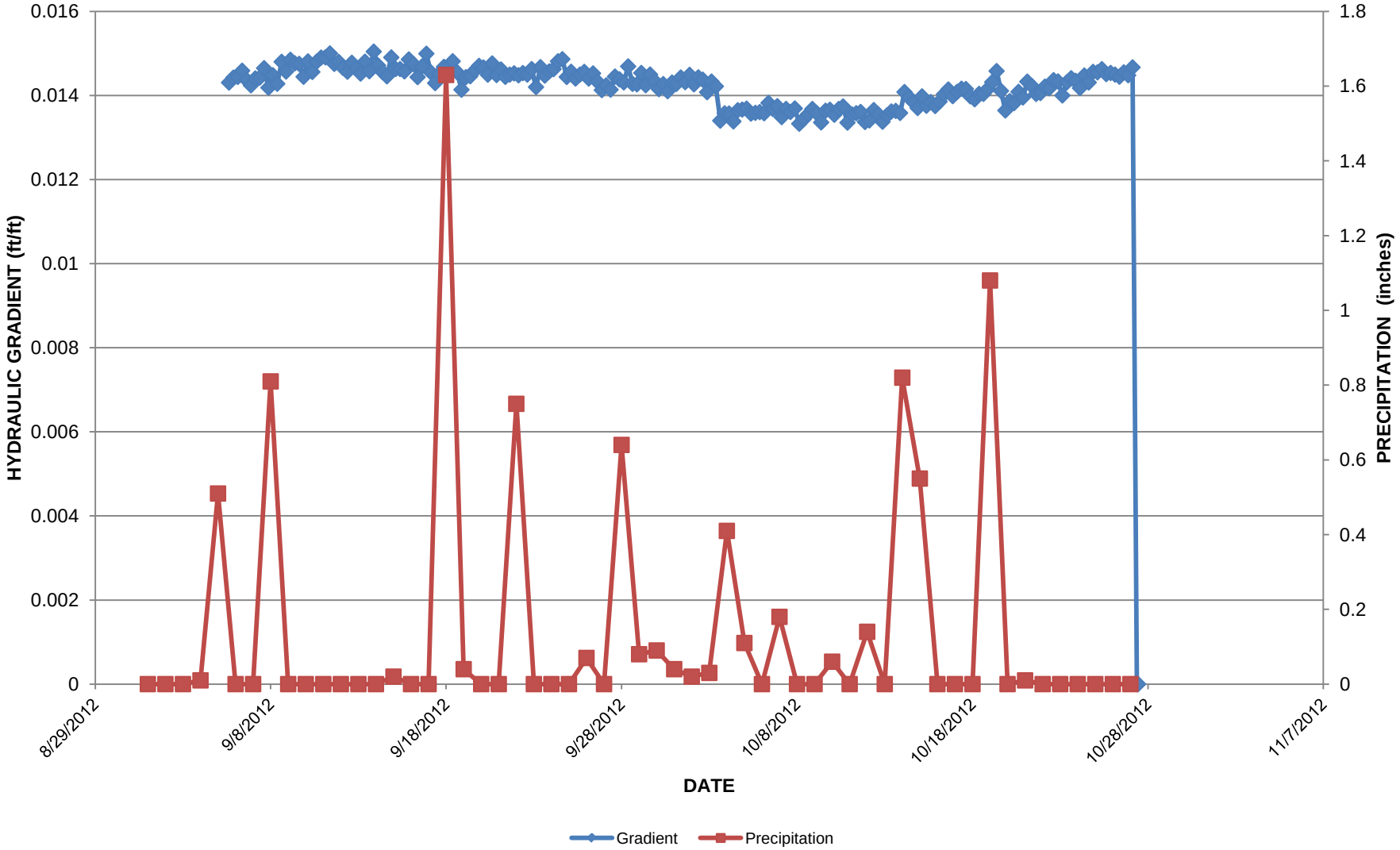


Figure
Hydraulic Gradient Azimuth at Compliance Boundary and Precipitation Events
W32-T W-04T, and PZ-2D

Burgess Brothers Superfund Site
Bennington, Vermont

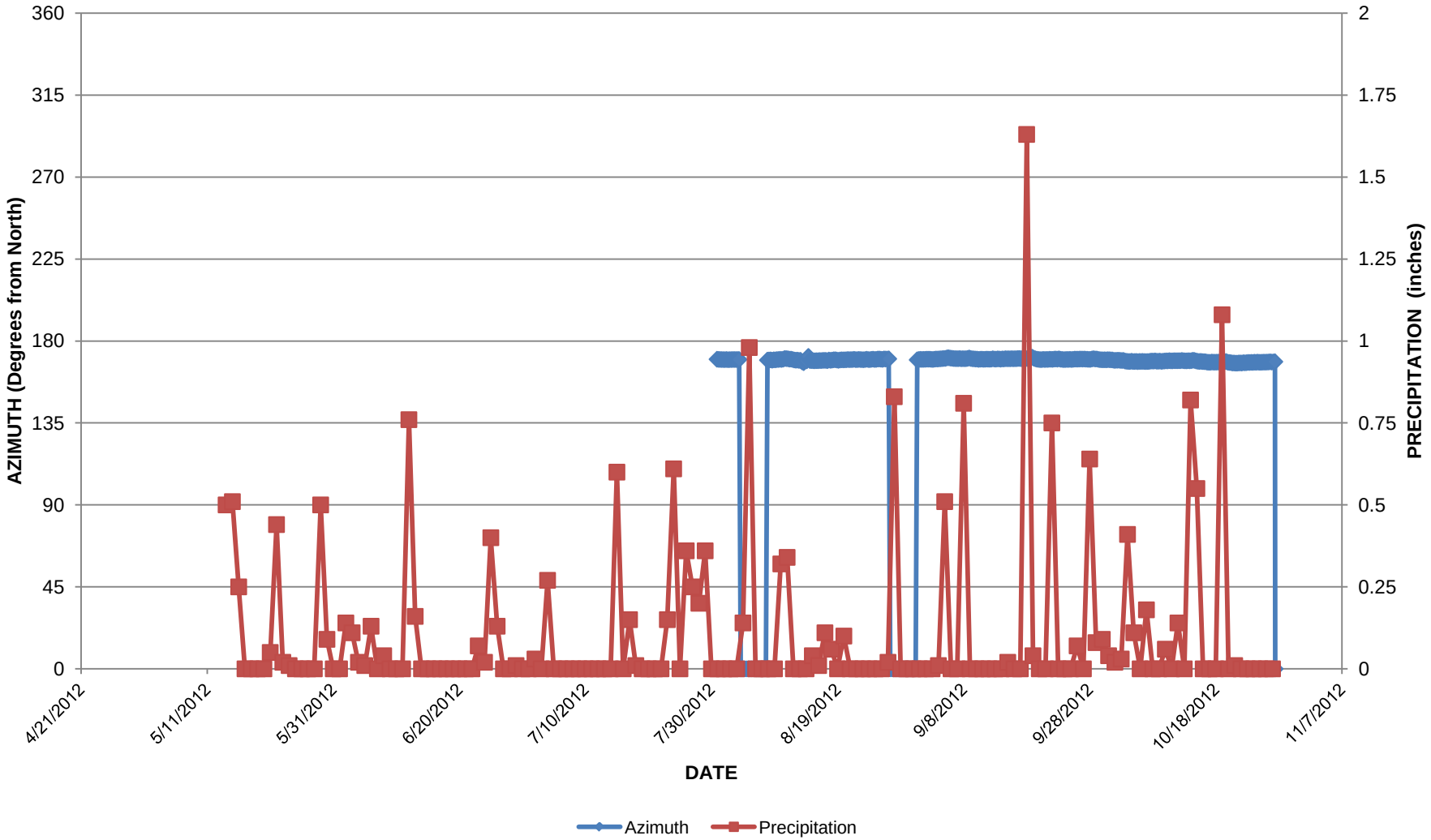


Figure
Hydraulic Gradient at Compliance Boundary and Precipitation Events
W32-T W-04T, and PZ-2D

Burgess Brothers Superfund Site
Bennington, Vermont

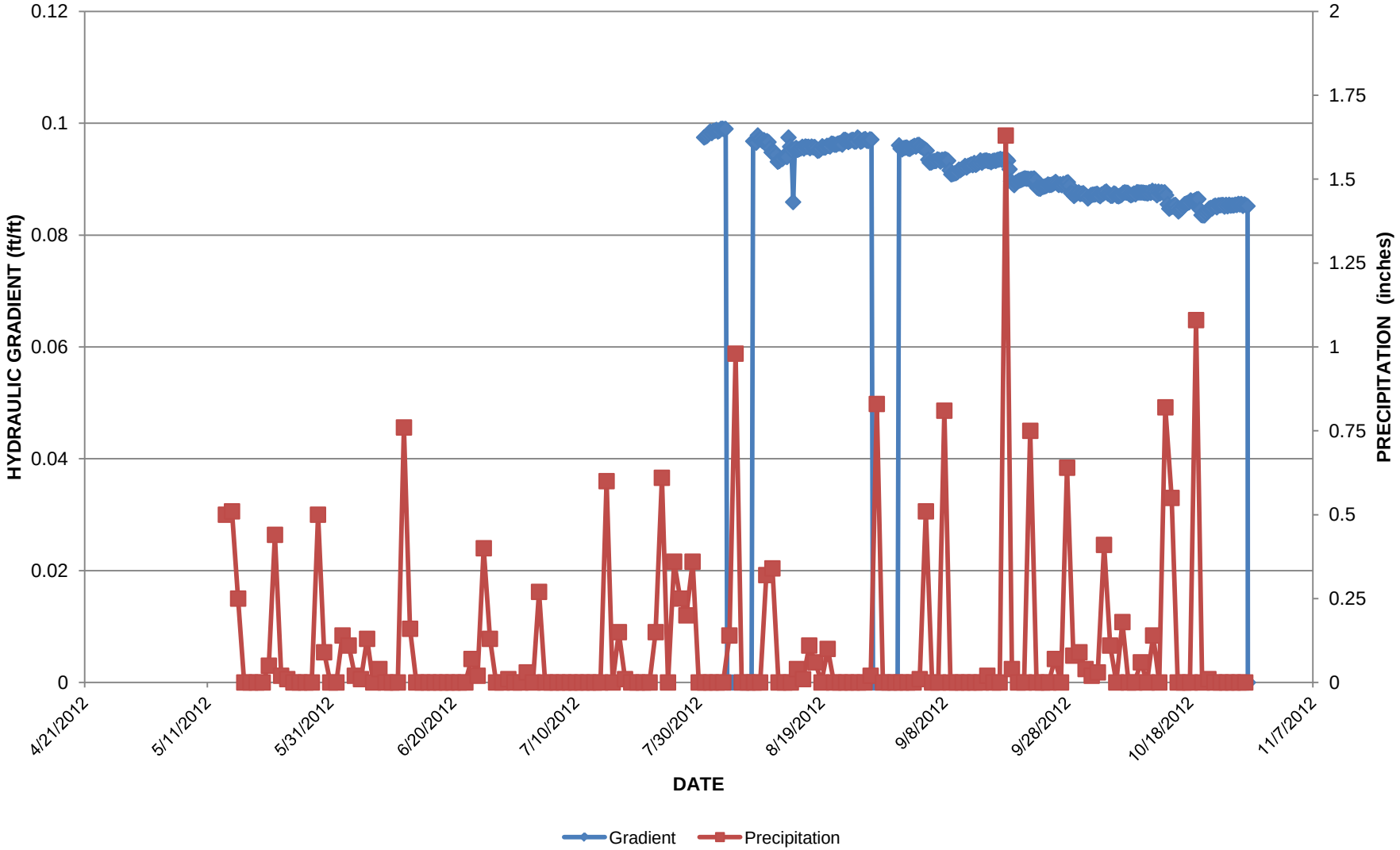


Figure
Hydraulic Gradient Azimuth at Downgradient Barrier, and Precipitation Events
PZ-9S, PZ-14S, and P-24

Burgess Brothers Superfund Site
Bennington, Vermont

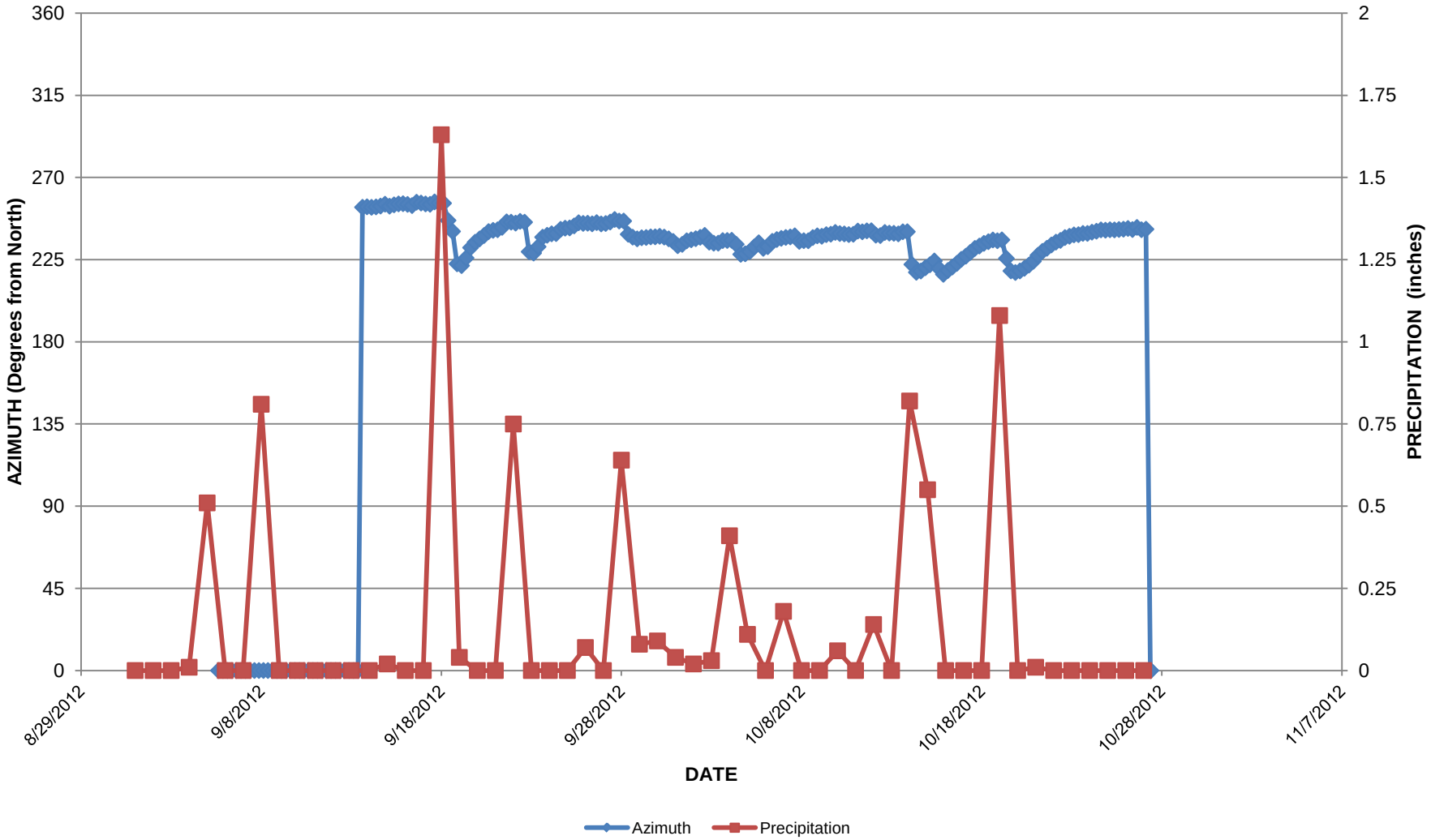


Figure
Hydraulic Gradient at Downgradent Barrier and Precipitation Events
PZ-9S, PZ-14S, and P-24

Burgess Brothers Superfund Site
Bennington, Vermont

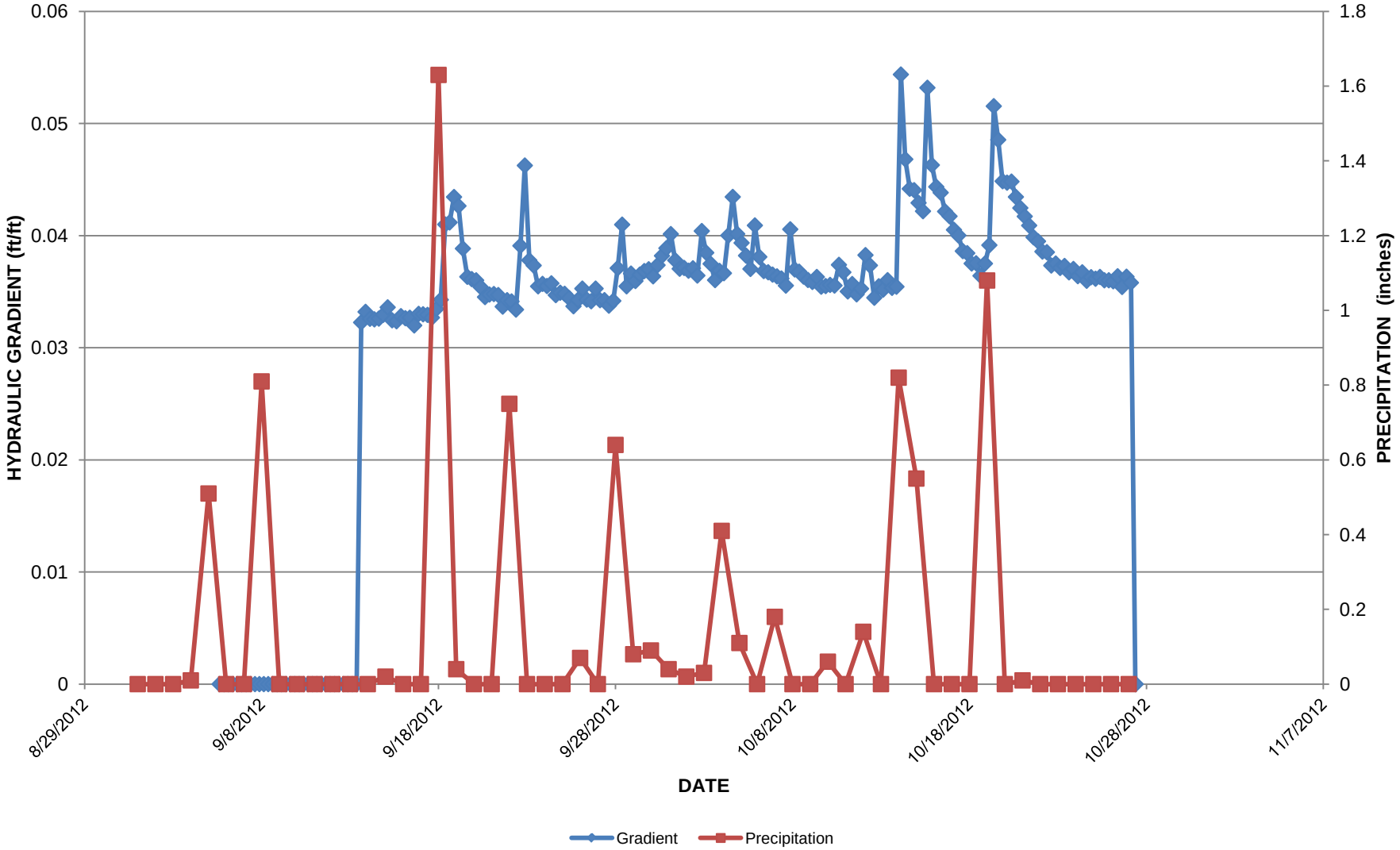


Figure
Hydraulic Gradient Azimuth at Downgradient Barrier, and Precipitation Events
PZ-9S, PZ-14S, and PZ-12S

Burgess Brothers Superfund Site
Bennington, Vermont

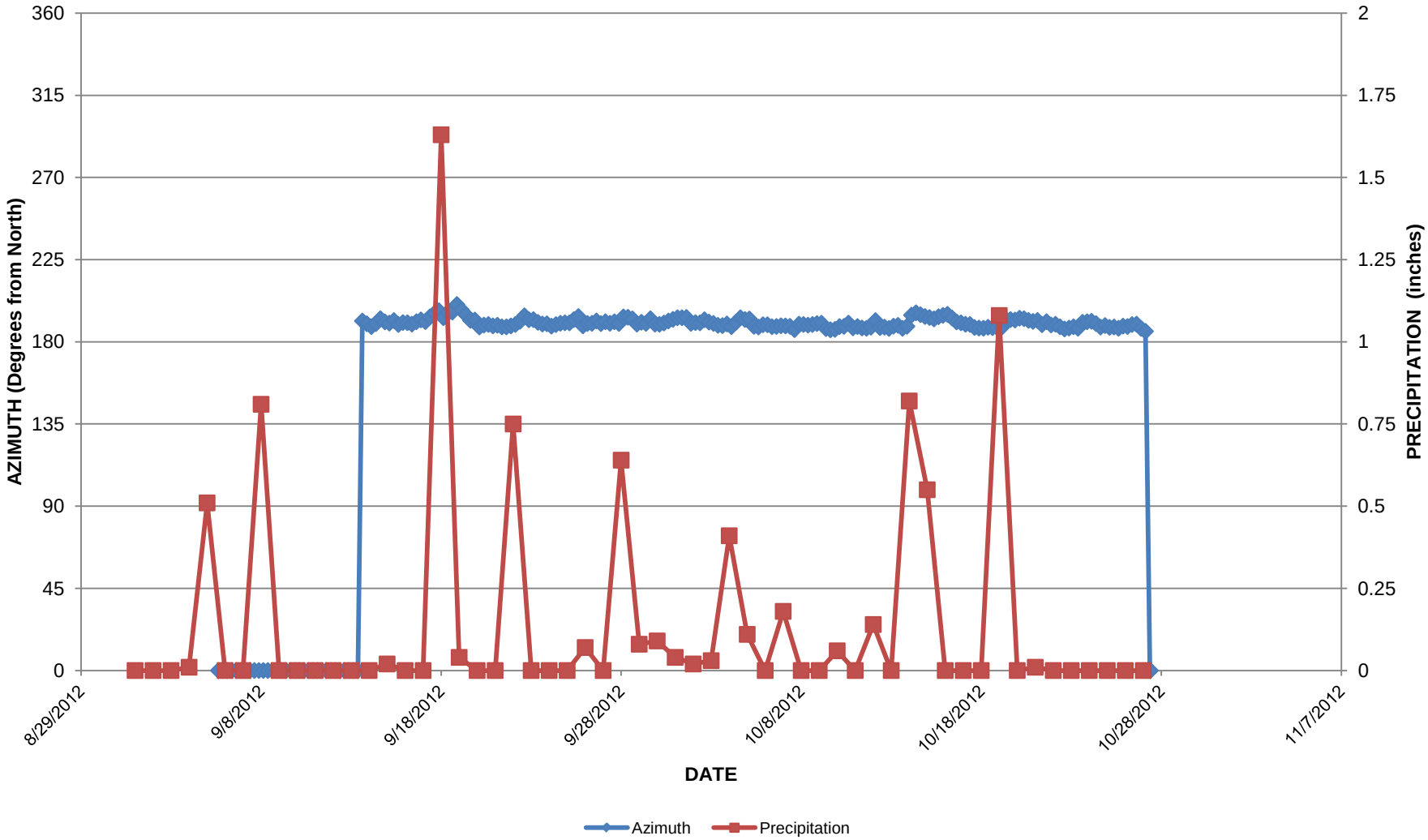


Figure
Hydraulic Gradient at Downgradient Barrier and Precipitation Events
PZ-9S, PZ-14S, and PZ-12S

Burgess Brothers Superfund Site
Bennington, Vermont

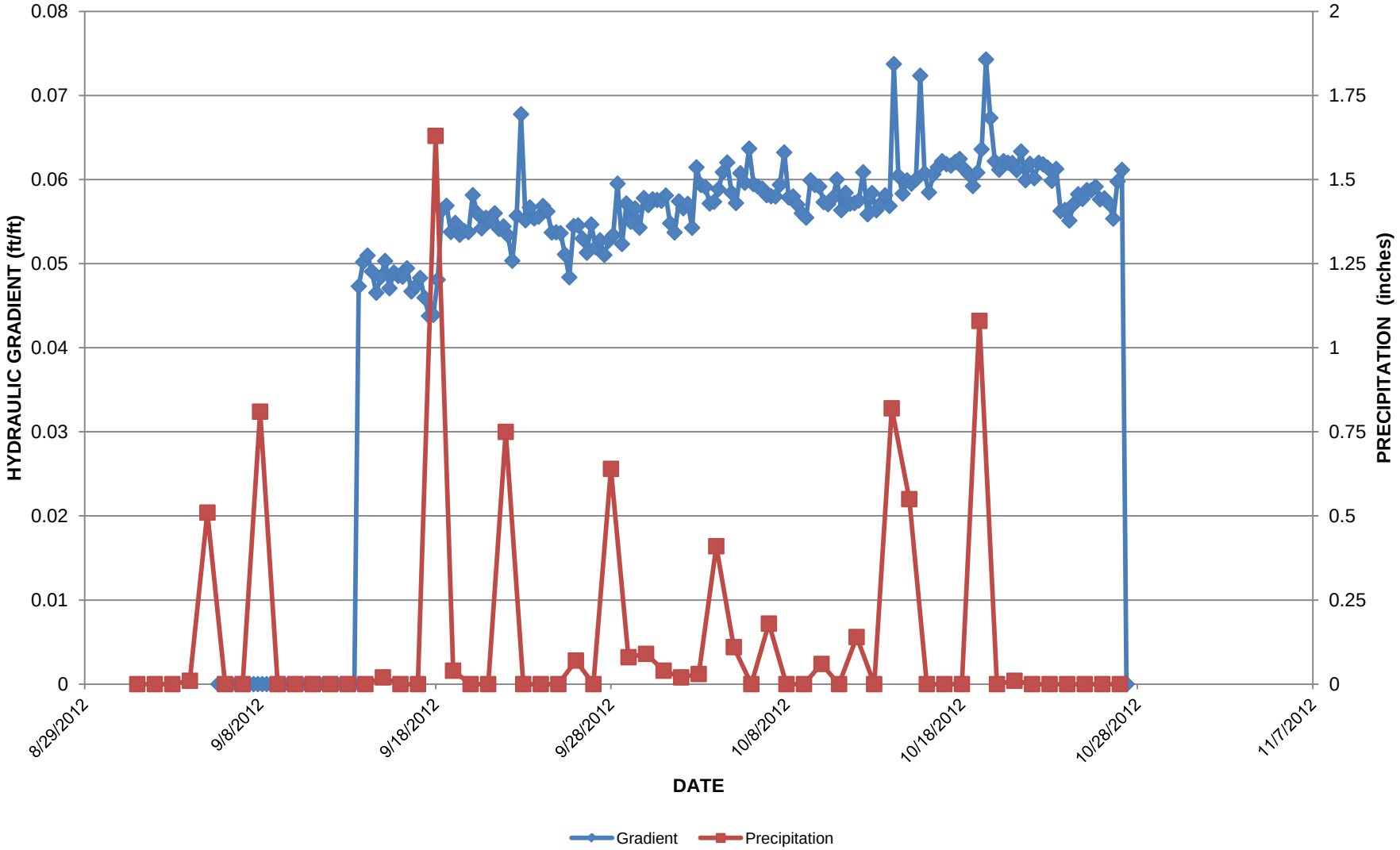


Figure
Hydraulic Gradient Azimuth at Downgradient Barrier, and Precipitation Events
PZ-9S, PZ-10S, and P-24

Burgess Brothers Superfund Site
Bennington, Vermont

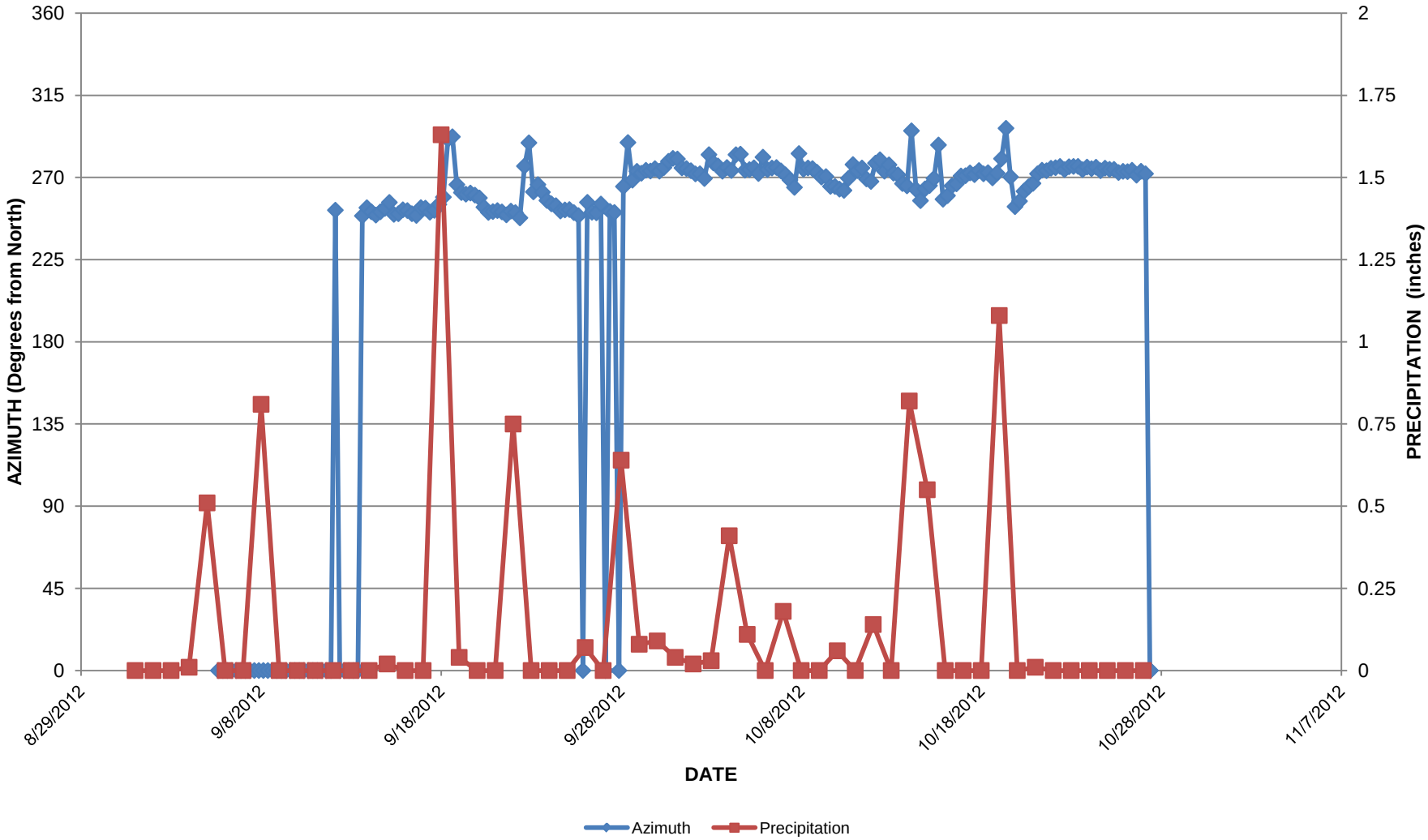


Figure
Hydraulic Gradient at Downgradient Barrier and Precipitation Events
PZ-9S, PZ-10S, and P-24

Burgess Brothers Superfund Site
Bennington, Vermont

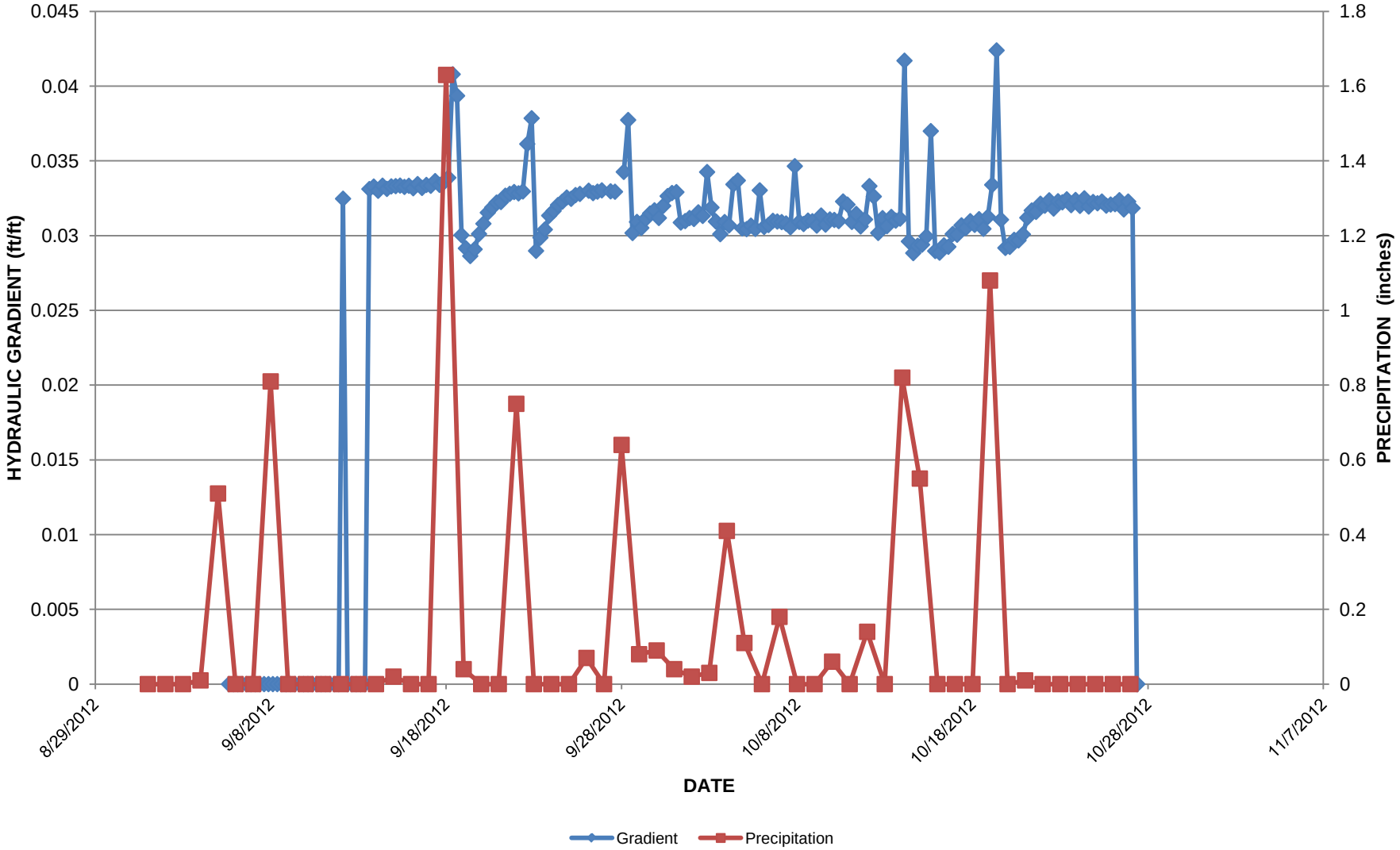


Figure
Hydraulic Gradient Azimuth at Downgradient Barrier, and Precipitation Events
PZ-9S, PZ-13S, and PZ-12S

Burgess Brothers Superfund Site
Bennington, Vermont

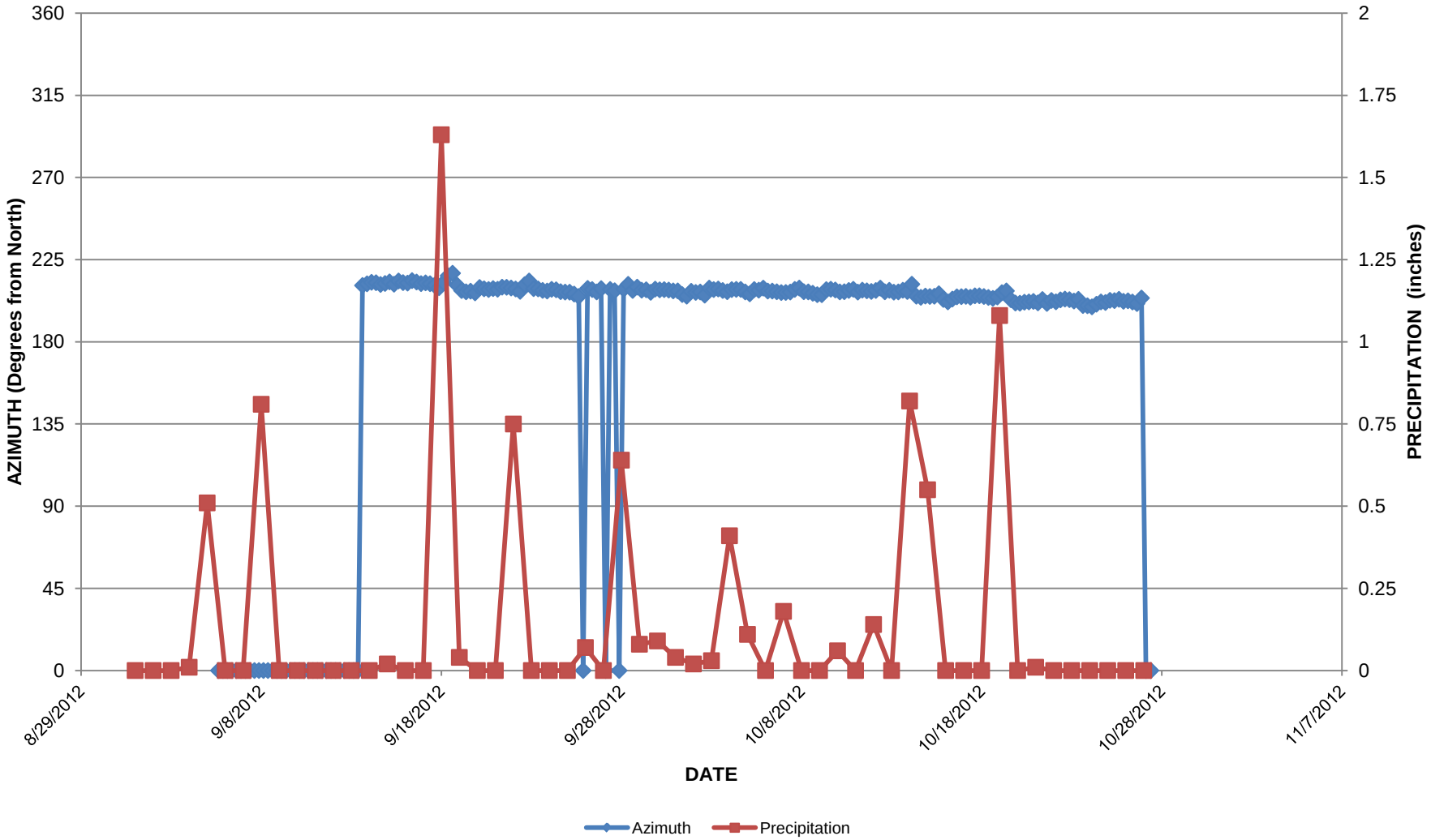


Figure
Hydraulic Gradient at Downgradient Barrier and Precipitation Events
PZ-9S, PZ-13S, and PZ-12S

Burgess Brothers Superfund Site
Bennington, Vermont

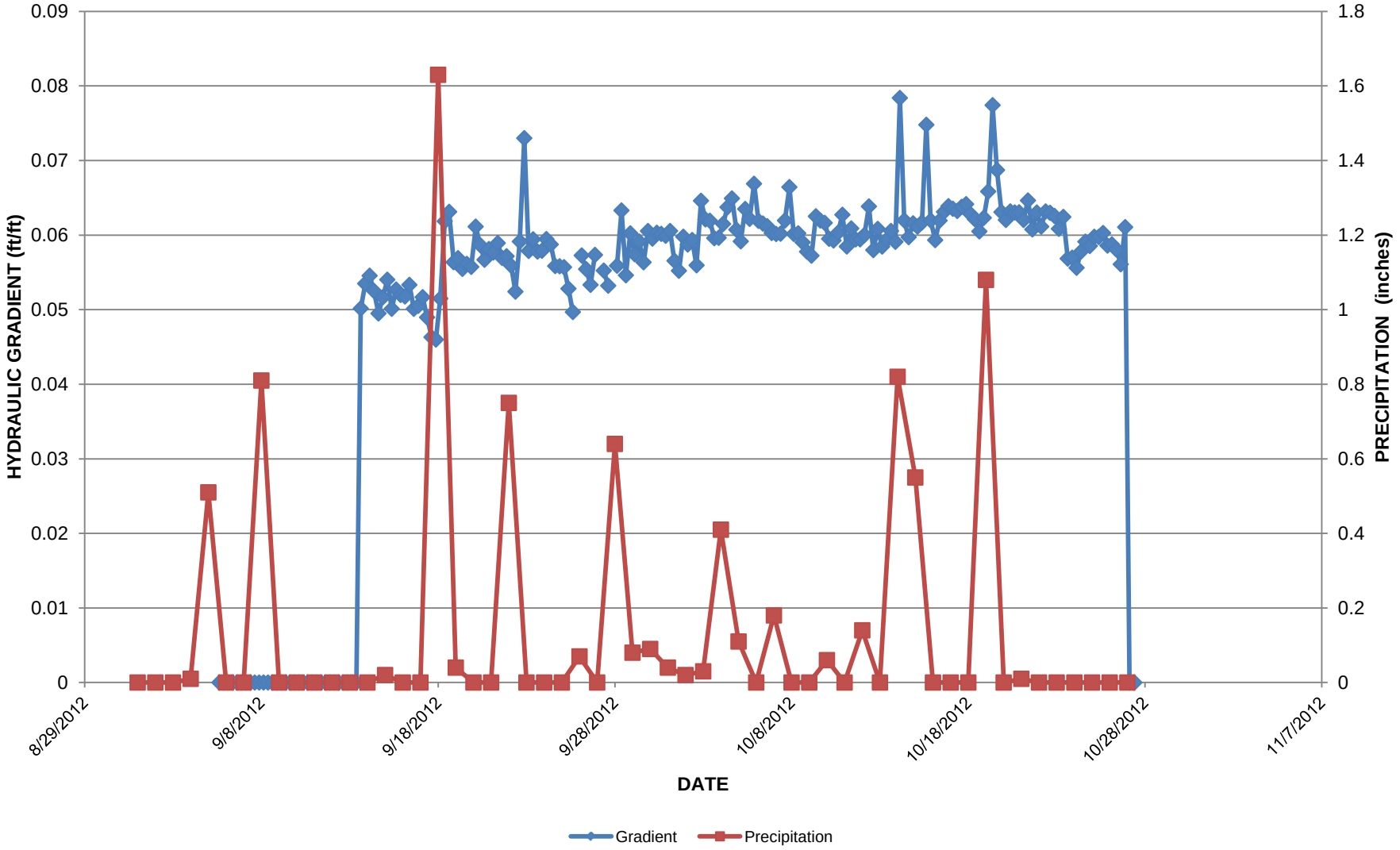


Figure
Hydraulic Gradient Azimuth at Downgradient Barrier, and Precipitation Events
PZ-7S, PZ-13S, and W-09S1

Burgess Brothers Superfund Site
Bennington, Vermont

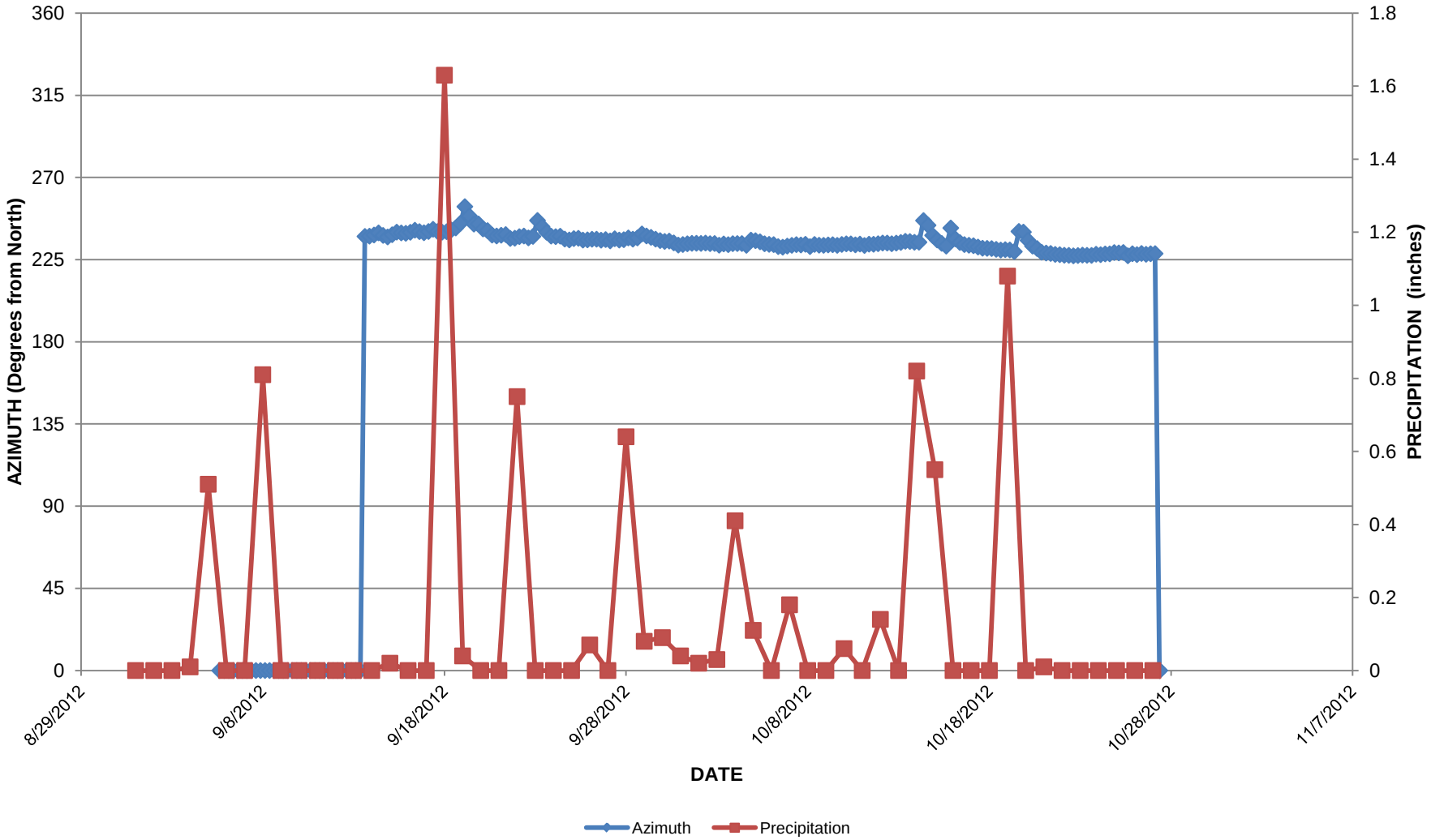


Figure
Hydraulic Gradient at Downgradient Barrier and Precipitation Events
PZ-7S, PZ-13S, and W-09S1

Burgess Brothers Superfund Site
Bennington, Vermont

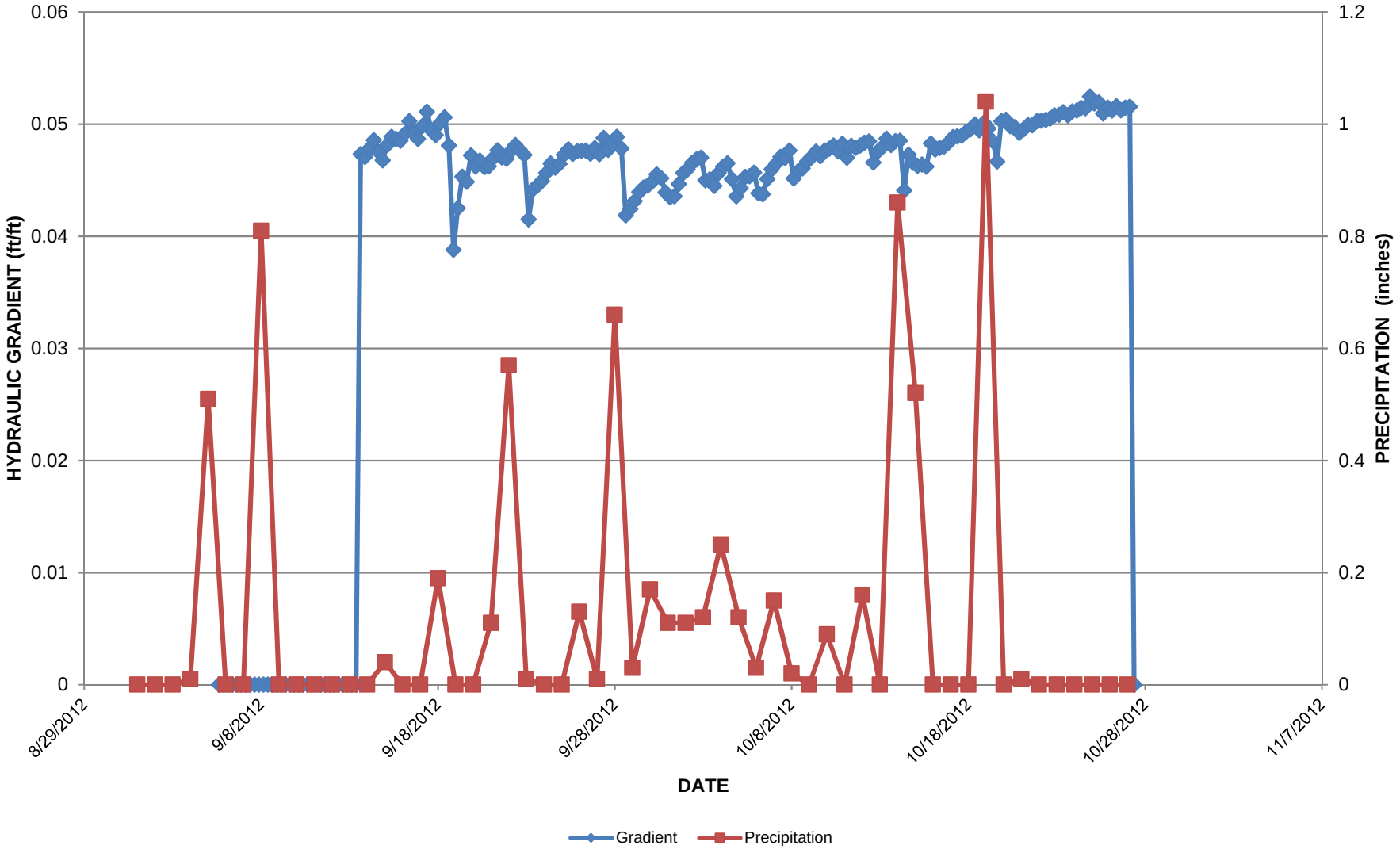


Figure
Hydraulic Gradient Azimuth at Downgradient Barrier, and Precipitation Events
PZ-9D, PZ-14D, and PZ-12D

Burgess Brothers Superfund Site
Bennington, Vermont

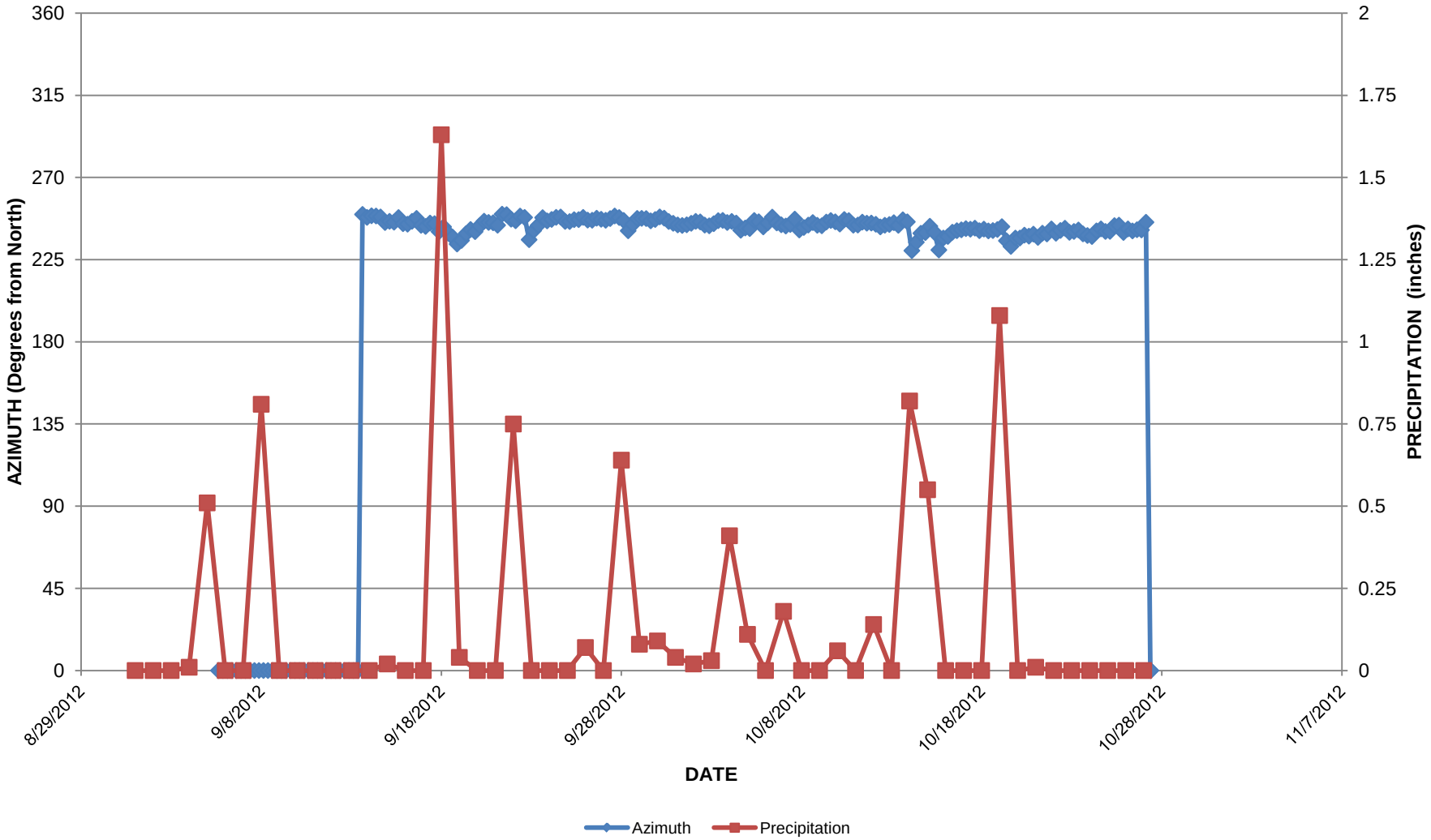


Figure
Hydraulic Gradient at Downgradient Barrier and Precipitation Events
PZ-9D, PZ-14D, and PZ-12D

Burgess Brothers Superfund Site
Bennington, Vermont

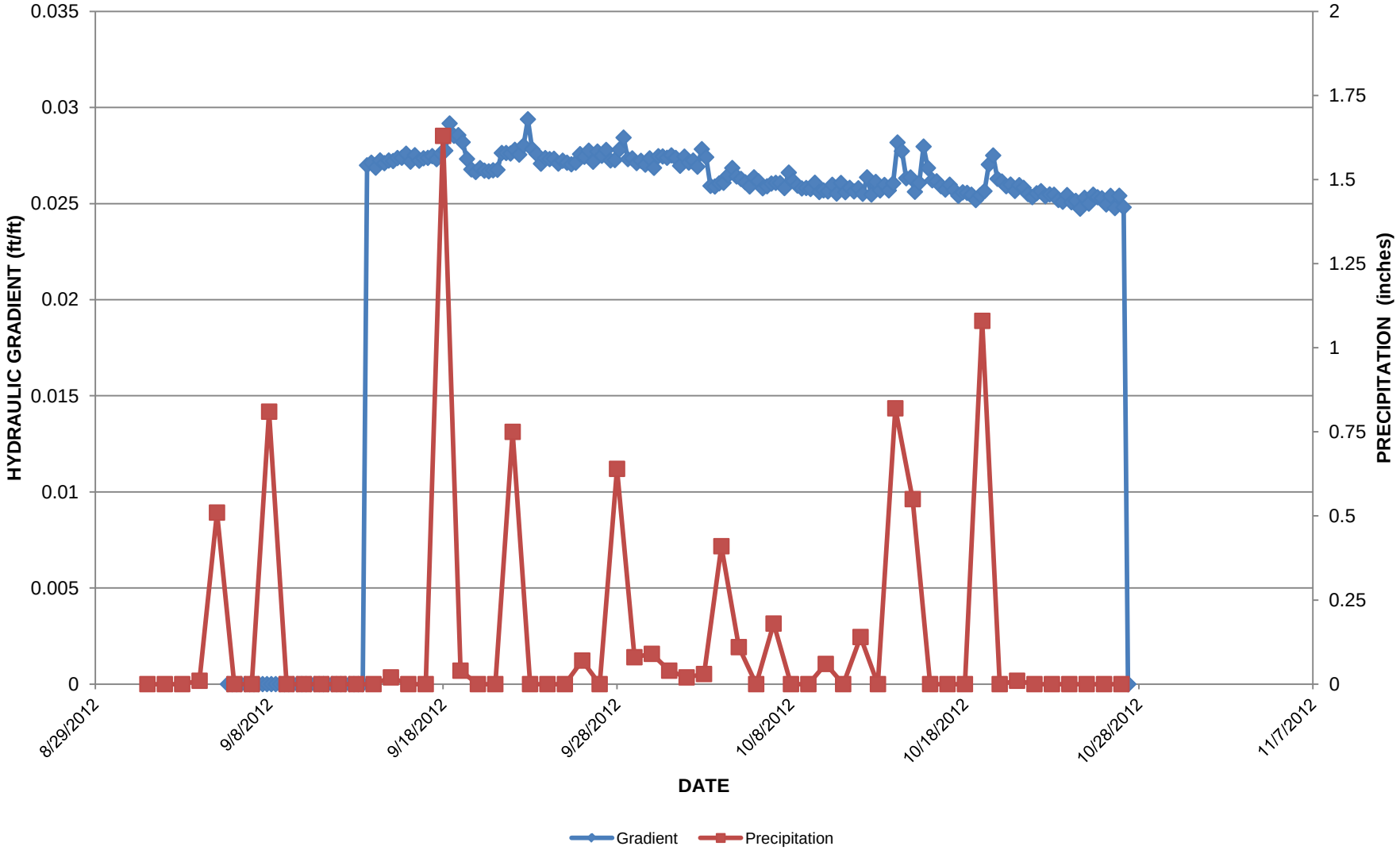


Figure
Hydraulic Gradient Azimuth at Downgradient Barrier, and Precipitation Events
PZ-9D, PZ-8D, and PZ-12D

Burgess Brothers Superfund Site
Bennington, Vermont

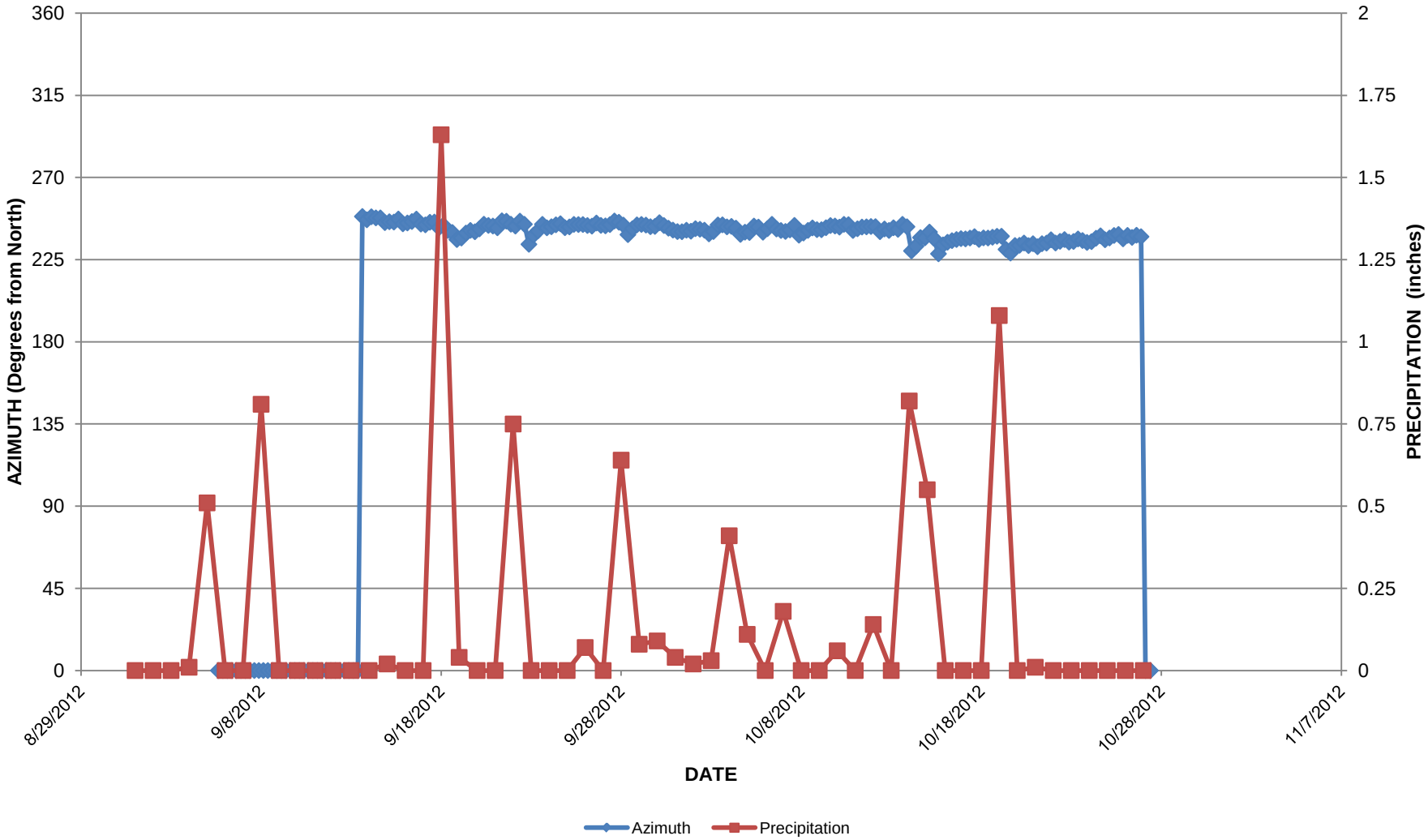


Figure
Hydraulic Gradient at Downgradint Barrier and Precipitation Events
PZ-9D, PZ-8D, and PZ-12D

Burgess Brothers Superfund Site
Bennington, Vermont

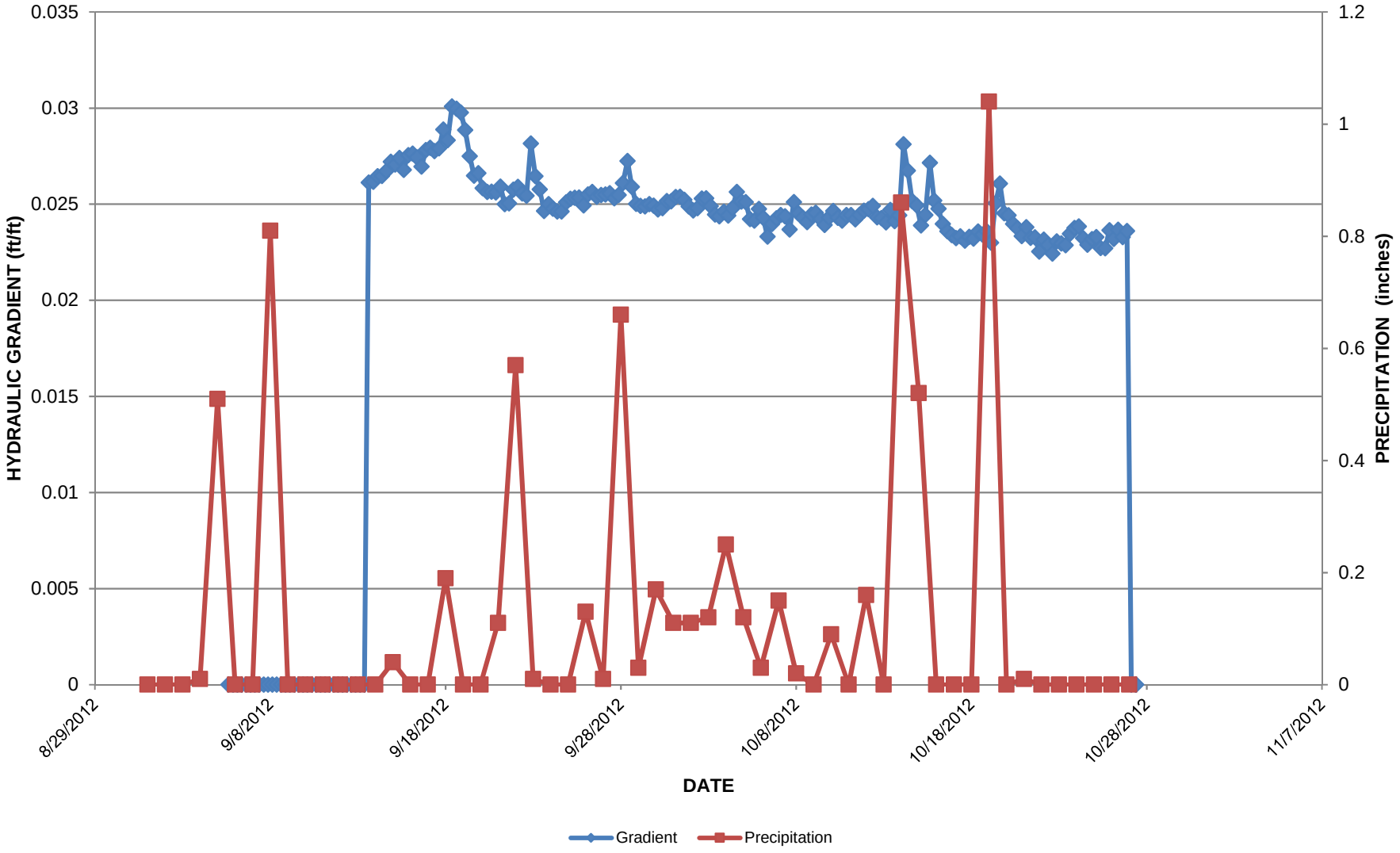


Figure
Hydraulic Gradient Azimuth at Downgradient Barrier, and Precipitation Events
PZ-13D, PZ-8D, and PZ-12D

Burgess Brothers Superfund Site
Bennington, Vermont

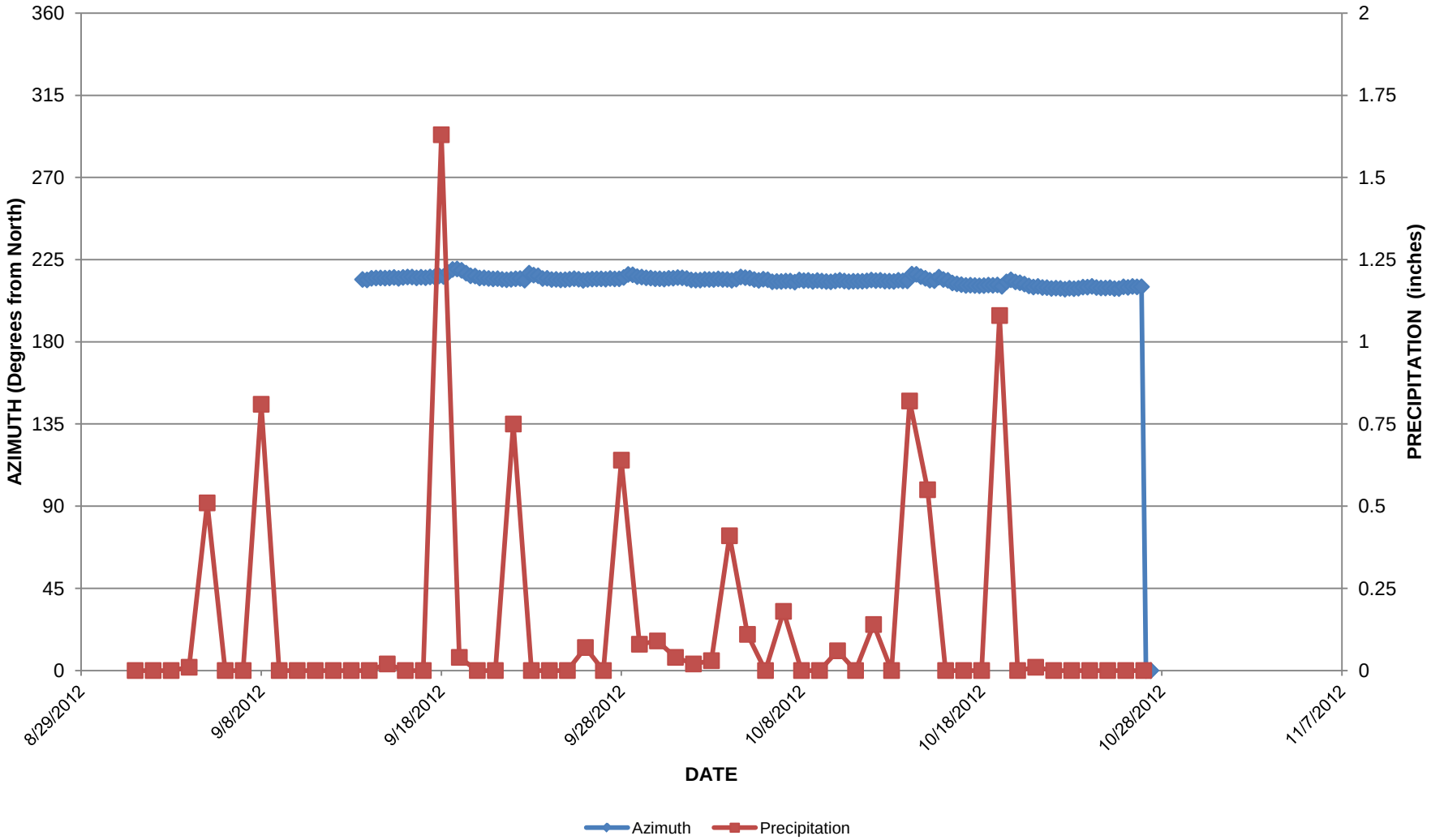


Figure
Hydraulic Gradient at Downgradient Barrier and Precipitation Events
PZ-13D, PZ-8D, and PZ-12D

Burgess Brothers Superfund Site
Bennington, Vermont

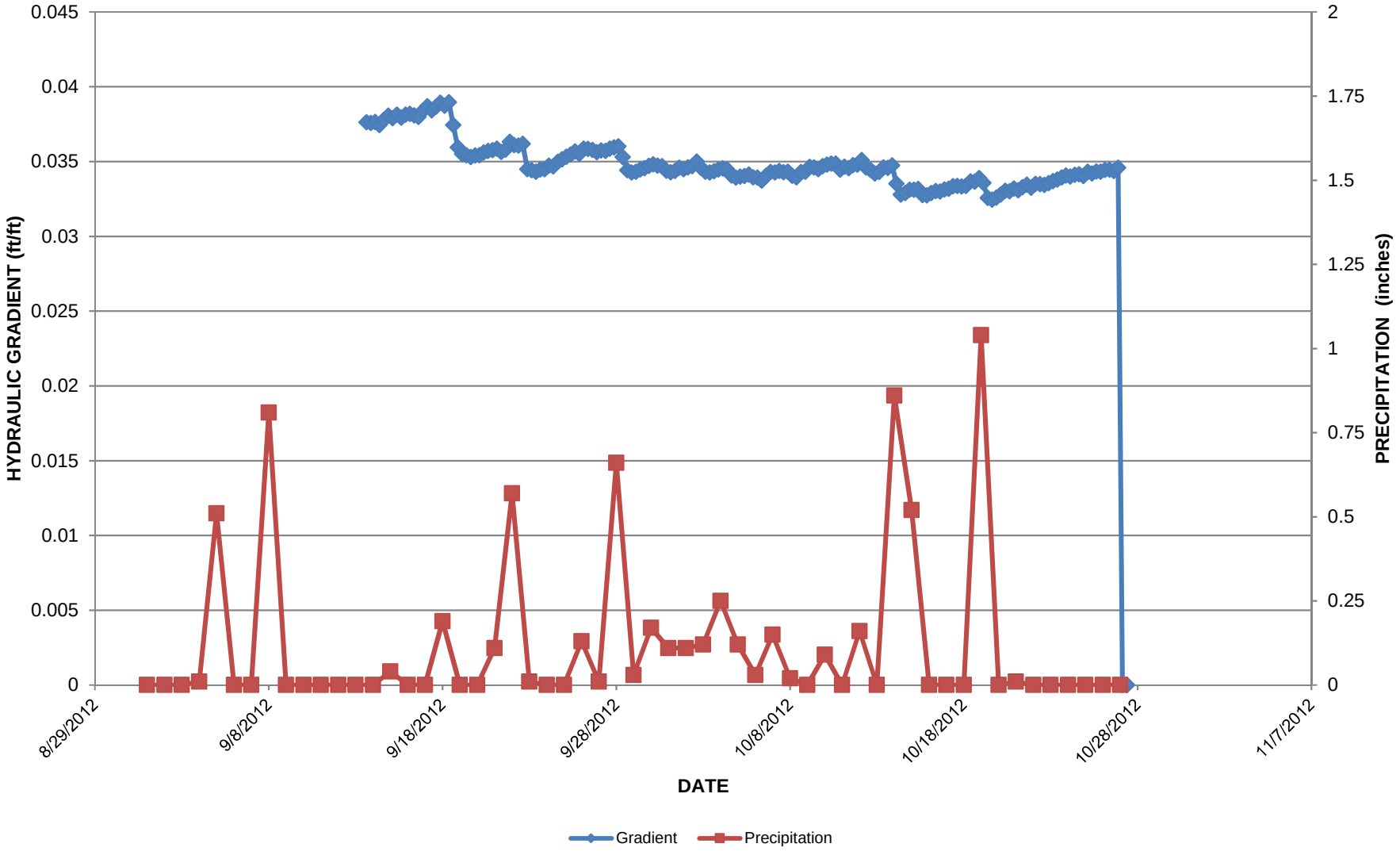


Figure
Hydraulic Gradient Azimuth at Downgradient Barrier, and Precipitation Events
PZ-9D, PZ-10D, and PZ-8D

Burgess Brothers Superfund Site
Bennington, Vermont

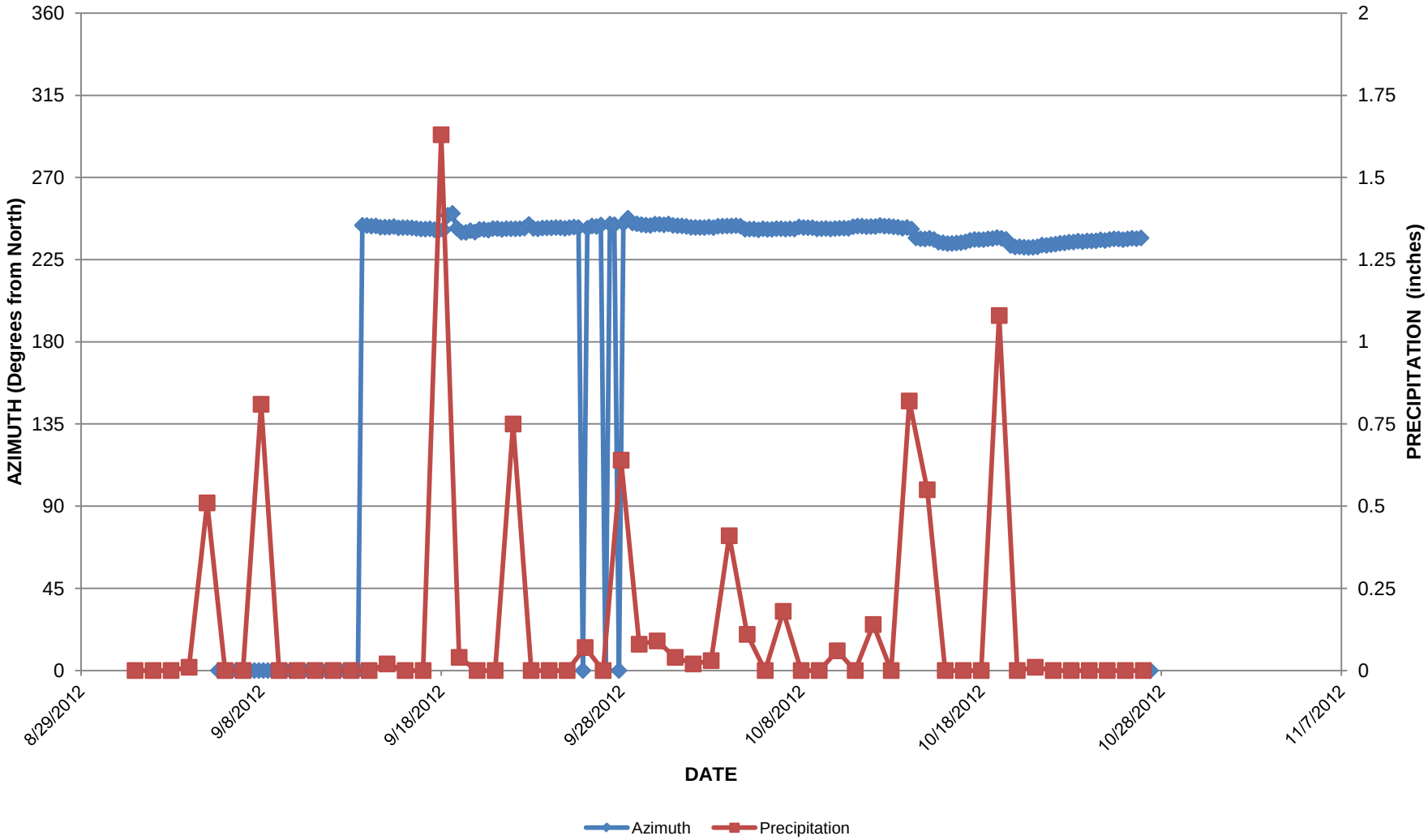


Figure
Hydraulic Gradient at Downgradient Barrier and Precipitation Events
PZ-9D, PZ-10D, and PZ-8D

Burgess Brothers Superfund Site
Bennington, Vermont

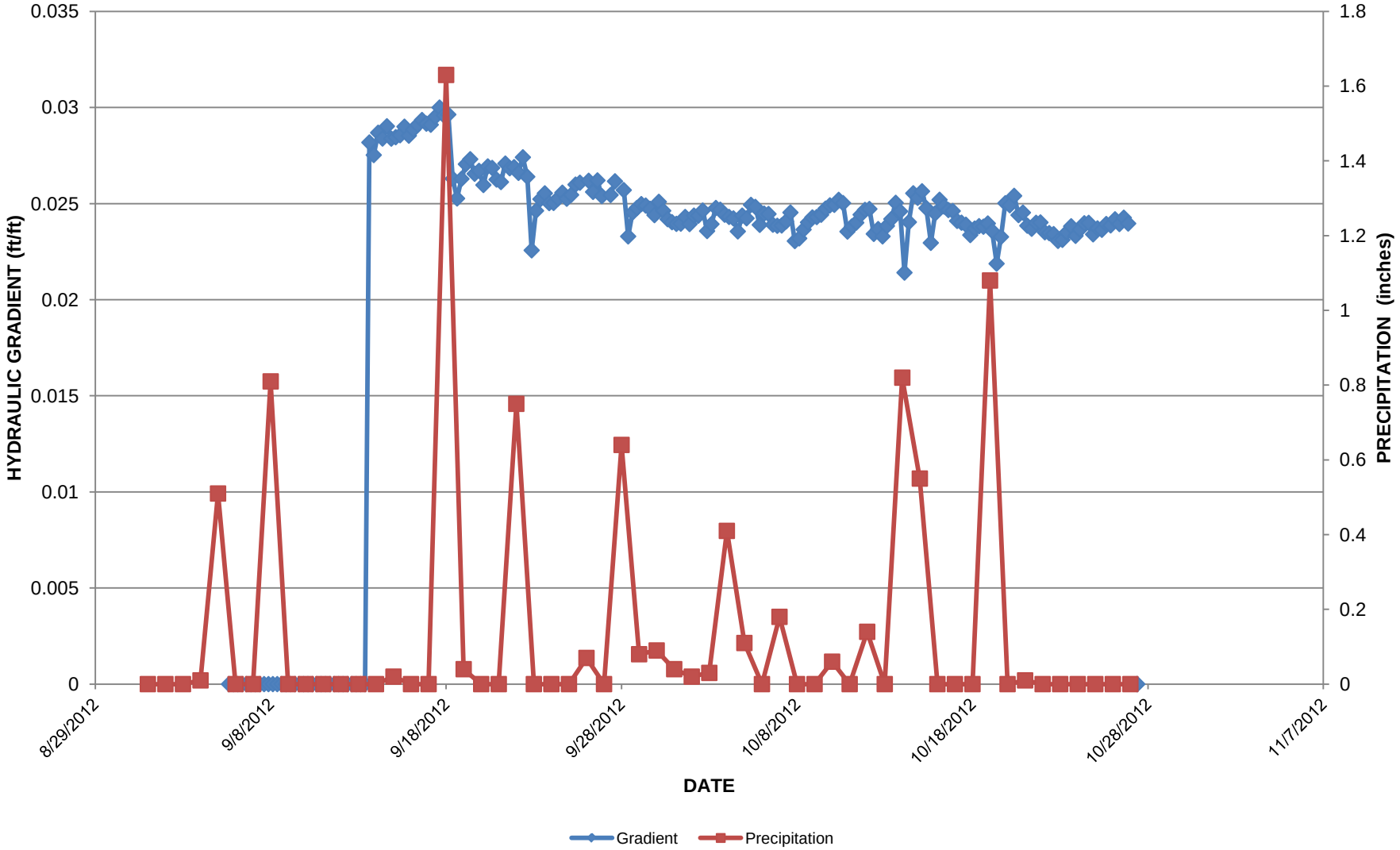


Figure
Hydraulic Gradient Azimuth at Downgradient Barrier, and Precipitation Events
PZ-9D, PZ-13D, and PZ-8D

Burgess Brothers Superfund Site
Bennington, Vermont

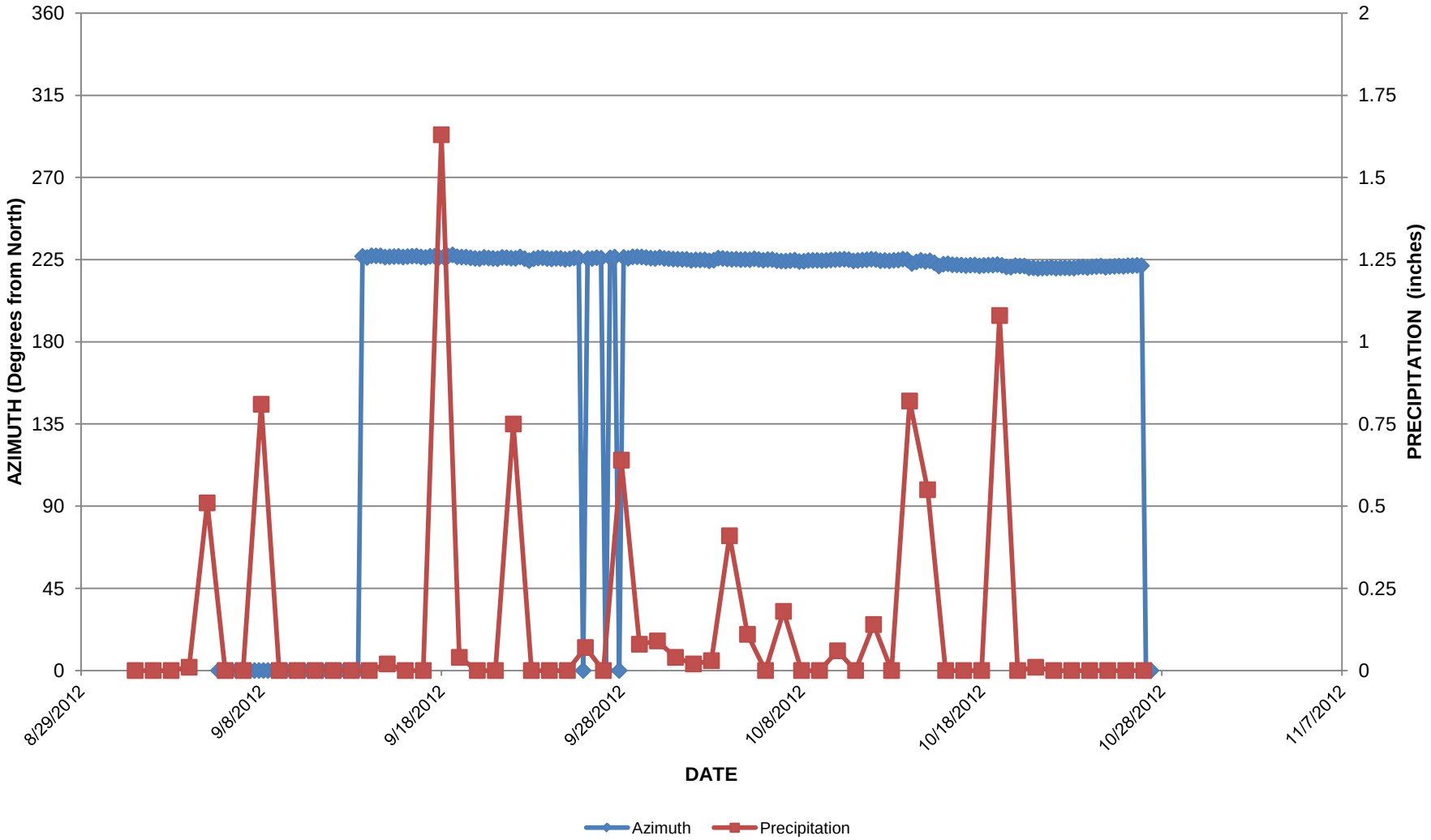


Figure
Hydraulic Gradient at Downgradint Barrier and Precipitation Events
PZ-9D, PZ-13D, and PZ-8D

Burgess Brothers Superfund Site
Bennington, Vermont

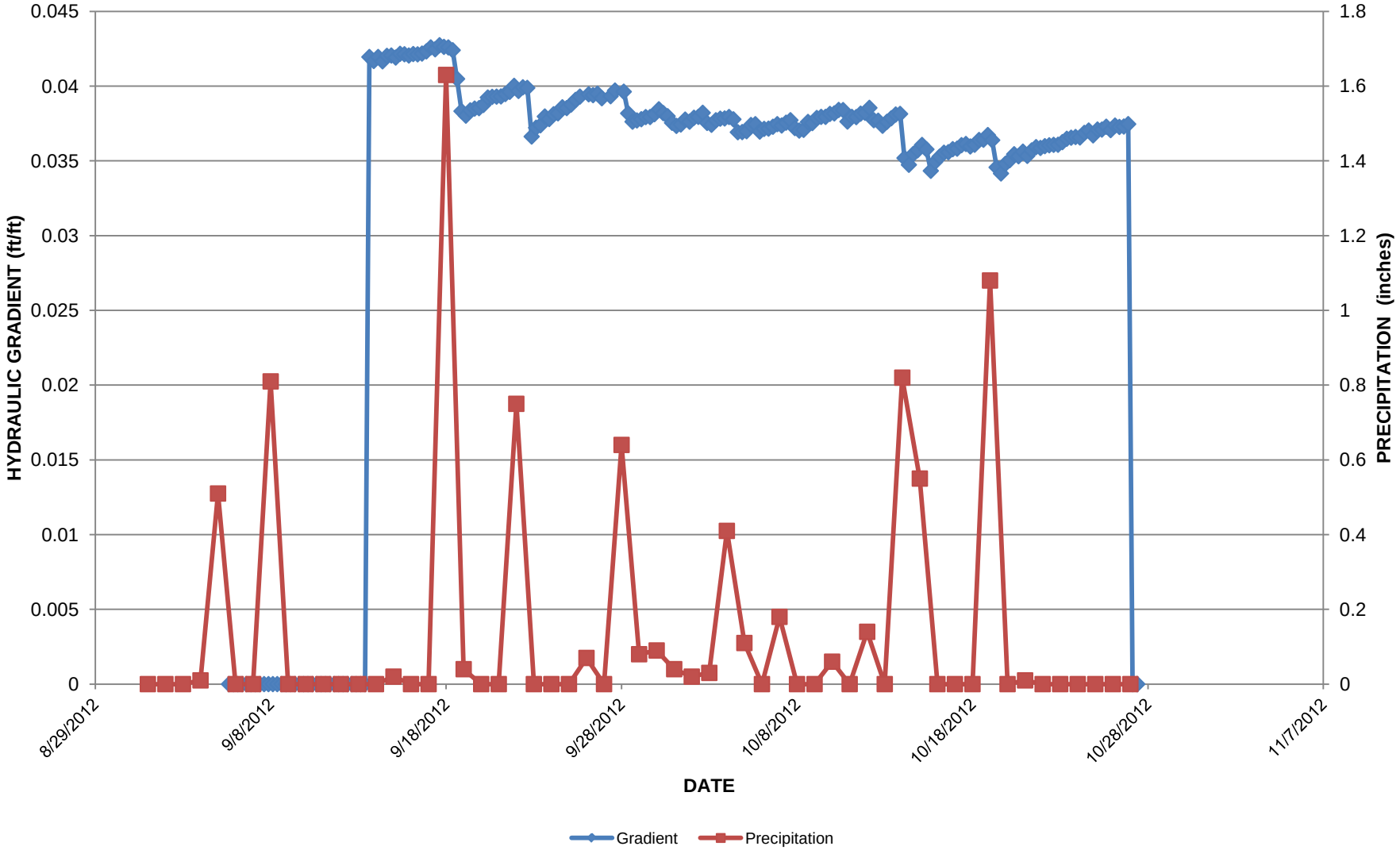


Figure
Hydraulic Ggradient Azimuth at Downgradient Barrier, and Precipitation Events
PZ-9D, PZ-13D, and PZ-12D

Burgess Brothers Superfund Site
Bennington, Vermont

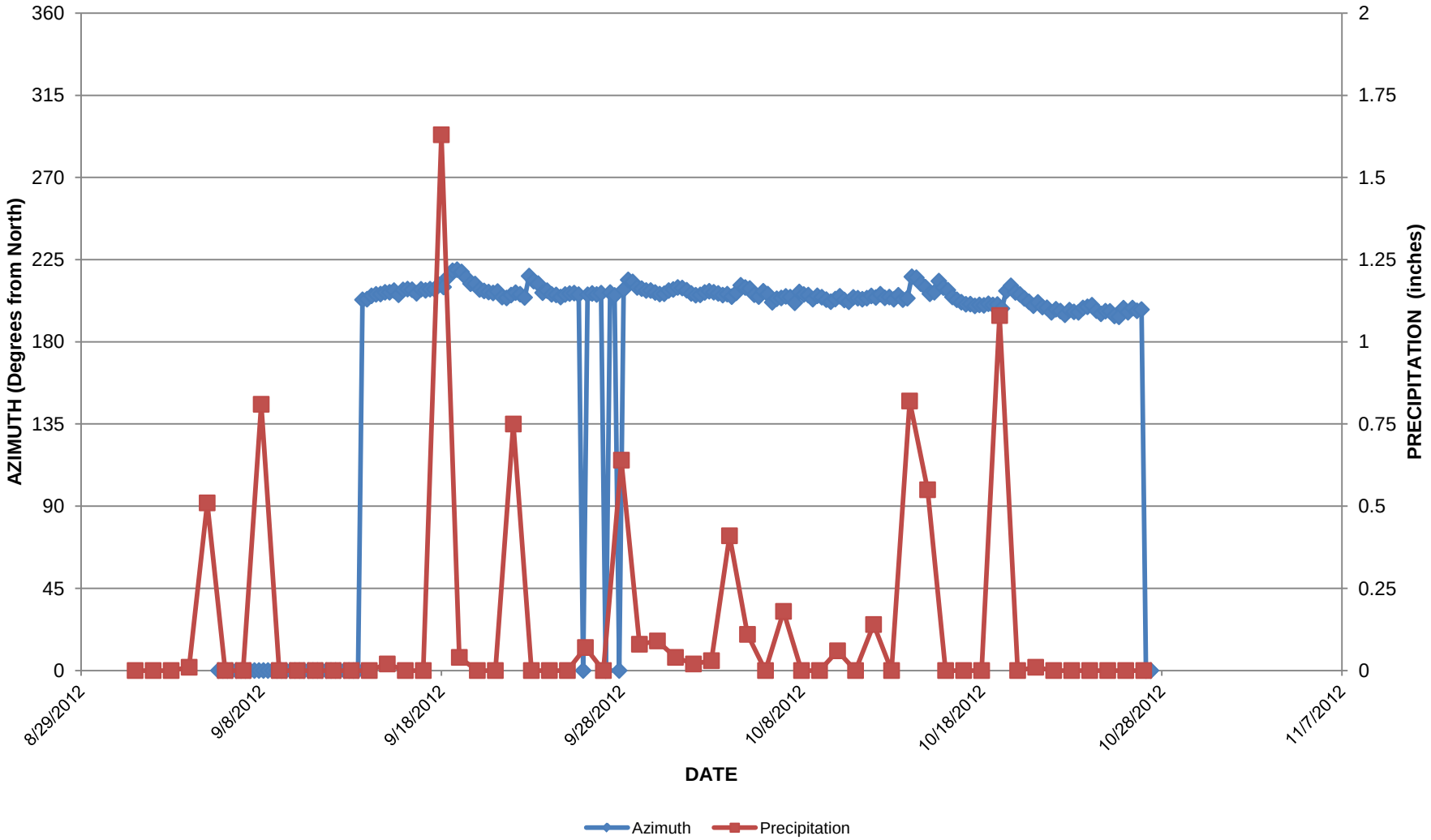


Figure
Hydraulic Gradient at Downgradint Barrier and Precipitation Events
PZ-9D, PZ-13D, and PZ-12D

Burgess Brothers Superfund Site
Bennington, Vermont

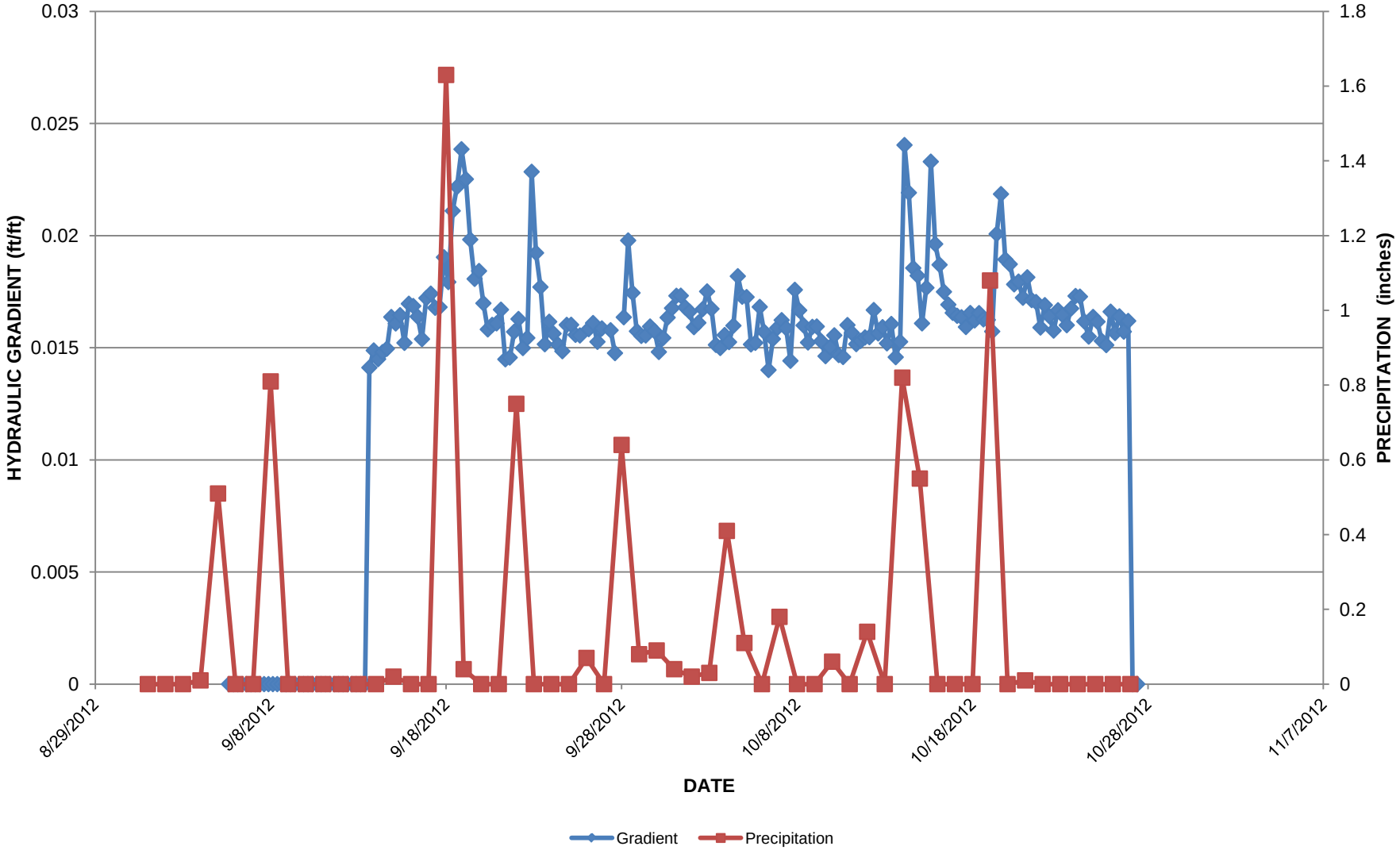


Figure
Hydraulic Gradient Azimuth at Downgradient Barrier, and Precipitation Events
PZ-7D, PZ-13D, and PZ-8D

Burgess Brothers Superfund Site
Bennington, Vermont

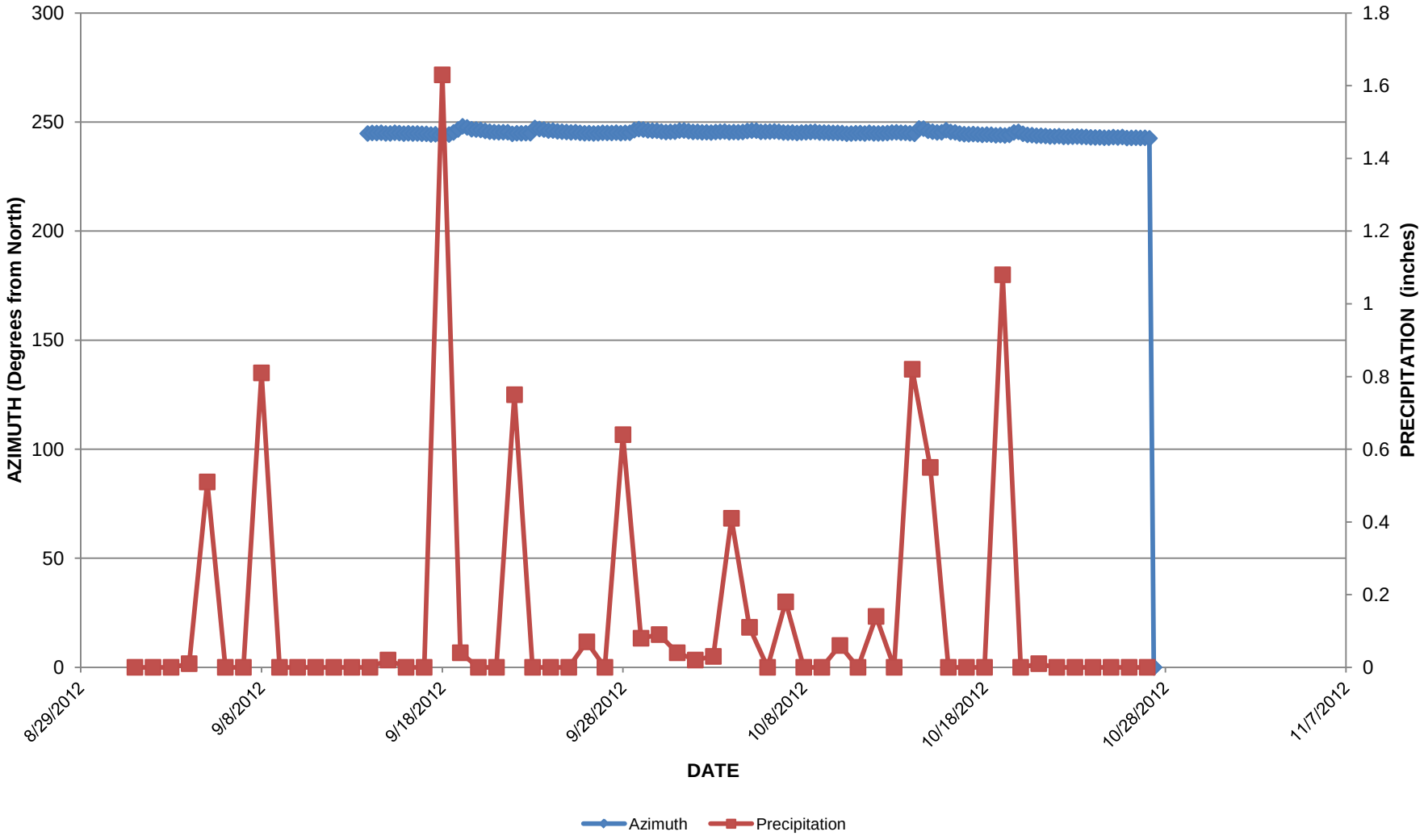
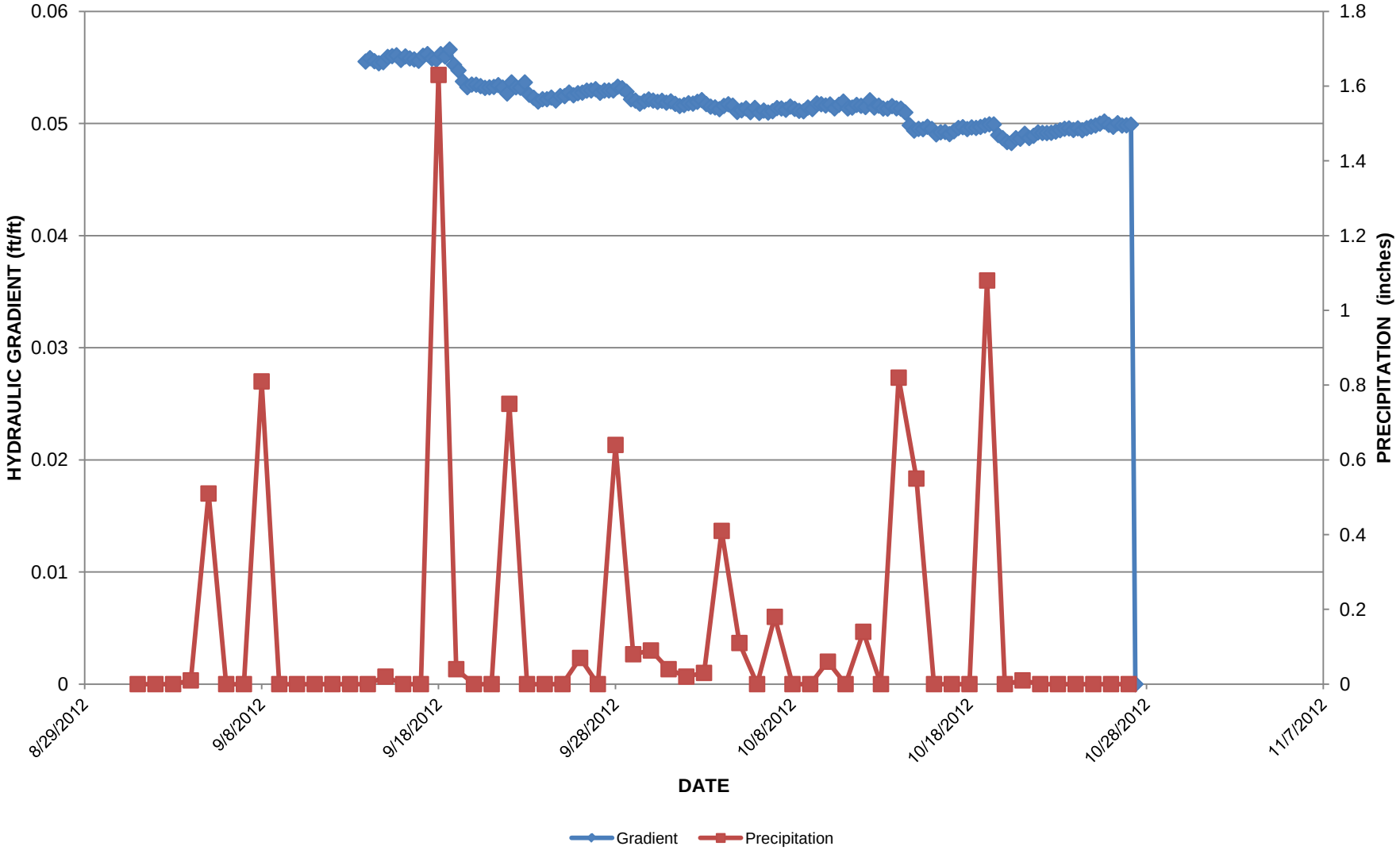
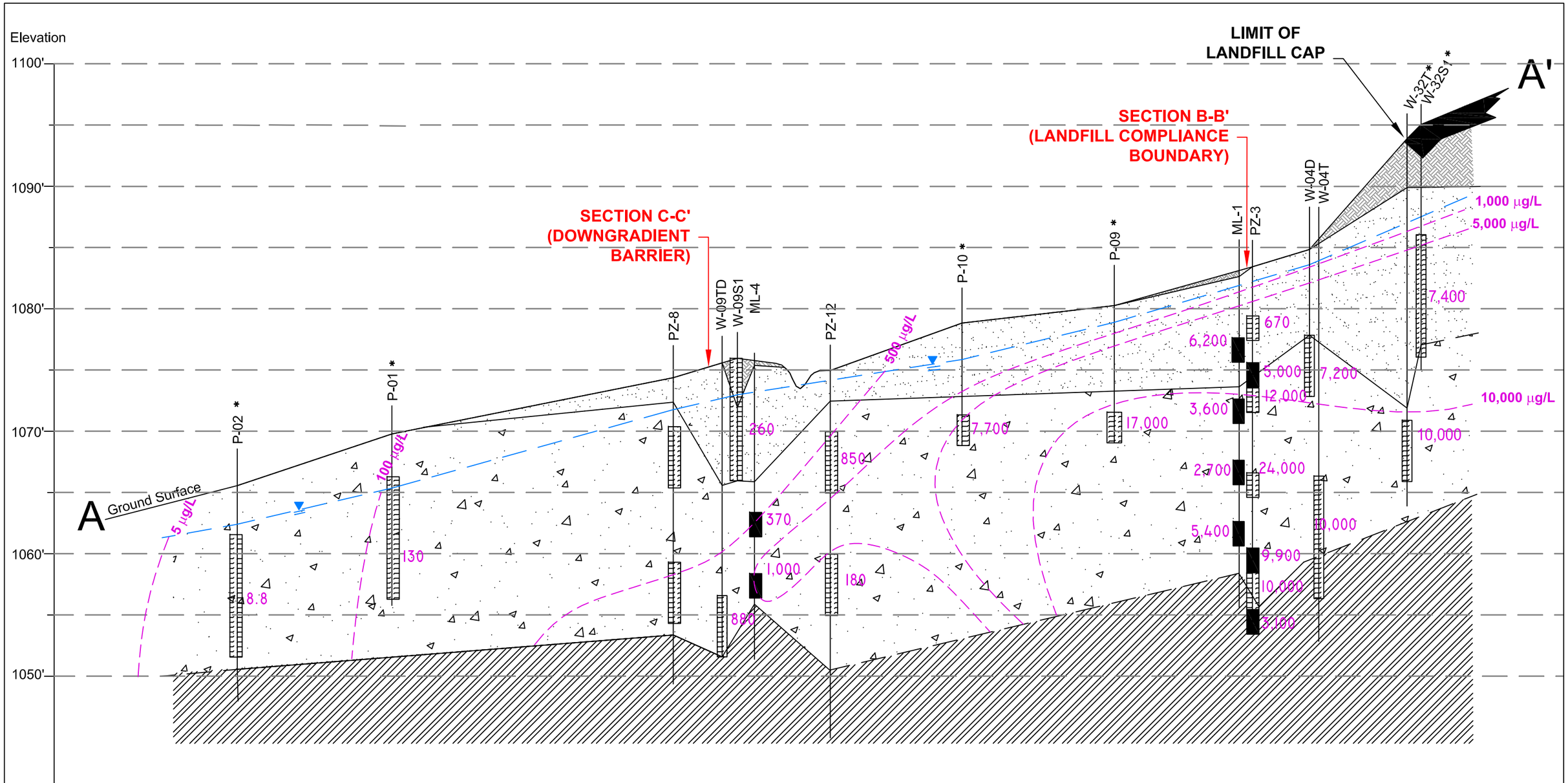


Figure
Hydraulic Gradient at Downgradient Barrier and Precipitation Events
PZ-7D, PZ-13D, and PZ-8D

Burgess Brothers Superfund Site
Bennington, Vermont



APPENDIX F
Cross-Sections with VOC Concentration Data



LEGEND

FILL
Sand and Silt; trace Gravel, roots, and organic matter

KAME SAND
Non-plastic Fine Sand to Silty Fine Sand, except as noted

ABLATION TILL
Non-plastic Fine Sand, Silty Fine Sand, or Fine Sandy Silt; some Gravel and Cobbles; trace to some Clay

LODGEMENT TILL
Silty Fine Sand, Fine Sandy Silt, or Silt; some Gravel and Cobbles; dry, very dense, slight to low plasticity

WELL SCREEN

VERTICAL PROFILE SAMPLE

GROUNDWATER ELEVATION SEPTEMBER 12, 2012

GROUNDWATER TETRACHLOROETHENE CONCENTRATIONS (UG/L)
AUGUST 2012 RESULTS, EXCEPT (*) MARCH 2012 RESULTS

VERTICAL EXAGGERATION = 5X
HORIZONTAL SCALE
20' 0' 20' 40'

SCALE: As Shown	
DATE: OCTOBER 17, 2012	
PROJECT NO.: 12012	
CLIENT: EPG	
DRAWN BY: DJW	
CHECKED BY: MW	
PROJ. MGMT. APPROVAL: MW	

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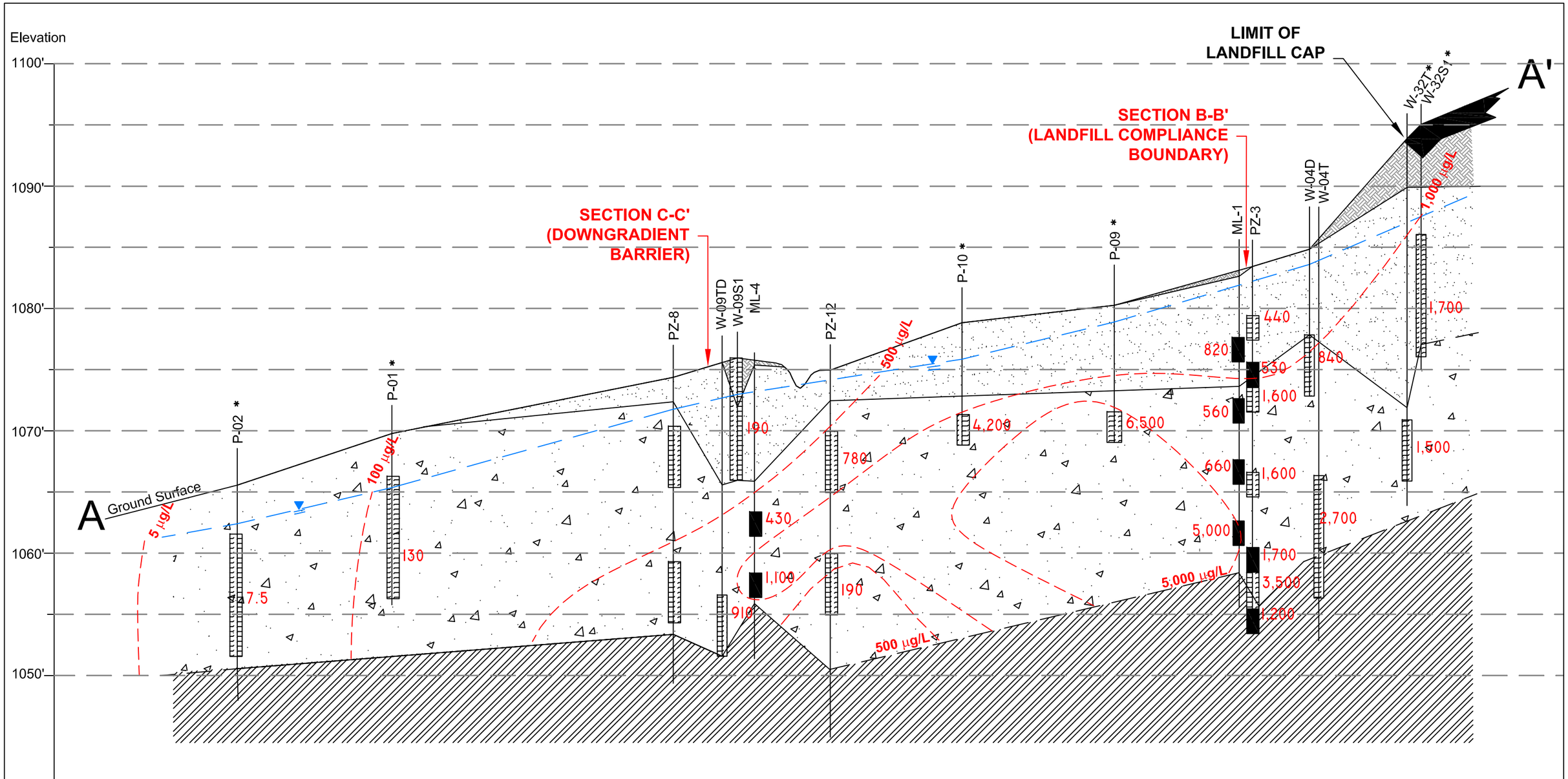
TITLE:
CROSS-SECTION A-A'
PCE CONCENTRATIONS

DRAWING NO.: FIGURE

REV: 0



LEGEND

FILL
Sand and Silt; trace Gravel, roots, and organic matter

KAME SAND
Non-plastic Fine Sand to Silty Fine Sand, except as noted

ABLATION TILL
Non-plastic Fine Sand, Silty Fine Sand, or Fine Sandy Silt; some Gravel and Cobbles; trace to some Clay

LODGEMENT TILL
Silty Fine Sand, Fine Sandy Silt, or Silt; some Gravel and Cobbles; dry, very dense, slight to low plasticity

WELL SCREEN

VERTICAL PROFILE SAMPLE

GROUNDWATER ELEVATION SEPTEMBER 12, 2012

GROUNDWATER TRICHLOROETHENE CONCENTRATIONS (UG/L)
AUGUST 2012 RESULTS, EXCEPT (*) MARCH 2012 RESULTS

VERTICAL EXAGGERATION = 5X
HORIZONTAL SCALE
20' 0' 20' 40'

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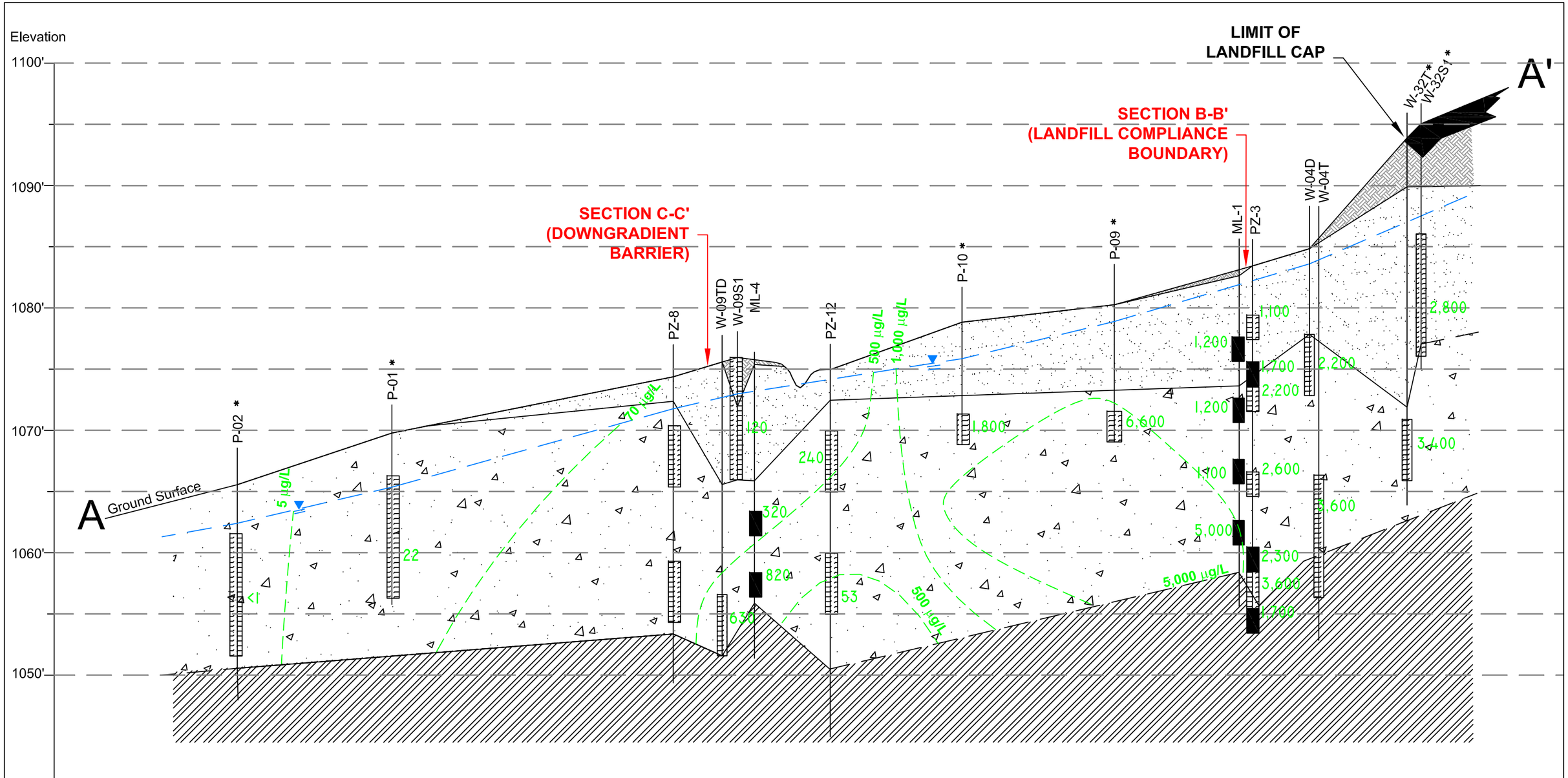
SCALE: As Shown	TITLE: CROSS-SECTION A-A' TCE CONCENTRATIONS
DATE: OCTOBER 17, 2012	
PROJECT NO.: 12012	
CLIENT: EPG	
DRAWN BY: DJW	DRAWING NO.: FIGURE
CHECKED BY: MW	REV: 0
PROJ. MGMT. APPROVAL: MW	



LEGEND

FILL
Sand and Silt; trace Gravel, roots, and organic matter

KAME SAND
Non-plastic Fine Sand to Silty Fine Sand, except as noted

ABLATION TILL
Non-plastic Fine Sand, Silty Fine Sand, or Fine Sandy Silt; some Gravel and Cobbles; trace to some Clay

LODGEMENT TILL
Silty Fine Sand, Fine Sandy Silt, or Silt; some Gravel and Cobbles; dry, very dense, slight to low plasticity

WELL SCREEN

VERTICAL PROFILE SAMPLE

GROUNDWATER ELEVATION SEPTEMBER 12, 2012

GROUNDWATER 1,2-DICHLOROETHENE CONCENTRATIONS (UG/L)
AUGUST 2012 RESULTS, EXCEPT (*) MARCH 2012 RESULTS

VERTICAL EXAGGERATION = 5X
HORIZONTAL SCALE
20' 0' 20' 40'

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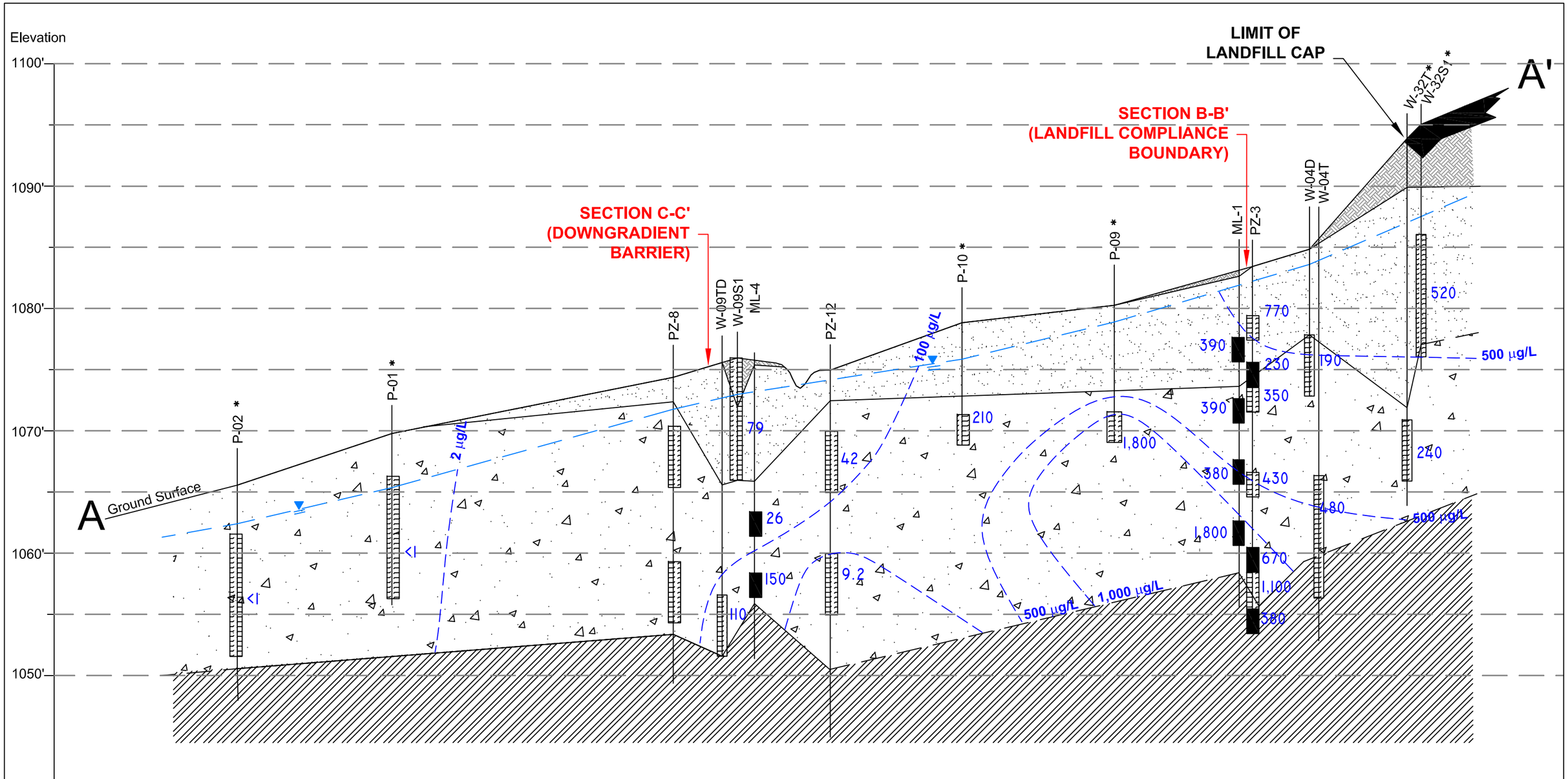
SCALE: As Shown	TITLE: CROSS-SECTION A-A' DCE CONCENTRATIONS
DATE: OCTOBER 17, 2012	
PROJECT NO.: 12012	
CLIENT: EPG	
DRAWN BY: DJW	DRAWING NO.: FIGURE
CHECKED BY: MW	REV: 0
PROJ. MGMT. APPROVAL: MW	



LEGEND

FILL
Sand and Silt; trace Gravel, roots, and organic matter

KAME SAND
Non-plastic Fine Sand to Silty Fine Sand, except as noted

ABLATION TILL
Non-plastic Fine Sand, Silty Fine Sand, or Fine Sandy Silt; some Gravel and Cobbles; trace to some Clay

LODGEMENT TILL
Silty Fine Sand, Fine Sandy Silt, or Silt; some Gravel and Cobbles; dry, very dense, slight to low plasticity

WELL SCREEN

VERTICAL PROFILE SAMPLE

GROUNDWATER ELEVATION SEPTEMBER 12, 2012

GROUNDWATER VINYL CHLORIDE CONCENTRATIONS (UG/L)
AUGUST 2012 RESULTS, EXCEPT (*) MARCH 2012 RESULTS

VERTICAL EXAGGERATION = 5X
HORIZONTAL SCALE
20' 0' 20' 40'

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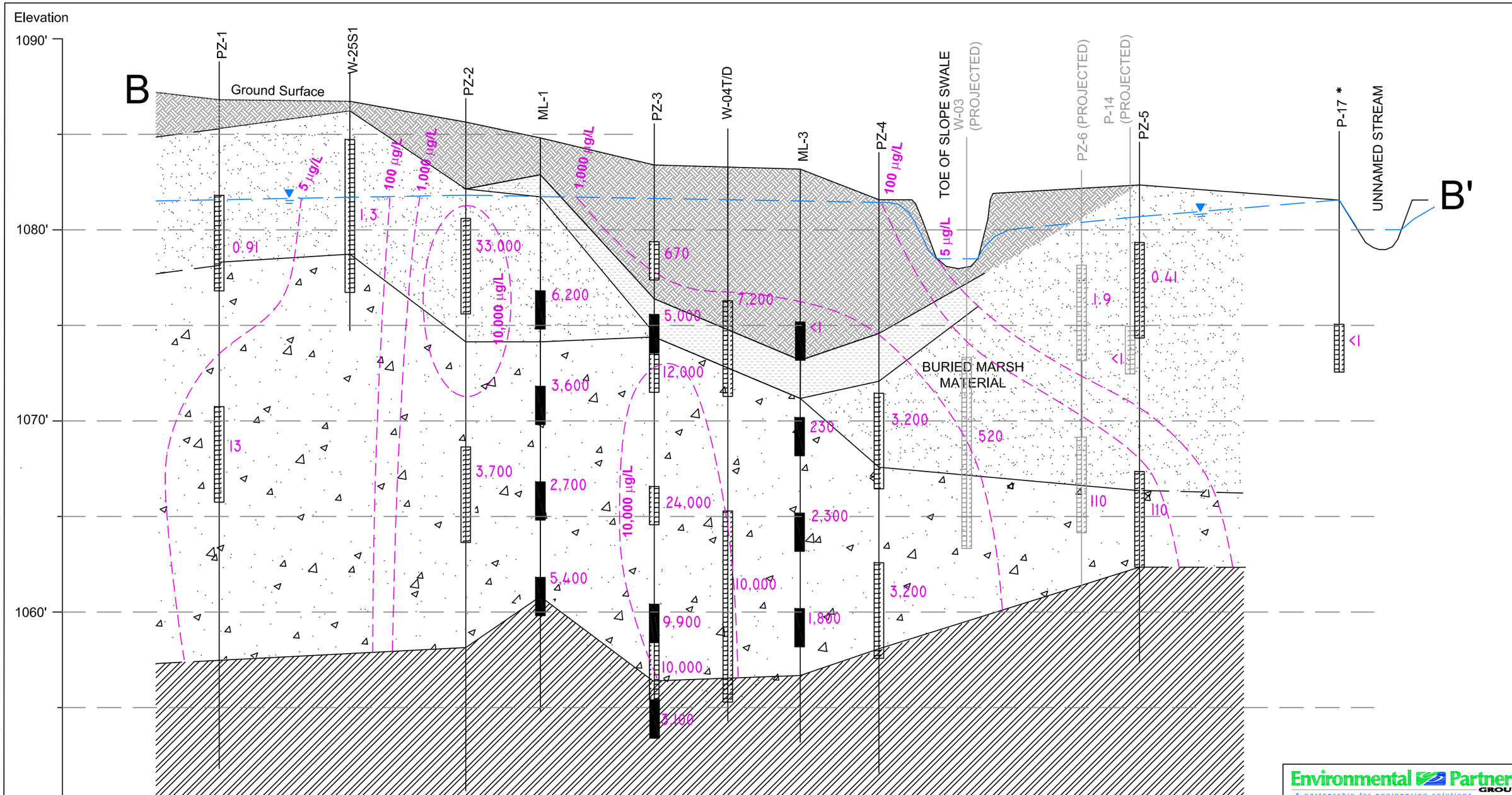
SCALE: As Shown	TITLE: CROSS-SECTION A-A' VC CONCENTRATIONS
DATE: OCTOBER 17, 2012	
PROJECT NO.: 12012	
CLIENT: EPG	
DRAWN BY: DJW	DRAWING NO.: FIGURE
CHECKED BY: MW	REV: 0
PROJ. MGMT. APPROVAL: MW	



LEGEND

FILL
Sand and Silt; trace Gravel, roots, and organic matter

KAME SAND
Non-plastic Fine Sand to Silty Fine Sand, except as noted

ABLATION TILL
Non-plastic Fine Sand, Silty Fine Sand, or Fine Sandy Silt; some Gravel and Cobbles; trace to some Clay

LODGEMENT TILL
Silty Fine Sand, Fine Sandy Silt, or Silt; some Gravel and Cobbles; dry, very dense, slight to low plasticity

WELL SCREEN

VERTICAL PROFILE SAMPLE

GROUNDWATER ELEVATION SEPTEMBER 12, 2012

GROUNDWATER TETRACHLOROETHENE CONCENTRATIONS (UG/L)
AUGUST 2012 RESULTS, EXCEPT (*) NOVEMBER 2006 RESULTS

VERTICAL EXAGGERATION = 4X
HORIZONTAL SCALE
10' 0' 10' 20'

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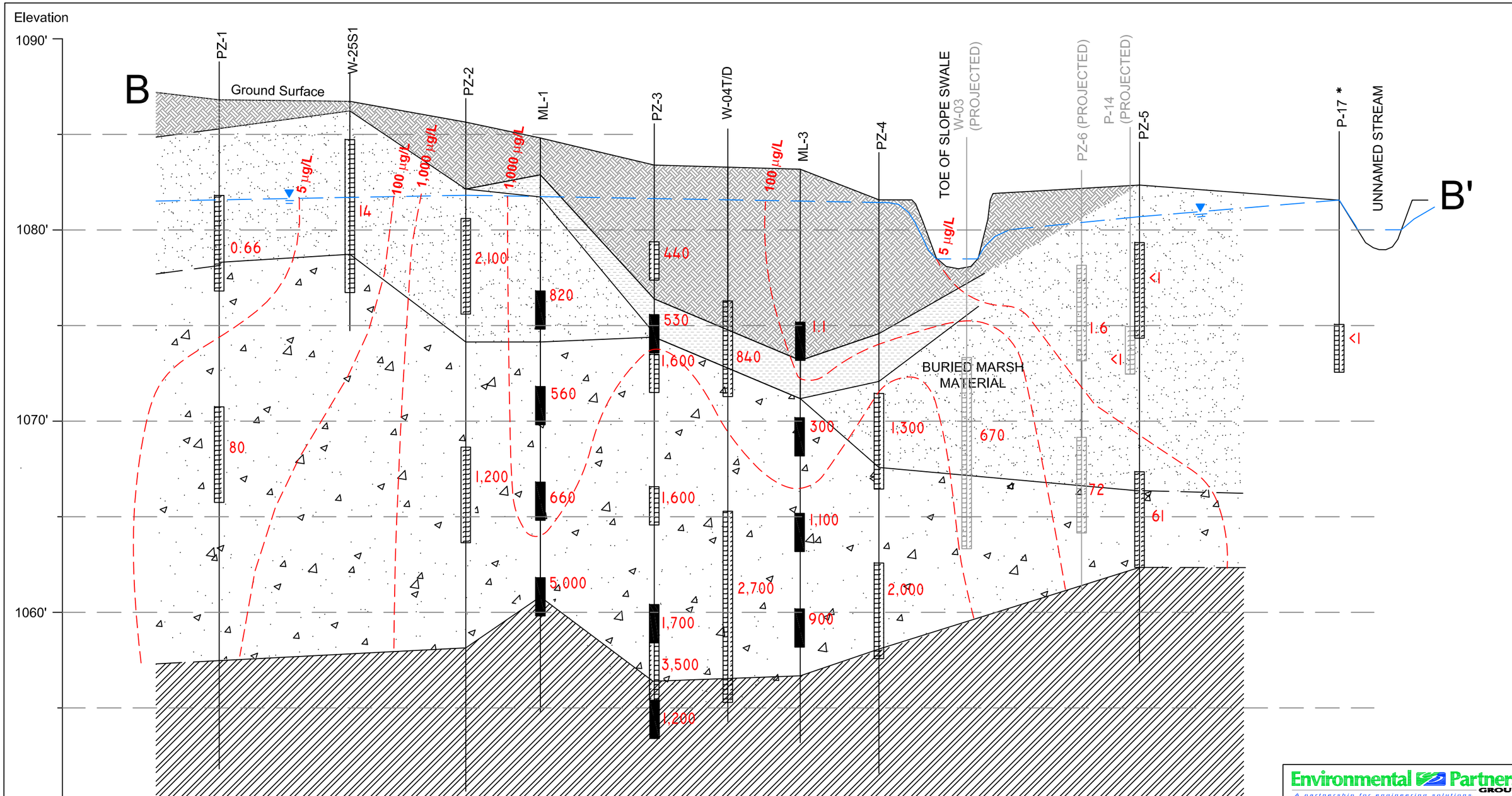
SCALE: As Shown	TITLE: CROSS-SECTION B-B' PCE CONCENTRATIONS
DATE: OCTOBER 10, 2012	
PROJECT NO.: 12012	
CLIENT: EPG	
DRAWN BY: DJW	DRAWING NO.: FIGURE
CHECKED BY: MTW	REV: 0
PROJ. MGMT. APPROVAL: MTW	



LEGEND

- FILL — Sand and Silt; trace Gravel, roots, and organic matter
- KAME SAND — Non-plastic Fine Sand to Silty Fine Sand, except as noted
- ABLATION TILL — Non-plastic Fine Sand, Silty Fine Sand, or Fine Sandy Silt; some Gravel and Cobbles; trace to some Clay
- LODGEMENT TILL — Silty Fine Sand, Fine Sandy Silt, or Silt; some Gravel and Cobbles; dry, very dense, slight to low plasticity
- WELL SCREEN
- VERTICAL PROFILE SAMPLE
- GROUNDWATER ELEVATION SEPTEMBER 12, 2012

GROUNDWATER TRICHLOROETHENE CONCENTRATIONS (UG/L)
AUGUST 2012 RESULTS, EXCEPT (*) NOVEMBER 2006 RESULTS

VERTICAL EXAGGERATION = 4X
HORIZONTAL SCALE
10' 0' 10' 20'

Environmental Partners GROUP
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XDD
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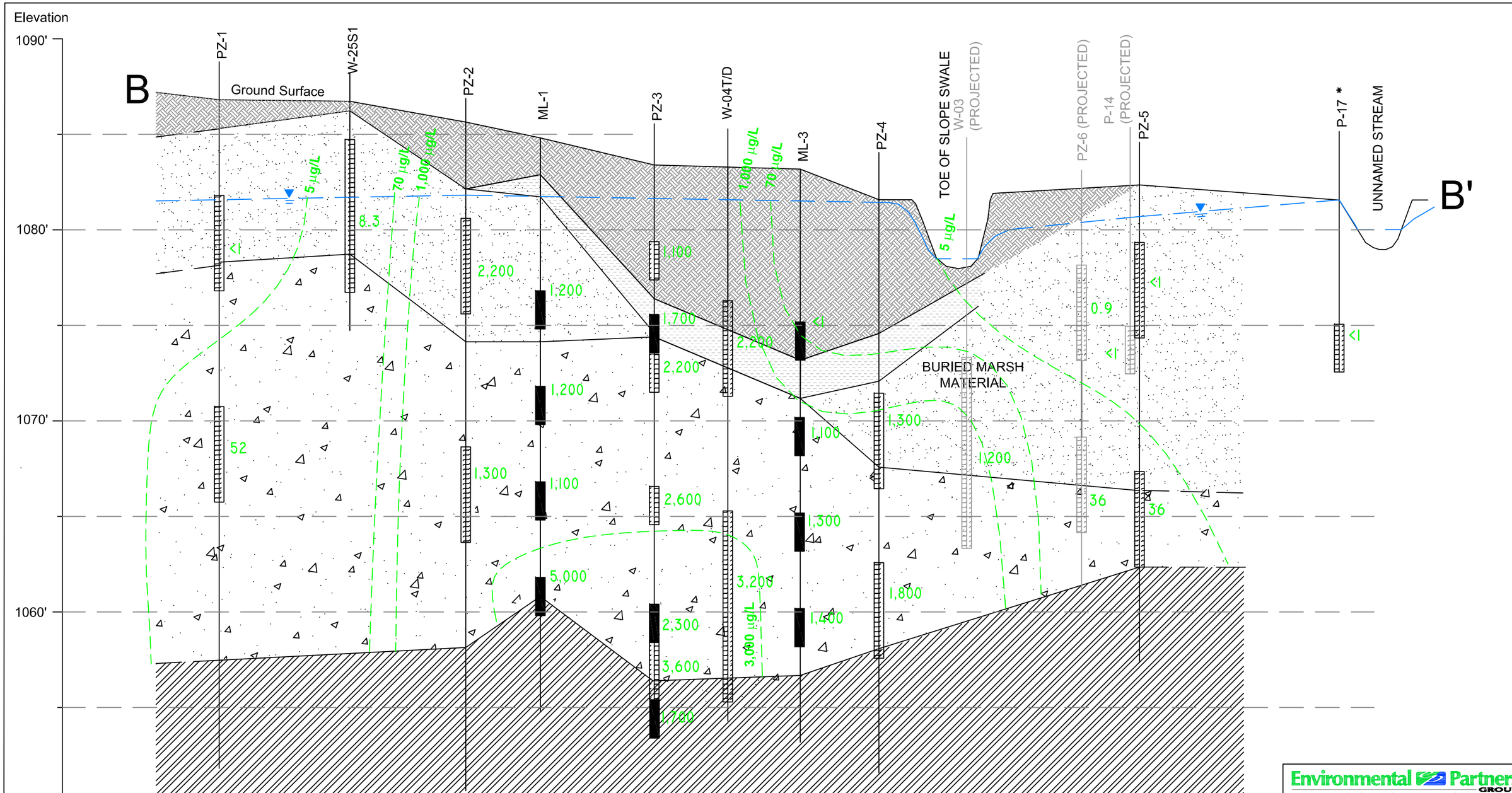
SCALE: As Shown	TITLE: CROSS-SECTION B-B' TCE CONCENTRATIONS
DATE: OCTOBER 10, 2012	
PROJECT NO.: 12012	
CLIENT: EPG	
DRAWN BY: DJW	DRAWING NO.: FIGURE
CHECKED BY: MTW	REV: 0
PROJ. MGMT. APPROVAL: MTW	



LEGEND

- FILL — Sand and Silt; trace Gravel, roots, and organic matter
- KAME SAND — Non-plastic Fine Sand to Silty Fine Sand, except as noted
- ABLATION TILL — Non-plastic Fine Sand, Silty Fine Sand, or Fine Sandy Silt; some Gravel and Cobbles; trace to some Clay
- LODGEMENT TILL — Silty Fine Sand, Fine Sandy Silt, or Silt; some Gravel and Cobbles; dry, very dense, slight to low plasticity
- WELL SCREEN
- VERTICAL PROFILE SAMPLE
- GROUNDWATER ELEVATION SEPTEMBER 12, 2012

GROUNDWATER 1,2-DICHLOROETHENE CONCENTRATIONS (UG/L)
AUGUST 2012 RESULTS, EXCEPT (*) NOVEMBER 2006 RESULTS

VERTICAL EXAGGERATION = 4X
HORIZONTAL SCALE
10' 0' 10' 20'

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SCALE: As Shown	TITLE: CROSS-SECTION B-B' DCE CONCENTRATIONS
DATE: OCTOBER 10, 2012	
PROJECT NO.: 12012	
CLIENT: EPG	
DRAWN BY: DJW	DRAWING NO.: FIGURE
CHECKED BY: MTW	REV: 0
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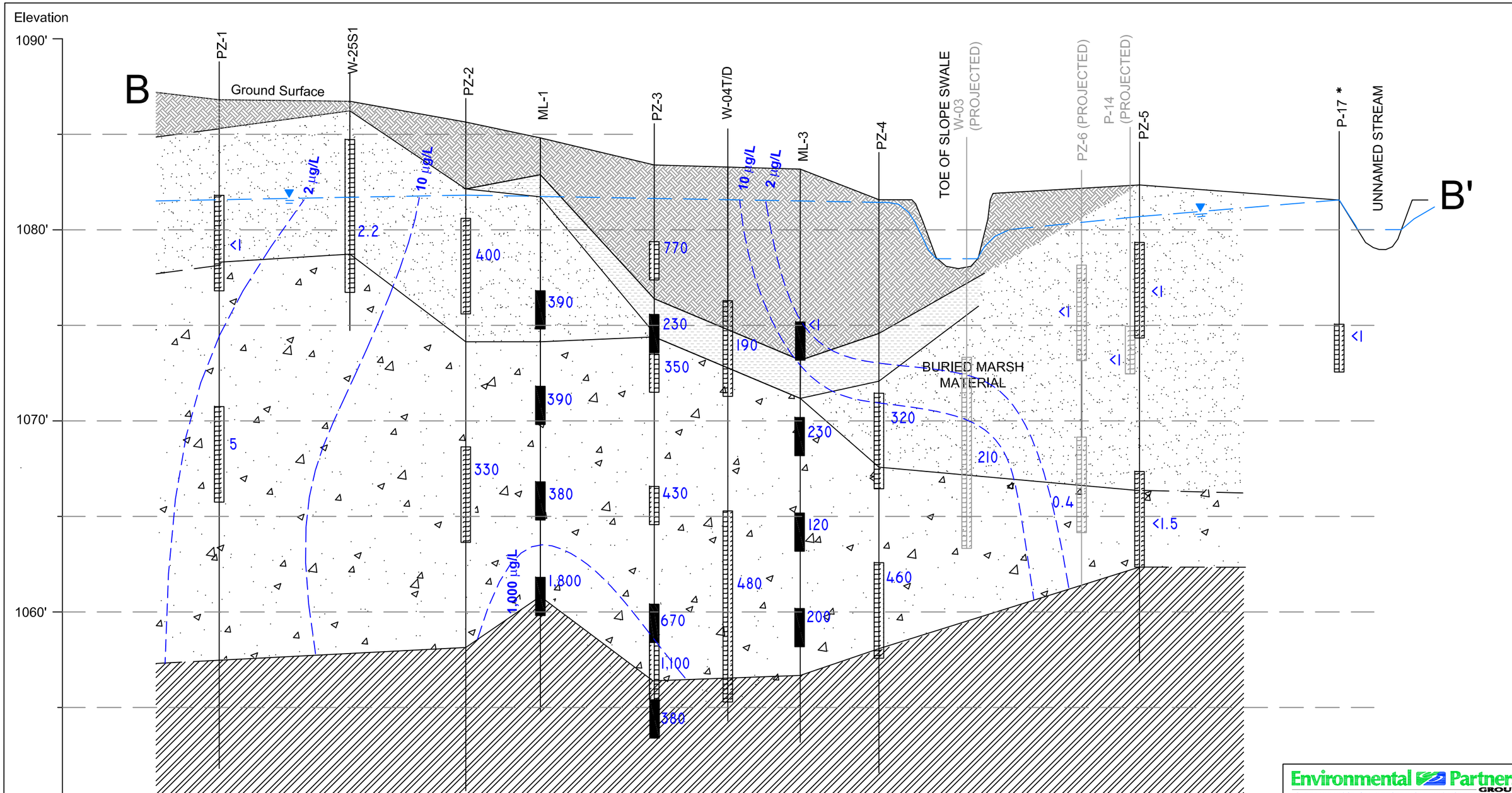

LEGEND

FILL
Sand and Silt; trace Gravel, roots, and organic matter

KAME SAND
Non-plastic Fine Sand to Silty Fine Sand, except as noted

ABLATION TILL
Non-plastic Fine Sand, Silty Fine Sand, or Fine Sandy Silt; some Gravel and Cobbles; trace to some Clay

LODGEMENT TILL
Silty Fine Sand, Fine Sandy Silt, or Silt; some Gravel and Cobbles; dry, very dense, slight to low plasticity

WELL SCREEN

VERTICAL PROFILE SAMPLE

GROUNDWATER ELEVATION SEPTEMBER 12, 2012

GROUNDWATER VINYL CHLORIDE CONCENTRATIONS (UG/L)
AUGUST 2012 RESULTS, EXCEPT (*) NOVEMBER 2006 RESULTS

VERTICAL EXAGGERATION = 4X
HORIZONTAL SCALE
10' 0' 10' 20'

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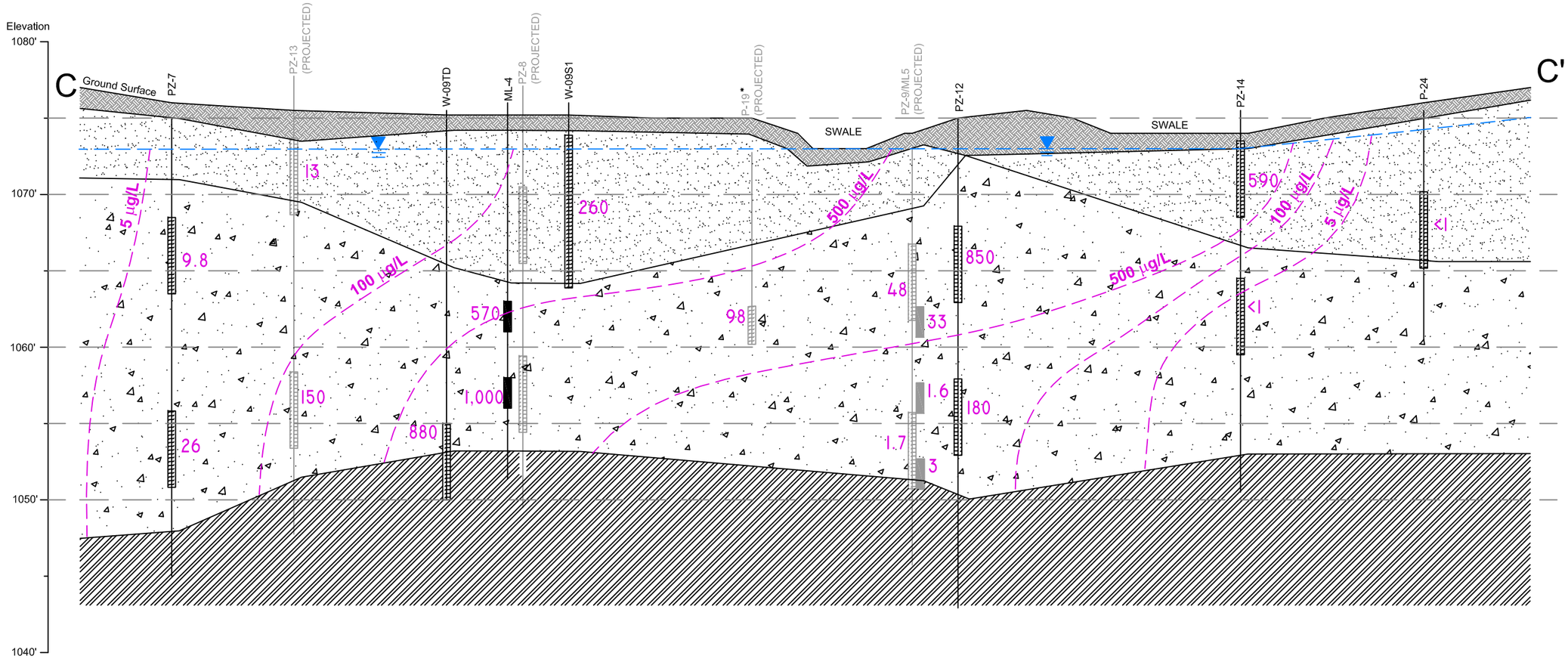
SCALE: As Shown	TITLE: CROSS–SECTION B–B' VC CONCENTRATIONS
DATE: OCTOBER 10, 2012	
PROJECT NO.: 12012	
CLIENT: EPG	
DRAWN BY: DJW	DRAWING NO.: FIGURE
CHECKED BY: MTW	REV: 0
PROJ. MGMT. APPROVAL: MTW	



LEGEND

FILL
Sand and Silt; trace Gravel, roots, and organic matter

KAME SAND
Non-plastic Fine Sand to Silty Fine Sand, except as noted

ABLATION TILL
Non-plastic Fine Sand, Silty Fine Sand, or Fine Sandy Silt; some Gravel and Cobbles; trace to some Clay

LODGEMENT TILL
Silty Fine Sand, Fine Sandy Silt, or Silt; some Gravel and Cobbles; dry, very dense, slight to low plasticity

WELL SCREEN

VERTICAL PROFILE SAMPLE

GROUNDWATER ELEVATION
SEPTEMBER 12, 2012

GROUNDWATER TETRACHLOROETHENE CONCENTRATIONS (UG/L)
AUGUST 2012 RESULTS, EXCEPT (*) MARCH 2012 RESULTS

VERTICAL EXAGGERATION = 2X
HORIZONTAL SCALE

7.5' 0' 7.5' 15'

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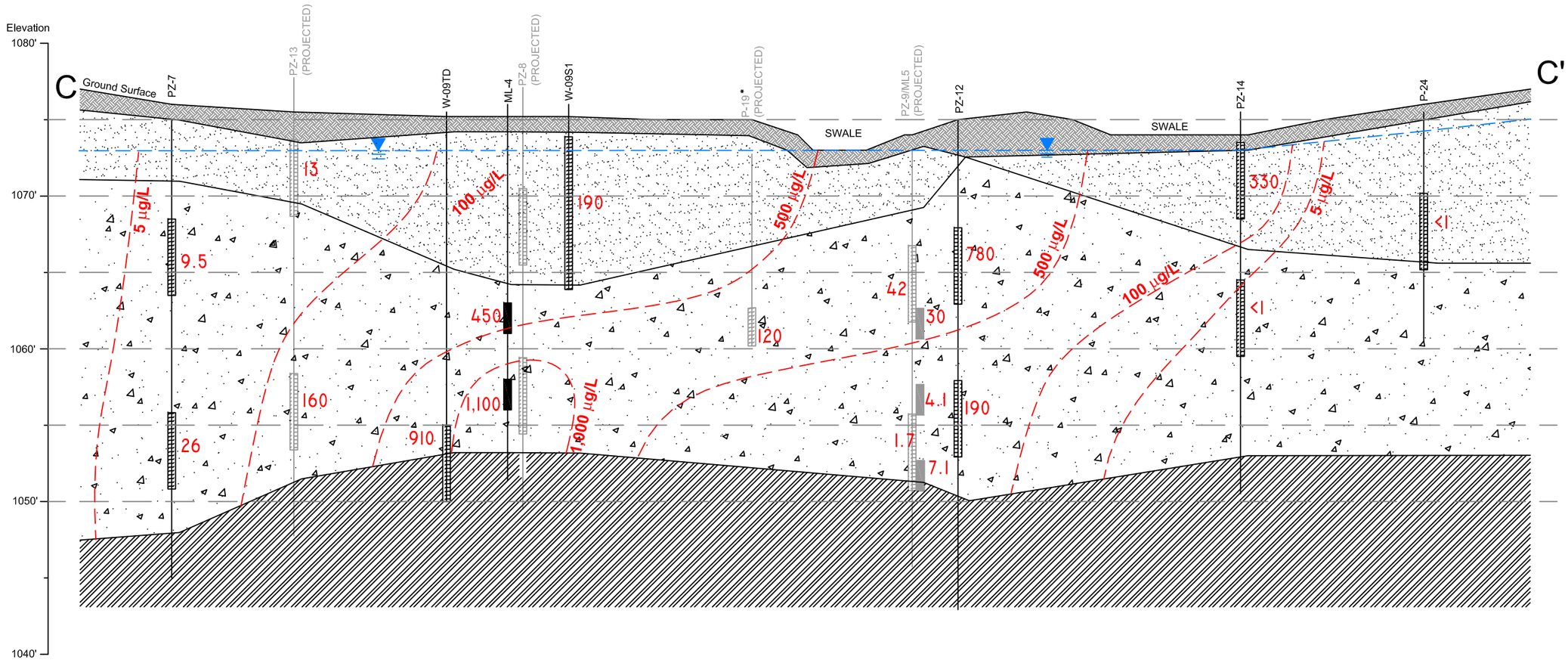
SCALE: As Shown	TITLE: CROSS-SECTION C-C' PCE CONCENTRATIONS
DATE: November 8, 2012	
PROJECT NO.: 12012	
CLIENT: EPG	
DRAWN BY: DJW	DRAWING NO.: FIGURE
CHECKED BY: MTW	REV: 0
PROJ. MGMT. APPROVAL: MTW	



LEGEND

FILL
Sand and Silt; trace Gravel, roots, and organic matter

KAME SAND
Non-plastic Fine Sand to Silty Fine Sand, except as noted

ABLATION TILL
Non-plastic Fine Sand, Silty Fine Sand, or Fine Sandy Silt; some Gravel and Cobbles; trace to some Clay

LODGEMENT TILL
Silty Fine Sand, Fine Sandy Silt, or Silt; some Gravel and Cobbles; dry, very dense, slight to low plasticity

WELL SCREEN

VERTICAL PROFILE SAMPLE

GROUNDWATER ELEVATION
SEPTEMBER 12, 2012

GROUNDWATER TRICHLOROETHENE CONCENTRATIONS (UG/L)
AUGUST 2012 RESULTS, EXCEPT (*) MARCH 2012 RESULTS

VERTICAL EXAGGERATION = 2X
HORIZONTAL SCALE

7.5' 0' 7.5' 15'

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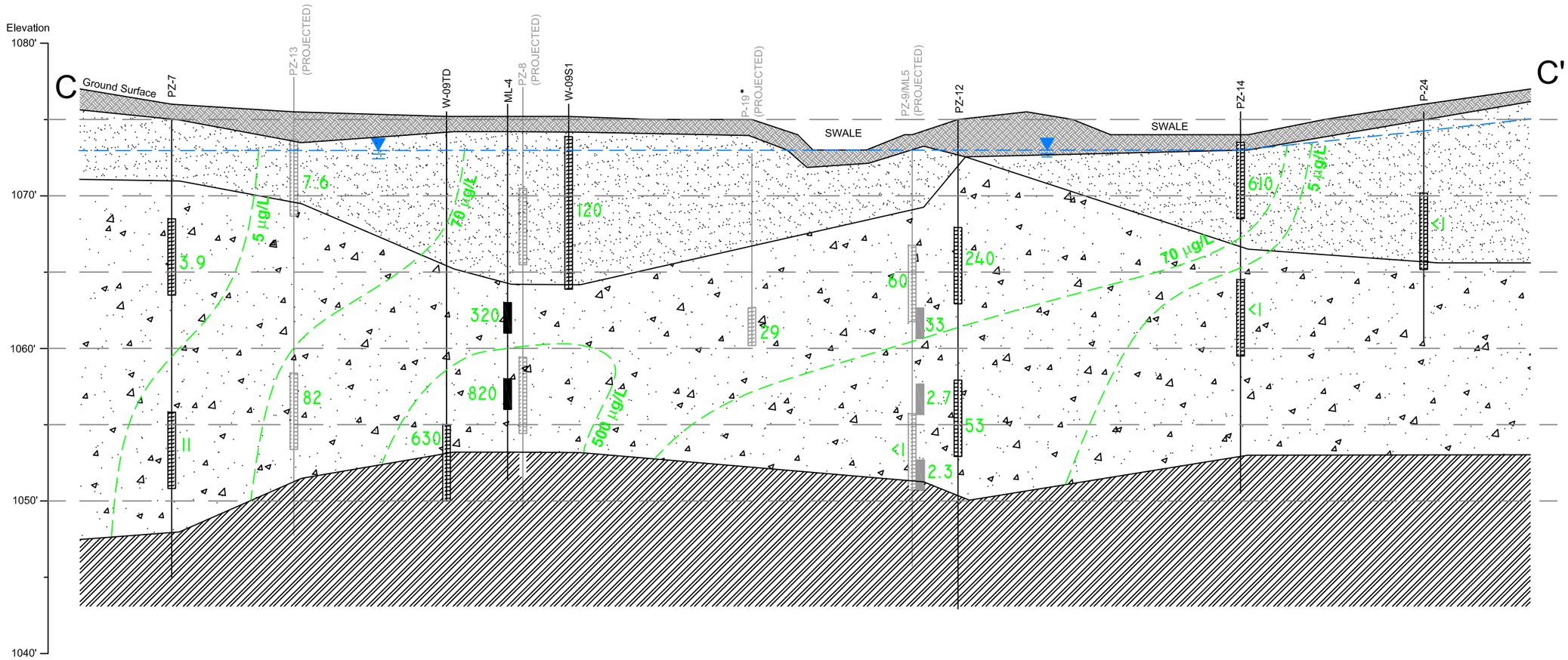
SCALE: As Shown	TITLE: CROSS-SECTION C-C' TCE CONCENTRATIONS
DATE: November 8, 2012	
PROJECT NO.: 12012	
CLIENT: EPG	
DRAWN BY: DJW	DRAWING NO.: FIGURE
CHECKED BY: MTW	REV: 0
PROJ. MGMT. APPROVAL: MTW	



LEGEND

FILL
Sand and Silt; trace Gravel, roots, and organic matter

KAME SAND
Non-plastic Fine Sand to Silty Fine Sand, except as noted

ABLATION TILL
Non-plastic Fine Sand, Silty Fine Sand, or Fine Sandy Silt; some Gravel and Cobbles; trace to some Clay

LODGEMENT TILL
Silty Fine Sand, Fine Sandy Silt, or Silt; some Gravel and Cobbles; dry, very dense, slight to low plasticity

WELL SCREEN

VERTICAL PROFILE SAMPLE

GROUNDWATER ELEVATION
SEPTEMBER 12, 2012

GROUNDWATER 1,2-DICHLOROETHENE CONCENTRATIONS (UG/L)
AUGUST 2012 RESULTS, EXCEPT (*) MARCH 2012 RESULTS

VERTICAL EXAGGERATION = 2X
HORIZONTAL SCALE

7.5' 0' 7.5' 15'

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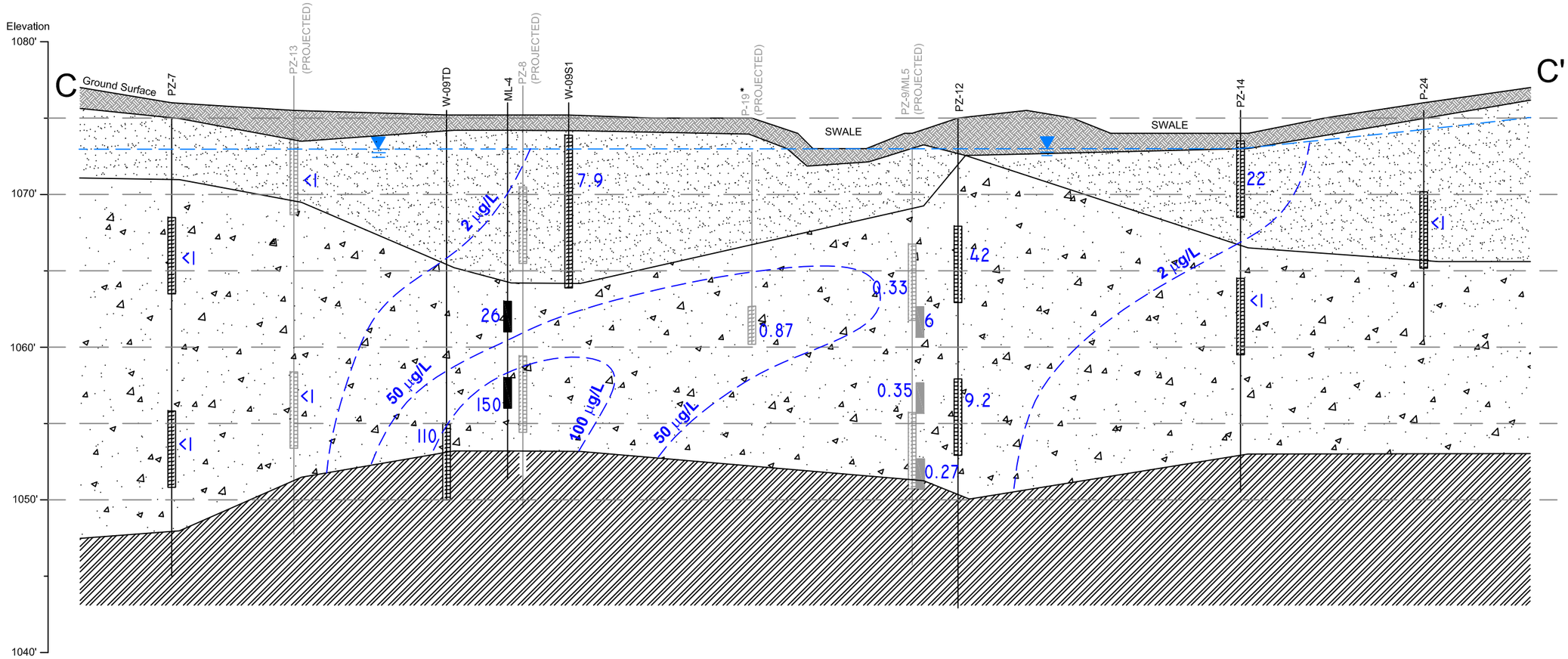
STRATEGIC. ENVIRONMENTAL. SOLUTIONS.

SCALE: As Shown	TITLE: CROSS-SECTION C-C' CDE CONCENTRATIONS
DATE: November 8, 2012	
PROJECT NO.: 12012	
CLIENT: EPG	
DRAWN BY: DJW	DRAWING NO.: FIGURE
CHECKED BY: MTW	REV: 0
PROJ. MGMT. APPROVAL: MTW	



LEGEND

FILL
Sand and Silt; trace Gravel, roots, and organic matter

KAME SAND
Non-plastic Fine Sand to Silty Fine Sand, except as noted

ABLATION TILL
Non-plastic Fine Sand, Silty Fine Sand, or Fine Sandy Silt; some Gravel and Cobbles; trace to some Clay

LODGEMENT TILL
Silty Fine Sand, Fine Sandy Silt, or Silt; some Gravel and Cobbles; dry, very dense, slight to low plasticity

WELL SCREEN

VERTICAL PROFILE SAMPLE

GROUNDWATER ELEVATION
SEPTEMBER 12, 2012

GROUNDWATER VINYL CHLORIDE CONCENTRATIONS (UG/L)
AUGUST 2012 RESULTS, EXCEPT (*) MARCH 2012 RESULTS

VERTICAL EXAGGERATION = 2X
HORIZONTAL SCALE

7.5' 0' 7.5' 15'

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STRATEGIC. ENVIRONMENTAL. SOLUTIONS.

SCALE: As Shown	TITLE: CROSS-SECTION C-C' VC CONCENTRATIONS
DATE: November 8, 2012	
PROJECT NO.: 12012	
CLIENT: EPG	
DRAWN BY: DJW	DRAWING NO.: FIGURE
CHECKED BY: MTW	REV: 0
PROJ. MGMT. APPROVAL: MTW	

APPENDIX G
Data Validation Reports

Vertical Profiling of Soil and Groundwater Data

December 11, 2012

Mr. Terrence Connelly
Remedial Project Manager
US Environmental Protection Agency – Region 1
5 Post Office Square, Suite 100
Boston, MA 02109-3912

Re: SDG 200-11784
TestAmerica Laboratories, Inc.
Burgess Brothers Superfund Site
Pre-Design Investigation
Tier I Organics Data Validation – Aqueous Samples

Volatiles: 13 / Aqueous / ML151-PD-W2, ML1-PD-W1 (8-10'), ML1-PD-W2 (13-15'), ML1-PD-W3 (18-20'), ML2-PD-W1 (8-10'), ML3-PD-W1 (8-10), ML3-PD-W2 (13-15), ML3-PD-W3 (18-20'), ML3-PD-W4 (23-25'), ML5-PD-W1 (8-10), ML5-PD-W2 (13-15), ML5-PD-W3 (18'-20'), ML1-PD-W4 (23-25')

6 / Aqueous Trip Blanks / TB151-PD-W1, TB153- PD-W1, TB-154-PD-W1, TB-PD-150, TRIP BLANK, TB-154

1 / Aqueous PES / ML152-PD-W1

Dear Mr. Connelly:

A Tier I data validation, in accordance with Region I, EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses, December 1996 criteria, and criteria required under the Pre-Design Investigation (PDI) Quality Assurance Project Plan (QAPP), dated July 2012, was performed on organic analytical data for 13 Aqueous Samples, 6 Trip Blanks, and 1 Aqueous PES collected by Environmental Partners Group, Inc. from the Burgess Brothers Superfund Site. The volatile aqueous samples, blanks and PESs were analyzed using the EPA SW-846 Method 8260B Volatile Organic Statement of Work. In accordance with the PDI QAPP, Tier I data validation was deemed sufficient for the groundwater vertical profiling samples at this time.

A summary of the laboratory analytical results for this SDG, including method reporting limits and dilution factors, is attached as Table 1.

A Tier I data validation is based on the following parameters:

- Complete Sample Delivery Group Files (CFS) Completeness Evidence Audit
- Evaluation of Performance Evaluation Sample (PES) Results

A CFS Completeness Evidence Audit was performed for this Sample Delivery Group (SDG) 200-11784 aqueous data. All criteria were met for this parameter. The attached Lab Report Table of Contents and Narrative provide the completeness information for this SDG.

The PES results were evaluated for this SDG aqueous data and are summarized in Table 2. All compounds were within performance acceptance limits except styrene, which was below the lower limit of the vendor's performance acceptance limits. If a Tier II or Tier IIII validation were performed, the following actions would be applied to the data, for the compound styrene:

- all positive detects in all samples associated with this PES would be estimated (J) to indicate potential high bias and
- all quantitation limits for non-detects in all samples associated with this PES would be accepted

A XI Accuracy Check (PE Results) Form is also attached. Styrene has never been detected in soil or groundwater at the Site and is not a contaminant of concern at the Site.

Environmental Partners recommends that the organics solid data in this SDG be accepted and that no further data validation be performed. Please contact Ann Marie Petricca at (617) 657-0299 should you have any questions or comments regarding this report.

Sincerely,

Ann Marie Petricca

Ann Marie Petricca, CPG
Data Validator

Attachments:
1. Data Summary Table
2. Accuracy Check/PES Score Report
3. Completeness Evidence Audit

cc: Geoffrey Seibel, *de maximis, inc.*

Table 1: Groundwater Analytical Data
Test America SDG 200-11784-1
Volatile Organic Compounds SW-846 EPA Method 8260B
Burgess Brothers Superufund Site, Woodford and Bennington, VT

						DUP ML3-PD-W2 (13-15)				
Analyte	**Units**	**Reports To**	**Basis**	**200-11784-2 ML2-PD-W1 (8-10') 7/17/2012 11:45 AM**	**200-11923-1 ML3-PD-W1 (8-10) 7/24/2012 10:30 AM**	**200-11923-2 ML3-PD-W2 (13-15) 7/24/2012 12:00 PM**	**200-11923-3 ML151-PD-W2 7/24/2012 12:00 PM**	**200-11941-1 ML3-PD-W3 (18-20') 7/24/2012 3:00 PM**	**200-11941-3 ML3-PD-W4 (23-25') 7/24/2012 4:35 PM**	**200-11941-7 ML1-PD-W1 (8-10') 7/25/2012 8:45 AM**
Ethylbenzene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
m&p-Xylene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
1,1,1,2-Tetrachloroethane	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
1,2-Dibromoethane	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Chlorobenzene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Bromoform	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Isopropylbenzene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Styrene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
o-Xylene	ug/L	MRL	Total	150 U	0.51 J	11 U	12 U	28 U	34 U	110 U
Xylenes, Total	ug/L	MRL	Total	150 U	0.51 J	11 U	12 U	28 U	34 U	110 U
trans-1,3-Dichloropropene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Ethyl methacrylate	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Toluene	ug/L	MRL	Total	150 U	**39**	**67**	**61**	**33**	**45**	71 J
cis-1,3-Dichloropropene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
4-Methyl-2-pentanone	ug/L	MRL	Total	730 U	5.0 U	55 U	61 U	140 U	170 U	550 U
2-Hexanone	ug/L	MRL	Total	730 U	5.0 U	55 U	61 U	140 U	170 U	550 U
Dibromochloromethane	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
1,3-Dichloropropane	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
1,1,2-Trichloroethane	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Tetrachloroethene	ug/L	MRL	Total	**5000**	1.0 U	**230**	**200**	**2300**	**1800**	**6200**
Bromobenzene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
1,2-Dichlorobenzene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
n-Butylbenzene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
1,4-Dichlorobenzene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
1,3-Dichlorobenzene	ug/L	MRL	Total	150 U	0.45 J	11 U	12 U	28 U	34 U	110 U
4-Isopropyltoluene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Naphthalene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
1,2,3-Trichlorobenzene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Hexachlorobutadiene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
1,2-Dibromo-3-Chloropropane	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
1,2,4-Trichlorobenzene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
n-Propylbenzene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
2-Chlorotoluene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
trans-1,4-Dichloro-2-butene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
1,1,2,2-Tetrachloroethane	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
1,2,3-Trichloropropane	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
1,2,4-Trimethylbenzene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
sec-Butylbenzene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
tert-Butylbenzene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
4-Chlorotoluene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
1,3,5-Trimethylbenzene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
2-Chloroethyl vinyl ether	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Methylene Chloride	ug/L	MRL	Total	62 J B	0.39 J B	4.3 J B	4.9 J B	12 J B	19 J B	39 J B
Acrylonitrile	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Allyl chloride	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Methyl iodide	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Carbon disulfide	ug/L	MRL	Total	150 U	0.45 J	11 U	12 U	28 U	34 U	110 U
1,1-Dichloroethane	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Vinyl acetate	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Methyl t-butyl ether	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
trans-1,2-Dichloroethene	ug/L	MRL	Total	150 U	1.0 U	6.9 J	6.9 J	28 U	34 U	110 U
1,2-Dichloroethene, Total	ug/L	MRL	Total	**1700**	1.0 U	**1100**	**1100**	**1300**	**1400**	**1200**
Bromomethane	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Chloroethane	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Vinyl chloride	ug/L	MRL	Total	**230**	1.0 U	**230**	**220**	**120**	**200**	**390**
Dichlorodifluoromethane	ug/L	MRL	Total	150 U	1.0 U	2.6 J	12 U	15 J	17 J	110 U
Chloromethane	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Freon TF	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Acetone	ug/L	MRL	Total	730 U	**8.2**	55 U	12 J	140 U	170 U	550 U
1,1-Dichloroethene	ug/L	MRL	Total	150 U	1.0 U	11 U	5.6 J	6.2 J	34 U	110 U
Trichlorofluoromethane	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Acrolein	ug/L	MRL	Total	730 U	5.0 U	55 U	61 U	140 U	170 U	550 U
Chloroprene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
1,2-Dichloroethane	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Trichloroethene	ug/L	MRL	Total	**530**	**1.1**	**300**	**280**	**1100**	**900**	**820**
Benzene	ug/L	MRL	Total	150 U	0.60 J	11 U	12 U	28 U	34 U	110 U
Carbon tetrachloride	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Isobutyl alcohol	ug/L	MRL	Total	7300 U	50 U	550 U	610 U	1400 U	1700 U	5500 U
1,4-Dioxane	ug/L	MRL	Total	7300 U	50 U	550 U	610 U	1400 U	1700 U	5500 U
Bromodichloromethane	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Methyl methacrylate	ug/L	MRL	Total	150 U	0.99 J	11 U	12 U	28 U	34 U	110 U
1,2-Dichloropropane	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Dibromomethane	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Propionitrile	ug/L	MRL	Total	590 U	4.0 U	44 U	49 U	110 U	140 U	440 U
Bromochloromethane	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
2-Butanone	ug/L	MRL	Total	730 U	5.0 U	55 U	61 U	140 U	170 U	550 U
2,2-Dichloropropane	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
cis-1,2-Dichloroethene	ug/L	MRL	Total	**1700**	1.0 U	**1100**	**1000**	**1300**	**1400**	**1200**
1,1,1-Trichloroethane	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
1,1-Dichloropropene	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Chloroform	ug/L	MRL	Total	150 U	**7.2**	6.1 J	6.0 J	7.3 J	34 U	110 U
Methacrylonitrile	ug/L	MRL	Total	150 U	1.0 U	11 U	12 U	28 U	34 U	110 U
Tetrahydrofuran	ug/L	MRL	Total	2100 U	**18**	150 U	170 U	390 U	470 U	1500 U
Dilution Factor				146.7	1	11	12.2	27.5	33.8	110
Date Analyzed				7/25/2012	8/1/2012	8/1/2012	8/1/2012	7/31/2012	8/1/2012	7/31/2012

Notes:
All values reported in micrograms per liter (ug/l)
U=Not detected above the reporting limit
B=Compound was found in the Blank and the Sample.
J=Estimated value.

Table 1: Groundwater Analytical Data
Test America SDG 200-11784-1
Volatile Organic Compounds SW-846 EPA Method 8260B
Burgess Brothers Superufund Site, Woodford and Benning

Analyte	Units	Reports To	Basis	200-11941-8 ML1-PD-W2 (13-15') 7/25/2012 11:15 AM	200-11941-9 ML1-PD-W3 (18-20') 7/25/2012 12:35 PM	200-11941-13 ML1-PD-W4 (23-25') 7/25/2012 3:10 PM	200-11966-1 ML5-PD-W1 (8-10) 7/26/2012 10:45 AM	200-11966-2 ML5-PD-W2 (13-15) 7/26/2012 12:30 PM	200-11984-1 ML5-PD-W3 (18'-20') 7/26/2012 2:15 PM	PE Sample 200-11941-11 ML152-PD-W1 7/25/2012 12:00 PM	200-11784-3 TB-PD-150 7/17/2012 12:00 AM
Ethylbenzene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	7.8	1.0 U
m&p-Xylene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	12	1.0 U
1,1,1,2-Tetrachloroethane	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromoethane	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chlorobenzene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	30	1.0 U
Bromoform	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Isopropylbenzene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Styrene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	3.4	1.0 U
o-Xylene	ug/L	MRL	Total	63 U	6.1 J	110 U	0.24 J	1.0 U	1.0 U	8.9	1.0 U
Xylenes, Total	ug/L	MRL	Total	63 U	6.1 J	110 U	0.24 J	1.0 U	1.0 U	21	1.0 U
trans-1,3-Dichloropropene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Ethyl methacrylate	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	ug/L	MRL	Total	27 J	10 J	21 J	110 E	75	38	4.5	1.0 U
cis-1,3-Dichloropropene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Methyl-2-pentanone	ug/L	MRL	Total	310 U	140 U	550 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Hexanone	ug/L	MRL	Total	310 U	140 U	550 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Dibromochloromethane	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-Dichloropropane	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	8.7	1.0 U
Tetrachloroethene	ug/L	MRL	Total	3600	2700	5400	33	1.6	3	8.4	1.0 U
Bromobenzene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	18	1.0 U
n-Butylbenzene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	8.5	1.0 U
1,3-Dichlorobenzene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Isopropyltoluene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Naphthalene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichlorobenzene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Hexachlorobutadiene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromo-3-Chloropropane	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trichlorobenzene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	12	1.0 U
n-Propylbenzene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Chlorotoluene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,4-Dichloro-2-butene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichloropropane	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
sec-Butylbenzene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
tert-Butylbenzene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Chlorotoluene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Chloroethyl vinyl ether	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene Chloride	ug/L	MRL	Total	26 J B	14 J B	70 J B	0.44 J B	0.43 J B	0.40 J B	9.0 B	0.41 J B
Acrylonitrile	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Allyl chloride	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methyl iodide	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon disulfide	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Vinyl acetate	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methyl t-butyl ether	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	27	1.0 U
1,2-Dichloroethene, Total	ug/L	MRL	Total	1200	1100	5000	33	2.7	2.3	54	1.0 U
Bromomethane	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Vinyl chloride	ug/L	MRL	Total	390	380	1800	6	0.35 J	0.27 J	1.8	1.0 U
Dichlorodifluoromethane	ug/L	MRL	Total	19 J	23 J	58 J	0.23 J	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Freon TF	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Acetone	ug/L	MRL	Total	310 U	140 U	550 U	15	11	60	5.0 U	5.0 U
1,1-Dichloroethene	ug/L	MRL	Total	63 U	16 J	95 J	0.36 J	1.0 U	1.0 U	3.7	1.0 U
Trichlorofluoromethane	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Acrolein	ug/L	MRL	Total	310 U	140 U	550 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Chloroprene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	13	1.0 U
Trichloroethene	ug/L	MRL	Total	560	660	5000	30	4.1	7.3	9.6	1.0 U
Benzene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	9.7	1.0 U
Carbon tetrachloride	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	12	1.0 U
Isobutyl alcohol	ug/L	MRL	Total	3100 U	1400 U	5500 U	50 U	50 U	50 U	50 U	50 U
1,4-Dioxane	ug/L	MRL	Total	3100 U	1400 U	5500 U	50 U	50 U	50 U	50 U	50 U
Bromodichloromethane	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	0.32 J	1.0 U	1.0 U
Methyl methacrylate	ug/L	MRL	Total	63 U	28 U	110 U	2.3	1.4	1.1	1.0 U	1.0 U
1,2-Dichloropropane	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	12	1.0 U
Dibromomethane	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Propionitrile	ug/L	MRL	Total	250 U	110 U	440 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U
Bromochloromethane	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Butanone	ug/L	MRL	Total	310 U	140 U	550 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2,2-Dichloropropane	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	ug/L	MRL	Total	1200	1100	5000	33	2.7	2.3	27	1.0 U
1,1,1-Trichloroethane	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	17	1.0 U
1,1-Dichloropropene	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroform	ug/L	MRL	Total	63 U	28 U	110 U	25	1.9	11	1.0 U	0.37 J
Methacrylonitrile	ug/L	MRL	Total	63 U	28 U	110 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrahydrofuran	ug/L	MRL	Total	880 U	390 U	1500 U	14 U	14 U	14 U	14 U	14 U
Dilution Factor				62.9	27.5	110	1	1	1	1	1
Date Analyzed				8/1/2012	7/31/2012	7/31/2012	8/6/2012	8/6/2012	8/6/2012	8/1/2012	7/23/2012

Notes:

All values reported in micrograms per liter (ug/l)

B=Compound was found in the Blank and the Sample.

Table 1: Groundwater Analytical Data
Test America SDG 200-11784-1
Volatile Organic Compounds SW-846 EPA Method 8260B
Burgess Brothers Superufund Site, Woodford and Benning

Analyte	Units	Reports To	Basis	200-11833-3 TB151-PD-W1 7/18/2012 12:00 AM	200-11923-6 TB153- PD-W1 7/24/2012 12:00 AM	200-11941-12 TB-154-PD-W1 7/24/2012 12:00 AM	200-11966-4 TB-154 7/25/2012 12:00 AM	200-11984-2 TRIP BLANK 7/26/2012 12:00 AM
Ethylbenzene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
m&p-Xylene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1,2-Tetrachloroethane	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromoethane	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chlorobenzene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Isopropylbenzene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Styrene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
o-Xylene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Xylenes, Total	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,3-Dichloropropene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Ethyl methacrylate	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,3-Dichloropropene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Methyl-2-pentanone	ug/L	MRL	Total	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Hexanone	ug/L	MRL	Total	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Dibromochloromethane	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-Dichloropropane	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromobenzene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Butylbenzene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-Dichlorobenzene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Isopropyltoluene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Naphthalene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichlorobenzene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Hexachlorobutadiene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromo-3-Chloropropane	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trichlorobenzene	ug/L	MRL	Total	1.0 U	1.0 U	0.38 J	1.0 U	1.0 U
n-Propylbenzene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Chlorotoluene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,4-Dichloro-2-butene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichloropropane	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
sec-Butylbenzene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
tert-Butylbenzene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Chlorotoluene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Chloroethyl vinyl ether	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene Chloride	ug/L	MRL	Total	0.37 J B	0.38 J B	0.42 J B	0.36 J B	0.40 J B
Acrylonitrile	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Allyl chloride	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methyl iodide	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon disulfide	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Vinyl acetate	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methyl t-butyl ether	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethene, Total	ug/L	MRL	Total	1.0 U	0.38 J	1.0 U	1.0 U	1.0 U
Bromomethane	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Vinyl chloride	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dichlorodifluoromethane	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Freon TF	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Acetone	ug/L	MRL	Total	5.0 U	2.1 J	2.0 J	1.6 J	1.5 J
1,1-Dichloroethene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichlorofluoromethane	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Acrolein	ug/L	MRL	Total	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Chloroprene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Benzene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon tetrachloride	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Isobutyl alcohol	ug/L	MRL	Total	50 U	50 U	50 U	50 U	50 U
1,4-Dioxane	ug/L	MRL	Total	50 U	50 U	50 U	50 U	50 U
Bromodichloromethane	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methyl methacrylate	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloropropane	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromomethane	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Propionitrile	ug/L	MRL	Total	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U
Bromochloromethane	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Butanone	ug/L	MRL	Total	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2,2-Dichloropropane	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	ug/L	MRL	Total	1.0 U	0.38 J	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloropropene	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroform	ug/L	MRL	Total	0.27 J	1.0 U	1.0 U	0.22 J	1.0 U
Methacrylonitrile	ug/L	MRL	Total	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrahydrofuran	ug/L	MRL	Total	14 U	14 U	14 U	14 U	14 U
Dilution Factor				1	1	1	1	1
Date Analyzed				7/25/2012	8/1/2012	7/31/2012	7/31/2012	8/6/2012

Notes:

All values reported in micrograms per liter (ug/l)

B=Compound was found in the Blank and the Sample.

Table 2: Summary of Performance Evaluation Sample (PES) Results

Pre-Design Investigation
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont
Groundwater Sampling SDG: 200-11784-1

	ML152-PD-W1 *TA Analysis*	*Lot No. S171-703* *ID No. 0703-12-04.1*	
Parameter	*VOCs Method 8260B* *Routine Level*	*Certified Value*	*QC Performance Acceptance Limits*
Aqueous (ug/L)			
ML152-PD-W1			
1,1,1,2-Tetrachloroethane	1 U		
1,1,1-Trichloroethane	17	18.7	13.5 - 23.2
1,1,2,2-Tetrachloroethane	1 U		
1,1,2-Trichloroethane	8.7	8.86	6.84 - 10.9
1,1-Dichloroethane	1 U		
1,1-Dichloroethene	3.7	3.77	2.60 - 4.94
1,1-Dichloropropene	1 U		
1,2,3-Trichlorobenzene	1 U		
1,2,3-Trichloropropane	1 U		
1,2,4-Trichlorobenzene	12	13.4	8.59 - 16.9
1,2,4-Trimethylbenzene	1 U		
1,2-Dibromo-3-Chloropropane	1 U		
1,2-Dibromoethane	1 U		
1,2-Dichlorobenzene	18	18.0	13.7 - 22.0
1,2-Dichloroethane	13	13.2	10.3 - 16.5
1,2-Dichloropropane	12	11.5	8.89 - 14.1
1,3,5-Trimethylbenzene	1 U		
1,3-Dichlorobenzene	1 U		
1,3-Dichloropropane	1 U		
1,4-Dichlorobenzene	8.5	9.06	6.52 - 11.1
1,4-Dioxane	50 U		
2,2-Dichloropropane	1 U		
2-Butanone	5 U		
2-Chloroethyl vinyl ether	1 U		
2-Chlorotoluene	1 U		
2-Hexanone	5 U		
4-Chlorotoluene	1 U		
4-Isopropyltoluene	1 U		
4-Methyl-2-pentanone	5 U		
Acetone	5 U		
Acrolein	5 U		
Acrylonitrile	1 U		
Allyl chloride	1 U		
Benzene	9.7	9.69	7.62 - 11.7
Bromobenzene	1 U		
Bromochloromethane	1 U		
Bromodichloromethane	1 U		
Bromoform	1 U		
Bromomethane	1 U		
Carbon disulfide	1 U		
Carbon tetrachloride	12	13.6	9.33 - 17.1
Chlorobenzene	30	30.2	23.6 - 36.8
Chloroethane	1 U		
Chloroform	1 U		
Chloromethane	1 U		
Chloroprene	1 U		

Groundwater Sampling SDG: 200-11784-1

Parameter	ML152-PD-W1 TA Analysis VOCs Method 8260B Routine Level	Lot No. S171-703 ID No. 0703-12-04.1 Certified Value	QC Performance Acceptance Limits
Aqueous (ug/L)			
cis-1,2-Dichloroethene	27	26.6	19.9 - 32.7
cis-1,3-Dichloropropene	1 U		
Dibromochloromethane	1 U		
Dibromomethane	1 U		
Dichlorodifluoromethane	1 U		
Ethyl methacrylate	1 U		
Ethylbenzene	7.8	8.45	6.42 - 10.5
Freon TF	1 U		
Hexachlorobutadiene	1 U		
Isobutyl alcohol	50 U		
Isopropylbenzene	1 U		
m&p-Xylene	12	13.66	10.33 - 16.94
Methacrylonitrile	1 U		
Methyl iodide	1 U		
Methyl methacrylate	1 U		
Methyl t-butyl ether	1 U		
Methylene Chloride	9 B	8.96	6.23 - 11.5
Naphthalene	1 U		
n-Butylbenzene	1 U		
n-Propylbenzene	1 U		
o-Xylene	8.9	9.82	7.42 - 12.2
Propionitrile	4 U		
sec-Butylbenzene	1 U		
Styrene	3.4	6.44	4.83 - 8.11
tert-Butylbenzene	1 U		
Tetrachloroethene	8.4	9.03	6.18 - 10.19
Tetrahydrofuran	14 U		
Toluene	4.5	4.77	3.69 - 5.77
trans-1,2-Dichloroethene	27	27.8	20.7 - 34.8
trans-1,3-Dichloropropene	1 U		
trans-1,4-Dichloro-2-butene	1 U		
Trichloroethene	9.6	10.3	7.63 - 12.3
Trichlorofluoromethane	1 U		
Vinyl acetate	1 U		
Vinyl chloride	1.8	2.00	1.18 - 2.94
1,2-Dichlorobenzene-d4	25		
1,2-Dichloroethane-d4	25		
Bromofluorobenzene	27		
Toluene-d8	26		
1,2-Dichloroethene, Total	54		
Xylenes, Total	21		

Notes

TA = Test America in South Burlington, VT

The Certified Values are the actual 'made to' concentrations confirmed by ERA analytical verification.

The QC Performance Acceptance Limits (QC PALs) based on actual historical dta collected in ERA's Prificiency Testing program. QC PALs reflect any inherent biases in the methods used to establish the limits and closely approximate a 95% conficence interval of the performance that experienced laboratories should achieve using accepted environmental methods.

XI. ACCURACY CHECK (Performance Evaluation Results)

SDG No.: 200-11784

Are more than one-half of the PES analytes within criteria for each parameter. [Y] N

PE Sample No./ ERA ID No,	Lot No.	Parameter	Type of PES	Matrix	Analyte	ML152-PD-W1 TA Analysis (ug/l)	Non-EPA PES Scores**	Samples Affected	Action
ML152-PD-W1/ ID No. 0703-12-04.1	S171703	VOCs	VOA	Aq.	Styrene	3.4	PES Compound Hit 6.44 (4.83-8.11)	ML151-PD-W2, ML1-PD-W1 (8-10'), ML1-PD-W2 (13-15'), ML1-PD-W3 (18-20'), ML2-PD-W1 (8-10'), ML3-PD-W1 (8-10), ML3-PD-W2 (13-15), ML3-PD-W3 (18-20'),ML3-PD-W4 (23-25'), ML5-PD-W1 (8-10), ML5-PD-W2 (13-15), ML5-PD-W3 (18'-20'), ML1-PD-W4 (23-25'), TB-151-PD-W1, TB-153-PD-W1, TB-154-PD-W1, TB-PD-W1, TRIP BLANK, TB-154	R, J

* For Region I PESs indicate the Region I PES Score Report Result: Action High; Action Low; TCL MISS; TCL CONTAMINANT; TIC HIT; TIC MISS; TIC CONTAMINANT

** For Non-EPA PESs indicate the Non-EPA PES Score: PES Compound MISS; PES Compound CONTAMINANT; PES Compound HIT (Range)

TIC Tentatively Identifiable Compound

Validator: Ann Marie Petricca

Date: 12/11/2012

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 200-11784-1

SDG Number: 200-11784

Job Description: Burgess Brother's Sanitary Landfill

For:
Environmental Partners Group
1900 Crown Colony Drive
Suite 402
Quincy, MA 02169

Attention: Ms. Ann Marie Petricca

Sara Goff

Approved for release.
Sara S Goff
Project Manager I
8/21/2012 1:04 PM

Sara S Goff
Project Manager I
sara.goff@testamericainc.com
08/21/2012

The test results in this report relate only to sample(s) as received by the laboratory. These test results were derived under a quality system that adheres to the requirements of NELAC. Pursuant to NELAC, this report may not be produced in full without written approval from the laboratory

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CASE NARRATIVE

Client: Environmental Partners Group

Project: Burgess Brother's Sanitary Landfill

Report Number: 200-11784-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT

The samples were received on 07/18/2012, 07/19/2012, 07/25/2012, 07/26/2012, 07/27/2012 and 07/28/2012; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 3.4° C, 4.6° C, 5.0° C, 5.8° C, 5.8° C and 6.2° C.

The Chain-of-Custody (COC) received on July 27th was not relinquished.

The container label for the following sample(s) did not match the information listed on the Chain-of-Custody (COC): PZ150-PD-S1 (17'-18'). The container labels list a depth of (17'-18'). The COC does not list the depth. The depth from the sample label was used for the log-in per PM direction. The container label for the following sample(s) did not match the information listed on the Chain-of-Custody (COC): ML3-PD-W2 (13-15). The container label lists a time of 1150. Sample logged in per the chain of custody. The container label for the following sample(s) did not match the information listed on the Chain-of-Custody (COC): ML3-PD-S2 (23'). Two of three container labels list a depth of 20'. The COC lists a depth of 23'. The container label for the following sample(s) did not match the information listed on the Chain-of-Custody (COC): ML1-PD-W1 (8-10'). The container labels list a time of 9:50. The COC lists 8:45. The samples were logged as on the COC.

VOLATILE ORGANIC COMPOUNDS (GC-MS) - SOLID

Samples PZ3-PD-S2 (17'-18'), PZ150-PD-S1 (17'-18'), ML1-PD-S3 (27'), ML3-PD-S1 (20), ML152-PD-S1, PZ4-PD-S1 (30'), PZ3-PD-S1 (12-13'), ML3-PD-S2 (23'), ML3-PD-S3 (29'), ML1-PD-S1 (5'), ML1-PD-S2 (9.5-10'), and ML153-PD-S1 were analyzed for volatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8260B. The samples were prepared on 07/18/2012, 07/20/2012, 07/26/2012, 07/27/2012 and 08/02/2012 and analyzed on 07/24/2012, 07/25/2012, 08/01/2012 and 08/07/2012.

The initial calibration curve was outside acceptance criteria for Methyl iodide. The continuing calibration verification (CCV) for analytical batch 42278 exceeded control criteria for Vinyl acetate. The continuing calibration verification (CCV) for Methyl iodide and Vinyl acetate associated with batch 42334 recovered above the upper control limit. The continuing calibration verification (CCV) for Methyl iodide and Vinly Acetate associated with batch 42432 recovered above the upper control limit. The continuing calibration verification (CCV) for Vinyl acetate and Bromomethane associated with batch42785 recovered above the upper control limit. The continuing calibration verification (CCV) for analytical batch 42794 exceeded control criteria for Bromomethane, Methyl Iodide, and Vinyl acetate. The continuing calibration verification (CCV) for analytical batch 43108 exceeded control criteria for Bromomethane ,Vinyl acetate, and 1,4-Dioxane. The continuing calibration verification (CCV) for analytical batch 43111 exceeded control criteria for Bromomethane and Vinyl acetate. The data have been qualified and reported.

Bromomethane and Methylene Chloride were detected in method blank MB 200-42282/2-A at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Bromomethane was detected in method blank MB 200-42282/3-A at a level exceeding the reporting limit. If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Methylene Chloride was detected in method blank MB 200-42282/3-A at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Chloroform was detected in method blank MB 200-42969/1-A at a level exceeding the reporting limit. If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Methylene Chloride and Naphthalene were detected in method blank MB 200-42969/1-A at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

Vinyl acetate failed the recovery criteria high for laboratory control sample 200-43111/3. Refer to the QC report for details.

Bromomethane, Chloroethane and Trichlorofluoromethane failed the recovery criteria low for the matrix spike and matrix spike duplicate

of sample ML1-PD-S3 (27'). Several analytes exceeded the relative percent difference limit. Refer to the QC report for details.

No other difficulties were encountered during the volatiles analyses. All other quality control parameters were within the acceptance limits.

VOLATILE ORGANIC COMPOUNDS (GC-MS) - AQUEOUS

Samples ML3-PD-W3 (18-20'), ML3-PD-W4 (23-25'), ML1-PD-W1 (8-10'), ML1-PD-W2 (13-15'), ML1-PD-W3 (18-20'), ML152-PD-W1, TB-154-PD-W1, ML1-PD-W4 (23-25'), ML5-PD-WI (8-10), ML5-PD-W2 (13-15), TB-154, ML5-PD-W3 (18'-20'),TRIP BLANK, TB151-PD-W1, ML2-PD-W1 (8-10'), TB-PD-150, ML3-PD-W1 (8-10), ML3-PD-W2 (13-15), ML151-PD-W2,and TB153- PD-W1 were analyzed for volatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8260B. The samples were analyzed on 07/23/2012, 07/25/2012, 07/31/2012, 08/01/2012 and 08/06/2012.

The initial calibration curve was outside acceptance criteria for Methyl iodide. The continuing calibration verification (CCV) for analytical batch 42278 exceeded control criteria for Vinyl acetate. The continuing calibration verification (CCV) for Methyl iodide and Vinyl acetate associated with batch 42334 recovered above the upper control limit. The continuing calibration verification (CCV) for Methyl iodide and Vinly Acetate associated with batch 42432 recovered above the upper control limit. The continuing calibration verification (CCV) for Vinyl acetate and Bromomethane associated with batch 42785 recovered above the upper control limit. The continuing calibration verification (CCV) for analytical batch 42794 exceeded control criteria for Bromomethane, Methyl Iodide, and Vinyl acetate. The continuing calibration verification (CCV) for analytical batch 43108 exceeded control criteria for Bromomethane ,Vinyl acetate, and 1,4-Dioxane. The continuing calibration verification (CCV) for analytical batch 43111 exceeded control criteria for Bromomethane and Vinyl acetate. The data have been qualified and reported.

For sample ML5-PD-WI (8-10) Toluene was detected above the instrument calibration range. Due to significant amount of sediment at the bottom of the sample vials two containers were combined in order to perform the analysis. Therefore insufficient sample volume remained for reanalysis of the over calibration result.

Bromomethane was detected in method blank MB 200-42282/4-A at a level exceeding the reporting limit. If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Methylene Chloride was detected in method blanks MB 200-42278/5, MB 200-42432/5, MB 200-42794/5 , and MB 200-43108/5 at a level that was above the method detection limit but below the reporting limit. Chloromethane, Methyl iodide and Methylene Chloride were detected in method blank MB 200-42282/4-A at levels that were above the method detection limit but below the reporting limit. 1,4-Dioxane and Methylene Chloride were detected in method blank MB 200-42785/5 at levels that were above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

One or more analytes failed the recovery and relative percent difference criteria for the matrix spike and matrix spike duplicate of sample ML3-PD-W2 (13-15). Refer to the QC report for details.

Samples ML3-PD-W3 (18-20')[28X], ML3-PD-W2 (13-15)[11X], ML2-PD-W1 (8-10')[147X], ML151-PD-W2[12X], ML3-PD-W4 (23-25') [34X], ML1-PD-W1 (8-10')[110X], ML1-PD-W2 (13-15')[63X], ML1-PD-W3 (18-20')[28X] and ML1-PD-W4 (23-25')[110X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No other difficulties were encountered during the volatiles analyses. All other quality control parameters were within the acceptance limits.

December 11, 2012

Mr. Terrence Connelly
Remedial Project Manager
US Environmental Protection Agency – Region 1
5 Post Office Square, Suite 100
Boston, MA 02109-3912

Re: SDG 200-11784-1
TestAmerica Laboratories, Inc.
Burgess Brothers Superfund Site
Pre-Design Investigation
Tier I Organics Data Validation – Soil Samples

Volatiles: 12 / Soil / ML152-PD-S1, ML1-PD-S1 (5'), ML1-PD-S2 (9.5-10'), ML1-PD-S3 (27'), ML3-PD-S1 (20), ML3-PD-S2 (23'), ML3-PD-S3 (29'), PZ150-PD-S1 (17'-18'), PZ3-PD-S1 (12-13'), PZ3-PD-S2 (17'-18'), PZ4-PD-S1 (30'), ML1-PD-S3 (27')

1 / Soilds PES / ML153-PD-S1

Dear Mr. Connelly:

A Tier I data validation, in accordance with Region I, EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses, December 1996 criteria, and criteria required under the Pre-Design Investigation (PDI) Quality Assurance Project Plan (QAPP), dated July 2012, was performed on the organic analytical data for 12 Soil Samples and 1 Solid PES collected by Environmental Partners Group, Inc. from the Burgess Brothers Superfund Site. The volatile soil samples and PES were analyzed using the EPA SW-846 Method 8260B Volatile Organic Statement of Work. In accordance with the PDI QAPP, Tier I Data Validation was deemed sufficient for the soil samples at this time.

A Tier I data validation is based on the following parameters:

- Complete Sample Delivery Group Files (CFS) Completeness Evidence Audit
- Evaluation of Performance Evaluation Sample (PES) Results

A summary of the laboratory analytical results for this SDG, including method reporting limits and dilution factors, is attached as Table 1.

A CFS Completeness Evidence Audit was performed for this Sample Delivery Group (SDG) 200-11784 soils data. All criteria were met for this parameter. The attached Lab Report Table of Contents and Narrative provide the completeness information for this SDG.

The solid PES results were evaluated for this SDG soil data and are summarized in Table 2. All criteria were not met. Bromobenzene was outside the upper limit of the vendor's documented acceptance limits; this less than one-half of the PES analytes. If a Tier II or Tier III validation were performed the following actions would be applied to the sample data, for the compound bromobenzene:

- all positive detects in all samples associated with this PES would be estimated (J) to indicate potential high bias and
- all quantitation limits for non-detects in all samples associated with this PES would be accepted.

A XI Accuracy Check (PE Results) Form is also attached. Bromobenzene has never been detected in soil or groundwater at the Site and is not a contaminant of concern at the Site.

Environmental Partners recommends that the organics soil data in this SDG be accepted and that no further data validation be performed. Please contact Ann Marie Petricca at (617) 657-0299 should you have any questions or comments regarding this report.

Sincerely,

Ann Marie Petricca

Ann Marie Petricca, CPG
Data Validator

Attachments:
1. Data Summary Table
2. Accuracy Check/PES Score Report
3. Completeness Evidence Audit

cc: Geoffrey Seibel, *de maximis, inc.*

Table 1: Soil Analytical Data
Test America SDG 200-11784-1
Volatile Organic Compounds SW-846 EPA Method 8260B
Burgess Brothers Superufund Site, Woodford and Bennington, VT

							DUP PZ3-PD-S2 (17'-18')			
Analyte	Units	Reports To	Basis	200-11784-1 PZ4-PD-S1 (30') 7/16/2012 4:00 PM	200-11784-4 PZ3-PD-S1 (12-13') 7/17/2012 12:55 PM	200-11833-1 PZ3-PD-S2 (17'-18') 7/18/2012 9:10 AM	200-11833-2 PZ150-PD-S1 (17'-18') 7/18/2012 8:10 AM	200-11923-4 ML3-PD-S1 (20) 7/24/2012 1:10 PM	200-11923-5 ML152-PD-S1 7/24/2012 1:15 PM	200-11941-2 ML3-PD-S2 (23') 7/24/2012 3:50 PM
Bromodichloromethane	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Dichlorodifluoromethane	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Chloromethane	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Vinyl chloride	ug/Kg	MRL	Total	32 J	71 J	100	84 J	110 U	97 U	88 U
Bromomethane	ug/Kg	MRL	Total	97 U	35 J B	100 U	96 U	110 U	97 U	88 U
Chloroethane	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Trichlorofluoromethane	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Acrolein	ug/Kg	MRL	Total	490 U	510 U	500 U	480 U	560 U	490 U	440 U
1,1-Dichloroethene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Freon TF	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Acetone	ug/Kg	MRL	Total	490 U	510 U	500 U	480 U	560 U	490 U	440 U
Methyl iodide	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Carbon disulfide	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Allyl chloride	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Methylene Chloride	ug/Kg	MRL	Total	64 J B	62 J B	40 J B	41 J B	55 J B	51 J B	42 J B
Acrylonitrile	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
trans-1,2-Dichloroethene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
1,2-Dichloroethene, Total	ug/Kg	MRL	Total	330	400	600	520	210	160	180
Methyl t-butyl ether	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
1,1-Dichloroethane	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Vinyl acetate	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Chloroprene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
2,2-Dichloropropane	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
cis-1,2-Dichloroethene	ug/Kg	MRL	Total	330	400	600	520	210	160	180
2-Butanone	ug/Kg	MRL	Total	490 U	510 U	500 U	480 U	560 U	490 U	440 U
Propionitrile	ug/Kg	MRL	Total	390 U	410 U	400 U	380 U	440 U	390 U	350 U
Bromochloromethane	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Methacrylonitrile	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Tetrahydrofuran	ug/Kg	MRL	Total	1400 U	1400 U	1400 U	1300 U	1600 U	1400 U	1200 U
Chloroform	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
1,1,1-Trichloroethane	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
1,1-Dichloropropene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Carbon tetrachloride	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Isobutyl alcohol	ug/Kg	MRL	Total	4900 U	5100 U	5000 U	4800 U	5600 U	4900 U	4400 U
Benzene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
1,2-Dichloroethane	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Trichloroethene	ug/Kg	MRL	Total	280	190	370	310	160	83 J	190
1,2-Dichloropropane	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Dibromomethane	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Methyl methacrylate	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
1,4-Dioxane	ug/Kg	MRL	Total	4900 U	5100 U	5000 U	4800 U	5600 U	4900 U	4400 U
1,2,3-Trichlorobenzene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
2-Chloroethyl vinyl ether	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
cis-1,3-Dichloropropene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
4-Methyl-2-pentanone	ug/Kg	MRL	Total	490 U	510 U	500 U	480 U	560 U	490 U	440 U
Toluene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
trans-1,3-Dichloropropene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Ethyl methacrylate	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
1,1,2-Trichloroethane	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Tetrachloroethene	ug/Kg	MRL	Total	720	3500	7200	6100	630	390	750
1,3-Dichloropropane	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
2-Hexanone	ug/Kg	MRL	Total	490 U	510 U	500 U	480 U	560 U	490 U	440 U
Dibromochloromethane	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
1,2-Dibromoethane	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Chlorobenzene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
1,1,1,2-Tetrachloroethane	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Ethylbenzene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
m&p-Xylene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
o-Xylene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Xylenes, Total	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Styrene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Bromoform	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Isopropylbenzene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Bromobenzene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
1,1,2,2-Tetrachloroethane	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
1,2,3-Trichloropropane	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
trans-1,4-Dichloro-2-butene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
n-Propylbenzene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
2-Chlorotoluene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
4-Chlorotoluene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
1,3,5-Trimethylbenzene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
tert-Butylbenzene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
1,2,4-Trimethylbenzene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
sec-Butylbenzene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
1,3-Dichlorobenzene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
4-Isopropyltoluene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
1,4-Dichlorobenzene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
1,2-Dichlorobenzene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
n-Butylbenzene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
1,2-Dibromo-3-Chloropropane	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
1,2,4-Trichlorobenzene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Hexachlorobutadiene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	88 U
Naphthalene	ug/Kg	MRL	Total	97 U	100 U	100 U	96 U	110 U	97 U	50 J
Percent Solids	%	MRL	Total	89.4	85.7	80.2	82.2	82.1	82.9	91
Dilution Factor				1	1	1	1	1	1	1
Data Analyzed				7/25/2012	7/25/2012	7/24/2012	7/24/2012	8/1/2012	8/1/2012	8/1/2012

Notes:

All values reported in micrograms per liter (ug/l)

B=Compound was found in the Blank and the Sample.

U=Not detected above the reporting limit

J=Estimated value.

Table 1: Soil Analytical Data
Test America SDG 200-11784-1
Volatile Organic Compounds SW-846 EPA Method 8260B
Burgess Brothers Superufund Site, Woodford and Bennington

Analyte	Units	Reports To	Basis	200-11941-4 ML3-PD-S3 (29') 7/24/2012 5:15 PM	200-11941-5 ML1-PD-S1 (5') 7/25/2012 8:15 AM	200-11941-6 ML1-PD-S2 (9.5-10') 7/25/2012 8:40 AM	200-11941-10 ML153-PD-S1 7/25/2012 12:00 PM	200-11966-3 ML1-PD-S3 (27') 7/25/2012 3:55 PM
Bromodichloromethane	ug/Kg	MRL	Total	81 U	120 U	100 U	**11000**	100 U
Dichlorodifluoromethane	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
Chloromethane	ug/Kg	MRL	Total	81 U	120 U	100 U	85 J	100 U
Vinyl chloride	ug/Kg	MRL	Total	39 J	37 J	**100**	**5700**	82 J
Bromomethane	ug/Kg	MRL	Total	81 U	120 U	47 J	180 U	100 U
Chloroethane	ug/Kg	MRL	Total	81 U	120 U	100 U	**7500**	100 U
Trichlorofluoromethane	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
Acrolein	ug/Kg	MRL	Total	410 U	580 U	520 U	920 U	520 U
1,1-Dichloroethene	ug/Kg	MRL	Total	81 U	120 U	100 U	**4900**	100 U
Freon TF	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
Acetone	ug/Kg	MRL	Total	410 U	580 U	520 U	**21000**	520 U
Methyl iodide	ug/Kg	MRL	Total	81 U	120 U	40 J	180 U	100 U
Carbon disulfide	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
Allyl chloride	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
Methylene Chloride	ug/Kg	MRL	Total	37 J B	54 J B	55 J B	**1700** B	46 J B
Acrylonitrile	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
trans-1,2-Dichloroethene	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
1,2-Dichloroethene, Total	ug/Kg	MRL	Total	**370**	**750**	**460**	**12000**	**380**
Methyl t-butyl ether	ug/Kg	MRL	Total	81 U	120 U	100 U	**5100**	100 U
1,1-Dichloroethane	ug/Kg	MRL	Total	81 U	120 U	100 U	**10000**	100 U
Vinyl acetate	ug/Kg	MRL	Total	81 U	120 U	100 U *	180 U *	100 U *
Chloroprene	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
2,2-Dichloropropane	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
cis-1,2-Dichloroethene	ug/Kg	MRL	Total	**370**	**750**	**460**	**12000**	**380**
2-Butanone	ug/Kg	MRL	Total	410 U	580 U	520 U	**17000**	520 U
Propionitrile	ug/Kg	MRL	Total	330 U	460 U	420 U	730 U	410 U
Bromochloromethane	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
Methacrylonitrile	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
Tetrahydrofuran	ug/Kg	MRL	Total	1100 U	1600 U	1500 U *	2600 U *	1500 U *
Chloroform	ug/Kg	MRL	Total	81 U	120 U	**350** B	**7200** B	51 J B
1,1,1-Trichloroethane	ug/Kg	MRL	Total	81 U	120 U	100 U	**3100**	100 U
1,1-Dichloropropene	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
Carbon tetrachloride	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
Isobutyl alcohol	ug/Kg	MRL	Total	4100 U	5800 U	5200 U	9200 U	5200 U
Benzene	ug/Kg	MRL	Total	81 U	120 U	100 U	**5700**	100 U
1,2-Dichloroethane	ug/Kg	MRL	Total	81 U	120 U	100 U	**11000**	100 U
Trichloroethene	ug/Kg	MRL	Total	**270**	**360**	**280**	**5800**	**560**
1,2-Dichloropropane	ug/Kg	MRL	Total	81 U	120 U	100 U	**6900**	100 U
Dibromomethane	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
Methyl methacrylate	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
1,4-Dioxane	ug/Kg	MRL	Total	4100 U	5800 U	5200 U	9200 U	5200 U
1,2,3-Trichlorobenzene	ug/Kg	MRL	Total	81 U	120 U	100 U	57 J	100 U
2-Chloroethyl vinyl ether	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
cis-1,3-Dichloropropene	ug/Kg	MRL	Total	81 U	120 U	100 U	**11000**	100 U
4-Methyl-2-pentanone	ug/Kg	MRL	Total	410 U	580 U	520 U	**12000**	520 U
Toluene	ug/Kg	MRL	Total	81 U	120 U	100 U	**5700**	100 U
trans-1,3-Dichloropropene	ug/Kg	MRL	Total	81 U	120 U	100 U	**2200**	100 U
Ethyl methacrylate	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
1,1,2-Trichloroethane	ug/Kg	MRL	Total	81 U	120 U	100 U	**7400**	100 U
Tetrachloroethene	ug/Kg	MRL	Total	**840**	**3600**	**5800**	**7900**	**500**
1,3-Dichloropropane	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
2-Hexanone	ug/Kg	MRL	Total	410 U	580 U	520 U	920 U	520 U
Dibromochloromethane	ug/Kg	MRL	Total	81 U	120 U	100 U	62 J	100 U
1,2-Dibromoethane	ug/Kg	MRL	Total	81 U	120 U	100 U	**9000**	100 U
Chlorobenzene	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
1,1,1,2-Tetrachloroethane	ug/Kg	MRL	Total	81 U	120 U	100 U	**5500**	100 U
Ethylbenzene	ug/Kg	MRL	Total	81 U	120 U	100 U	**2100**	100 U
m&p-Xylene	ug/Kg	MRL	Total	81 U	120 U	100 U	**5300**	100 U
o-Xylene	ug/Kg	MRL	Total	81 U	120 U	100 U	**5100**	100 U
Xylenes, Total	ug/Kg	MRL	Total	81 U	120 U	100 U	**10000**	100 U
Styrene	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
Bromoform	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
Isopropylbenzene	ug/Kg	MRL	Total	81 U	120 U	100 U	**10000**	100 U
Bromobenzene	ug/Kg	MRL	Total	81 U	120 U	100 U	**11000**	100 U
1,1,2,2-Tetrachloroethane	ug/Kg	MRL	Total	81 U	120 U	100 U	**3000**	100 U
1,2,3-Trichloropropane	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
trans-1,4-Dichloro-2-butene	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
n-Propylbenzene	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
2-Chlorotoluene	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
4-Chlorotoluene	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
1,3,5-Trimethylbenzene	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
tert-Butylbenzene	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
1,2,4-Trimethylbenzene	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
sec-Butylbenzene	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
1,3-Dichlorobenzene	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
4-Isopropyltoluene	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
1,4-Dichlorobenzene	ug/Kg	MRL	Total	81 U	120 U	100 U	**3800**	100 U
1,2-Dichlorobenzene	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
n-Butylbenzene	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
1,2-Dibromo-3-Chloropropane	ug/Kg	MRL	Total	81 U	120 U	100 U	**5800**	100 U
1,2,4-Trichlorobenzene	ug/Kg	MRL	Total	81 U	120 U	100 U	**5200**	100 U
Hexachlorobutadiene	ug/Kg	MRL	Total	81 U	120 U	100 U	180 U	100 U
Naphthalene	ug/Kg	MRL	Total	81 U	120 U	100 U	**11000** B	58 J B
Percent Solids	%	MRL	Total	**91.9**	**84.4**	**84.7**		**91**
Dilution Factor				1	1	1	3.7	1
Data Analyzed				8/1/2012	8/1/2012	8/7/2012	8/7/2012	8/7/2012

Notes:

All values reported in micrograms per liter (ug/l)

B=Compound was found in the Blank and the Sample.

Table 2: Summary of Performance Evaluation Sample (PES) Results

Pre-Design Investigation
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont
Soil Sampling SDG: 200-11784-1

	ML153-PD-S1	*Lot No. D074-721*	
	TA Analysis	*ID No. 0703-12-06.2*	
Parameter	*VOCs Method 8260B High Level*	*Certified Value*	*QC Performance Acceptance Limits*
Solid (ug/Kg)			
ML153-PD-S1			
1,1,1,2-Tetrachloroethane	5500	4600	3380 - 5900
1,1,1-Trichloroethane	3100	2780	1960 - 3650
1,1,2,2-Tetrachloroethane	3000	2400	1560 - 3170
1,1,2-Trichloroethane	7400	6100	4510 - 7700
1,1-Dichloroethane	10000	8500	6050 - 11200
1,1-Dichloroethene	4900	3880	2520 - 5700
1,1-Dichloropropene	180 U		
1,2,3-Trichlorobenzene	57 J		
1,2,3-Trichloropropane	180 U	<1000	
1,2,4-Trichlorobenzene	5200	4720	2840 - 6300
1,2,4-Trimethylbenzene	180 U		
1,2-Dibromo-3-Chloropropane	5800	4500	2050 - 6500
1,2-Dibromoethane	9000	7250	5150 - 9300
1,2-Dichlorobenzene	180 U	<1000	-
1,2-Dichloroethane	11000	9850	7100 - 12700
1,2-Dichloropropane	6900	5750	4450 - 7050
1,3,5-Trimethylbenzene	180 U		
1,3-Dichlorobenzene	180 U	<1000	-
1,3-Dichloropropane	180 U		
1,4-Dichlorobenzene	3800	3360	2080 - 4340
1,4-Dioxane	9200 U		
2,2-Dichloropropane	180 U		
2-Butanone	17000	14000	4500 - 20000
2-Chloroethyl vinyl ether	180 U	<1000	-
2-Chlorotoluene	180 U		
2-Hexanone	920 U	<1000	-
4-Chlorotoluene	180 U		
4-Isopropyltoluene	180 U		
4-Methyl-2-pentanone	12000	10200	5700 - 14000
Acetone	21000	18000	1260 - 28900
Acrolein	920 U		
Acrylonitrile	180 U	<1000	-
Allyl chloride	180 U		
Benzene	5700	4680	3420 - 5800
Bromobenzene	11000	8300	6200 - 10300
Bromochloromethane	180 U		
Bromodichloromethane	11000	9500	7100 - 12400
Bromoform	180 U	<1000	-
Bromomethane	180 U	<1000	-
Carbon disulfide	180 U	<1000	-
Carbon tetrachloride	180 U	<1000	-
Chlorobenzene	180 U	<1000	-
Chloroethane	7500	8550	5700 - 11500
Chloroform	7200 B	6200	4570 - 7900
Chloromethane	85 J	<1000	-
Chloroprene	180 U		
cis-1,2-Dichloroethene	12000	9700	6700 - 12500

Soil Sampling SDG: 200-11784-1

Parameter	ML153-PD-S1 TA Analysis VOCs Method 8260B High Level	Lot No. D074-721 ID No. 0703-12-06.2 Certified Value	QC Performance Acceptance Limits
Solid (ug/Kg)			
cis-1,3-Dichloropropene	11000	9650	6900 - 12200
Dibromochloromethane	62 J		
Dibromomethane	180 U		
Dichlorodifluoromethane	180 U	<1000	-
Ethyl methacrylate	180 U		
Ethylbenzene	2100	2100	1500 - 2740
Freon TF	180 U		
Hexachlorobutadiene	180 U		
Isobutyl alcohol	9200 U		
Isopropylbenzene	10000	8300	6100 - 11600
m&p-Xylene	5300	4900	3290 - 6580
Methacrylonitrile	180 U		
Methyl iodide	180 U		
Methyl methacrylate	180 U		
Methyl t-butyl ether	5100	4360	3280 - 5850
Methylene Chloride	1700 B	1480	900 - 1930
Naphthalene	11000 B	9500	5900 - 12400
n-Butylbenzene	180 U		
n-Propylbenzene	180 U		
o-Xylene	5100	4510	3020 - 6050
Propionitrile	730 U		
sec-Butylbenzene	180 U		
Styrene	180 U	<1000	-
tert-Butylbenzene	180 U		
Tetrachloroethene	7900	6800	4270 - 8900
Tetrahydrofuran	2600 U *		
Toluene	5700	4860	3520 - 6050
trans-1,2-Dichloroethene	180 U	<1000	-
trans-1,3-Dichloropropene	2200	2120	1490 - 2820
trans-1,4-Dichloro-2-butene	180 U		
Trichloroethene	5800	5150	3600 - 6600
Trichlorofluoromethane	180 U	<1000	-
Vinyl acetate	180 U *	<1000	-
Vinyl chloride	5700	5550	3040 - 9250
1,2-Dichloroethene, Total	12000	9700	6700 - 12500
Xylenes, Total	10000	9400	6300 - 12600

Notes

TA = Test America in South Burlington, VT

The QC Performance Acceptance Limits (QC PALs) based on actual historical dta collected in ERA's Prificiency Testing program. QC PALs reflect any inherent biases in the methods used to establish the limits and closely approximate a 95% conficence interval of the performance that experienced laboratories should achieve using accepted environmental methods.

XI. ACCURACY CHECK (Performance Evaluation Results)

SDG No.: 200-11784

Are more than one-half of the PES analytes within criteria for each parameter. [Y] N

PE Sample No./ ERA ID No,	Lot No.	Parameter	Type of PES	Matrix	Analyte	ML153-PD-S1 TA Analysis (ug/l)	Non-EPA PES Scores**	Samples Affected	Action
ML153-PD-S1/ ID No. 0703-12-06.2	D074721	VOCs	VOA	Solid	Bromobenzene	11000	PES Compound Hit 8300 (6200-10300)	ML152-PD-S1, ML1-PD-S1 (5'), ML1-PD-S2 (9.5-10'), ML1-PD-S3 (27'), ML3-PD-S1 (20), ML3-PD-S2 (23'), ML3-PD-S3 (29'), PZ150-PD-S1 (17'-18'), PZ3-PD-S1 (12-13'), PZ3-PD-S2 (17'-18'), PZ4-PD-S1 (30'), ML1-PD-S3 (27')	J

* For Region I PESs indicate the Region I PES Score Report Result: Action High; Action Low; TCL MISS; TCL CONTAMINANT; TIC HIT; TIC MISS; TIC CONTAMINANT

** For Non-EPA PESs indicate the Non-EPA PES Score: PES Compound MISS; PES Compound CONTAMINANT; PES Compound HIT (Range)

TIC Tentatively Identifiable Compound

Validator: Ann Marie Petrucci

Date: 12/11/2012

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 200-11784-1

SDG Number: 200-11784

Job Description: Burgess Brother's Sanitary Landfill

For:
Environmental Partners Group
1900 Crown Colony Drive
Suite 402
Quincy, MA 02169

Attention: Ms. Ann Marie Petricca

Approved for release.
Sara S Goff
Project Manager I
8/21/2012 1:04 PM

Sara S Goff
Project Manager I
sara.goff@testamericainc.com
08/21/2012

The test results in this report relate only to sample(s) as received by the laboratory. These test results were derived under a quality system that adheres to the requirements of NELAC. Pursuant to NELAC, this report may not be produced in full without written approval from the laboratory

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CASE NARRATIVE

Client: Environmental Partners Group

Project: Burgess Brother's Sanitary Landfill

Report Number: 200-11784-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT

The samples were received on 07/18/2012, 07/19/2012, 07/25/2012, 07/26/2012, 07/27/2012 and 07/28/2012; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 3.4° C, 4.6° C, 5.0° C, 5.8° C, 5.8° C and 6.2° C.

The Chain-of-Custody (COC) received on July 27th was not relinquished.

The container label for the following sample(s) did not match the information listed on the Chain-of-Custody (COC): PZ150-PD-S1 (17'-18'). The container labels list a depth of (17'-18'). The COC does not list the depth. The depth from the sample label was used for the log-in per PM direction. The container label for the following sample(s) did not match the information listed on the Chain-of-Custody (COC): ML3-PD-W2 (13-15). The container label lists a time of 1150. Sample logged in per the chain of custody. The container label for the following sample(s) did not match the information listed on the Chain-of-Custody (COC): ML3-PD-S2 (23'). Two of three container labels list a depth of 20'. The COC lists a depth of 23'. The container label for the following sample(s) did not match the information listed on the Chain-of-Custody (COC): ML1-PD-W1 (8-10'). The container labels list a time of 9:50. The COC lists 8:45. The samples were logged as on the COC.

VOLATILE ORGANIC COMPOUNDS (GC-MS) - SOLID

Samples PZ3-PD-S2 (17'-18'), PZ150-PD-S1 (17'-18'), ML1-PD-S3 (27'), ML3-PD-S1 (20), ML152-PD-S1, PZ4-PD-S1 (30'), PZ3-PD-S1 (12-13'), ML3-PD-S2 (23'), ML3-PD-S3 (29'), ML1-PD-S1 (5'), ML1-PD-S2 (9.5-10'), and ML153-PD-S1 were analyzed for volatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8260B. The samples were prepared on 07/18/2012, 07/20/2012, 07/26/2012, 07/27/2012 and 08/02/2012 and analyzed on 07/24/2012, 07/25/2012, 08/01/2012 and 08/07/2012.

The initial calibration curve was outside acceptance criteria for Methyl iodide. The continuing calibration verification (CCV) for analytical batch 42278 exceeded control criteria for Vinyl acetate. The continuing calibration verification (CCV) for Methyl iodide and Vinyl acetate associated with batch 42334 recovered above the upper control limit. The continuing calibration verification (CCV) for Methyl iodide and Vinly Acetate associated with batch 42432 recovered above the upper control limit. The continuing calibration verification (CCV) for Vinyl acetate and Bromomethane associated with batch42785 recovered above the upper control limit. The continuing calibration verification (CCV) for analytical batch 42794 exceeded control criteria for Bromomethane, Methyl Iodide, and Vinyl acetate. The continuing calibration verification (CCV) for analytical batch 43108 exceeded control criteria for Bromomethane ,Vinyl acetate, and 1,4-Dioxane. The continuing calibration verification (CCV) for analytical batch 43111 exceeded control criteria for Bromomethane and Vinyl acetate. The data have been qualified and reported.

Bromomethane and Methylene Chloride were detected in method blank MB 200-42282/2-A at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Bromomethane was detected in method blank MB 200-42282/3-A at a level exceeding the reporting limit. If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Methylene Chloride was detected in method blank MB 200-42282/3-A at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Chloroform was detected in method blank MB 200-42969/1-A at a level exceeding the reporting limit. If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Methylene Chloride and Naphthalene were detected in method blank MB 200-42969/1-A at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

Vinyl acetate failed the recovery criteria high for laboratory control sample 200-43111/3. Refer to the QC report for details.

Bromomethane, Chloroethane and Trichlorofluoromethane failed the recovery criteria low for the matrix spike and matrix spike duplicate

of sample ML1-PD-S3 (27'). Several analytes exceeded the relative percent difference limit. Refer to the QC report for details.

No other difficulties were encountered during the volatiles analyses. All other quality control parameters were within the acceptance limits.

VOLATILE ORGANIC COMPOUNDS (GC-MS) - AQUEOUS

Samples ML3-PD-W3 (18-20'), ML3-PD-W4 (23-25'), ML1-PD-W1 (8-10'), ML1-PD-W2 (13-15'), ML1-PD-W3 (18-20'), ML152-PD-W1, TB-154-PD-W1, ML1-PD-W4 (23-25'), ML5-PD-WI (8-10), ML5-PD-W2 (13-15), TB-154, ML5-PD-W3 (18'-20'),TRIP BLANK, TB151-PD-W1, ML2-PD-W1 (8-10'), TB-PD-150, ML3-PD-W1 (8-10), ML3-PD-W2 (13-15), ML151-PD-W2,and TB153- PD-W1 were analyzed for volatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8260B. The samples were analyzed on 07/23/2012, 07/25/2012, 07/31/2012, 08/01/2012 and 08/06/2012.

The initial calibration curve was outside acceptance criteria for Methyl iodide. The continuing calibration verification (CCV) for analytical batch 42278 exceeded control criteria for Vinyl acetate. The continuing calibration verification (CCV) for Methyl iodide and Vinyl acetate associated with batch 42334 recovered above the upper control limit. The continuing calibration verification (CCV) for Methyl iodide and Vinly Acetate associated with batch 42432 recovered above the upper control limit. The continuing calibration verification (CCV) for Vinyl acetate and Bromomethane associated with batch 42785 recovered above the upper control limit. The continuing calibration verification (CCV) for analytical batch 42794 exceeded control criteria for Bromomethane, Methyl Iodide, and Vinyl acetate. The continuing calibration verification (CCV) for analytical batch 43108 exceeded control criteria for Bromomethane ,Vinyl acetate, and 1,4-Dioxane. The continuing calibration verification (CCV) for analytical batch 43111 exceeded control criteria for Bromomethane and Vinyl acetate. The data have been qualified and reported.

For sample ML5-PD-WI (8-10) Toluene was detected above the instrument calibration range. Due to significant amount of sediment at the bottom of the sample vials two containers were combined in order to perform the analysis. Therefore insufficient sample volume remained for reanalysis of the over calibration result.

Bromomethane was detected in method blank MB 200-42282/4-A at a level exceeding the reporting limit. If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Methylene Chloride was detected in method blanks MB 200-42278/5, MB 200-42432/5, MB 200-42794/5 , and MB 200-43108/5 at a level that was above the method detection limit but below the reporting limit. Chloromethane, Methyl iodide and Methylene Chloride were detected in method blank MB 200-42282/4-A at levels that were above the method detection limit but below the reporting limit. 1,4-Dioxane and Methylene Chloride were detected in method blank MB 200-42785/5 at levels that were above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

One or more analytes failed the recovery and relative percent difference criteria for the matrix spike and matrix spike duplicate of sample ML3-PD-W2 (13-15). Refer to the QC report for details.

Samples ML3-PD-W3 (18-20')[28X], ML3-PD-W2 (13-15)[11X], ML2-PD-W1 (8-10')[147X], ML151-PD-W2[12X], ML3-PD-W4 (23-25') [34X], ML1-PD-W1 (8-10')[110X], ML1-PD-W2 (13-15')[63X], ML1-PD-W3 (18-20')[28X] and ML1-PD-W4 (23-25')[110X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No other difficulties were encountered during the volatiles analyses. All other quality control parameters were within the acceptance limits.

December 11, 2012

Mr. Terrence Connelly
Remedial Project Manager
US Environmental Protection Agency – Region 1
5 Post Office Square, Suite 100
Boston, MA 02109-3912

Re: SDG 200-12228
TestAmerica Laboratories, Inc.
Burgess Brothers Superfund Site
Pre-Design Investigation
Tier I Organics Data Validation – Aqueous Samples

Volatiles: 4 / Aqueous / ML2-PD-W4(23'-25'), ML2-PD-W5(28'-30'), ML4-PD-W1(13'-15'), ML4-PD-W2(18'-20')

2 / Aqueous Trip Blanks / TB153-PD-W1, TB154-PD-W1

1 / Aqueous PES / ML160-PD-W1

Dear Mr. Connelly:

A Tier I data validation, in accordance with Region I, EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses, December 1996 criteria, and criteria required under the Pre-Design Investigation (PDI) Quality Assurance Project Plan (QAPP), dated July 2012, was performed on organic analytical data for 13 Aqueous Samples, 6 Trip Blanks, and 1 Aqueous PES collected by Environmental Partners Group, Inc. from the Burgess Brothers Superfund Site. The volatile aqueous samples, blanks and PESs were analyzed using the EPA SW-846 Method 8260B Volatile Organic Statement of Work. In accordance with the PDI QAPP, Tier I data validation was deemed sufficient for the groundwater vertical profiling samples at this time.

A summary of the laboratory analytical results for this SDG, including method reporting limits and dilution factors, is attached as Table 1.

A Tier I data validation is based on the following parameters:

- Complete Sample Delivery Group Files (CFS) Completeness Evidence Audit
- Evaluation of Performance Evaluation Sample (PES) Results

A CFS Completeness Evidence Audit was performed for this Sample Delivery Group (SDG) 200-12228-1 aqueous data. All criteria were met for this parameter. The attached Lab Report Table of Contents and Narrative provide the completeness information for this SDG.

The PES results were evaluated for this SDG aqueous data and are summarized in Table 2. All criteria were met and all compounds were within performance acceptance limits. A XI Accuracy Check (PE Results) Form is included also attached.

Environmental Partners recommends that the organics solid data in this SDG be accepted and that no further data validation be performed. Please contact Ann Marie Petricca at (617) 657-0299 should you have any questions or comments regarding this report.

Sincerely,

Ann Marie Petricca

Ann Marie Petricca, CPG
Data Validator

Attachments:
1. Data Summary Table
2. Accuracy Check/PES Score Report
3. Completeness Evidence Audit

cc: Geoffrey Seibel, *de maximis, inc.*

Table 1: Groundwater Analytical Data
Test America SDG 200-12228-1
Volatile Organic Compounds SW-846 EPA Method 8260B
Burgess Brothers Superufund Site, Woodford and Bennington, VT

								PE Sample		
Analyte	**Units**	**Reports To**	**Basis**	**200-12278-1 ML2-PD-W4(23'-25') 8/13/2012 12:15 PM**	**200-12278-2 ML2-PD-W5(28'-30') 8/13/2012 3:30 PM**	**200-12278-3 ML4-PD-W1(13'-15') 8/14/2012 2:45 PM**	**200-12278-4 ML4-PD-W2(18'-20') 8/14/2012 3:45 PM**	**200-12384-1 ML160-PD-W1 8/22/2012 12:00 PM**	**200-12278-5 TB153-PD-W1 8/15/2012 12:00 AM**	**200-12384-3 TB154-PD-W1 8/22/2012 12:00 AM**
Dichlorodifluoromethane	ug/L	MRL	Total	39 J	69 U	2.5 J	7.6 J	1.0 U	1.0 U	1.0 U
Chloromethane	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	0.30 J B	1.0 U	0.30 J B
Vinyl chloride	ug/L	MRL	Total	**670**	**380**	**26**	**150**	7.5 *	1.0 U	1.0 U *
Bromomethane	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U *	1.0 U	1.0 U *
Chloroethane	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
Trichlorofluoromethane	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
Acrolein	ug/L	MRL	Total	730 U	340 U *	25 U	63 U	5.0 U	5.0 U	5.0 U
1,1-Dichloroethene	ug/L	MRL	Total	150 U	17 J	**7**	**20**	**6.7**	1.0 U	1.0 U
Freon TF	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
Acetone	ug/L	MRL	Total	730 U *	340 U *	5.1 J *	63 U *	5.0 U	5.0 U *	5.0 U
Methyl iodide	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
Carbon disulfide	ug/L	MRL	Total	150 U	69 U *	4.9 U	13 U	1.0 U	1.0 U	1.0 U
Allyl chloride	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
Methylene Chloride	ug/L	MRL	Total	70 J B	33 J B	2.5 J B	6.3 J B	**16** B	0.45 J B	0.55 J B
Acrylonitrile	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	ug/L	MRL	Total	150 U	69 U	1.8 J	13 U	**13**	1.0 U	1.0 U
1,2-Dichloroethene, Total	ug/L	MRL	Total	**2300**	**1700**	**320**	**820**	**36**	1.0 U	1.0 U
Methyl t-butyl ether	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
Vinyl acetate	ug/L	MRL	Total	150 U *	69 U	4.9 U *	13 U *	1.0 U	1.0 U *	1.0 U
Chloroprene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
2,2-Dichloropropane	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	ug/L	MRL	Total	**2300**	**1700**	**320**	**820**	**23**	0.28 J	1.0 U
2-Butanone	ug/L	MRL	Total	730 U *	340 U *	25 U *	63 U *	5.0 U	5.0 U *	5.0 U
Proplonitrile	ug/L	MRL	Total	590 U	280 U	20 U	50 U	4.0 U	4.0 U	4.0 U
Bromochloromethane	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
Methacrylonitrile	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
Tetrahydrofuran	ug/L	MRL	Total	2100 U	960 U	69 U	180 U	14 U	14 U	14 U
Chloroform	ug/L	MRL	Total	**370**	28 J	**7.4**	**17**	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	**10**	1.0 U	1.0 U
1,1-Dichloropropene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
Carbon tetrachloride	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	**9.1**	1.0 U	1.0 U
Isobutyl alcohol	ug/L	MRL	Total	7300 U	3400 U	250 U	630 U	50 U	50 U	50 U
Benzene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	**11**	1.0 U	1.0 U
1,2-Dichloroethane	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	**6.3**	1.0 U	1.0 U
Trichloroethene	ug/L	MRL	Total	**1700**	**1200**	**430**	**1100**	**17**	0.17 J	1.0 U
1,2-Dichloropropane	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	**11**	1.0 U	1.0 U
Dibromomethane	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
Methyl methacrylate	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
1,4-Dioxane	ug/L	MRL	Total	7300 U	3400 U	250 U	630 U	50 U	50 U	50 U
Bromodichloromethane	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
2-Chloroethyl vinyl ether	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
cis-1,3-Dichloropropene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
4-Methyl-2-pentanone	ug/L	MRL	Total	730 U	340 U	25 U	63 U	5.0 U	5.0 U	5.0 U
Toluene	ug/L	MRL	Total	150 U	16 J	**120**	**24**	**17**	1.0 U	1.0 U
trans-1,3-Dichloropropene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
Ethyl methacrylate	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	ug/L	MRL	Total	150 U	69 U	**14**	13 U	**3.4**	1.0 U	1.0 U
Tetrachloroethene	ug/L	MRL	Total	**9900**	**3100**	**370**	**1000**	**11**	1.0 U	1.0 U
1,3-Dichloropropane	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
2-Hexanone	ug/L	MRL	Total	730 U *	340 U *	25 U *	63 U *	5.0 U	5.0 U *	5.0 U
Dibromochloromethane	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
1,2-Dibromoethane	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
Chlorobenzene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	**14**	1.0 U	1.0 U
1,1,1,2-Tetrachloroethane	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
Ethylbenzene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	**16**	1.0 U	1.0 U
m&p-Xylene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	**4.9**	1.0 U	1.0 U
o-Xylene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	**3.8**	1.0 U	1.0 U
Xylenes, Total	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	**8.6**	1.0 U	1.0 U
Styrene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	**5**	1.0 U	1.0 U
Bromoform	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
Isopropylbenzene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
Bromobenzene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichloropropane	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
trans-1,4-Dichloro-2-butene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U *	1.0 U	1.0 U *
n-Propylbenzene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
2-Chlorotoluene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
4-Chlorotoluene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
tert-Butylbenzene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
sec-Butylbenzene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
1,3-Dichlorobenzene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
4-Isopropyltoluene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	**11**	1.0 U	1.0 U
1,2-Dichlorobenzene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	**12**	1.0 U	1.0 U
n-Butylbenzene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
1,2-Dibromo-3-Chloropropane	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
1,2,4-Trichlorobenzene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	**5.0** B	1.0 U	0.25 J B
Hexachlorobutadiene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
Naphthalene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	0.52 J B	1.0 U	1.0 U
1,2,3-Trichlorobenzene	ug/L	MRL	Total	150 U	69 U	4.9 U	13 U	1.0 U	1.0 U	1.0 U
Dilution Factor				146.7	68.8	4.9	12.6	1	1	1
Data Analyzed				8/22/2012	8/23/2012	8/22/2012	8/22/2012	8/30/2012	8/22/2012	8/30/2012

Notes:

All values reported in micrograms per liter (ug/l)

U=Not detected above the reporting limit

B=Compound was found in the Blank and the Sample.

J=Estimated value.

Table 2: Summary of Performance Evaluation Sample (PES) Results

Pre-Design Investigation
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont
Groundwater Sampling SDG: 200-12228-1

	ML160-PD-W1 TA Analysis	Lot No. S174-703 ID No. 0820-12-01.2	
Parameter	VOCs Method 8260B Routine Level	Certified Value	QC Performance Acceptance Limits
Aqueous (ug/L)			
ML160-PD-W1			
1,1,1,2-Tetrachloroethane	1 U		
1,1,1-Trichloroethane	10	11.7	8.42 - 14.5
1,1,2,2-Tetrachloroethane	1 U		
1,1,2-Trichloroethane	3.4	3.94	3.04 - 4.85
1,1-Dichloroethane	1 U		
1,1-Dichloroethene	6.7	7.06	4.88 - 9.25
1,1-Dichloropropene	1 U		
1,2,3-Trichlorobenzene	1 U		
1,2,3-Trichloropropane	1 U		
1,2,4-Trichlorobenzene	5 B	6.41	4.11 - 8.08
1,2,4-Trimethylbenzene	1 U		
1,2-Dibromo-3-Chloropropane	1 U		
1,2-Dibromoethane	1 U		
1,2-Dichlorobenzene	12	14.2	10.8 - 17.3
1,2-Dichloroethane	6.3	6.71	5.21 - 8.39
1,2-Dichloropropane	11	12.5	9.66 - 15.4
1,3,5-Trimethylbenzene	1 U		
1,3-Dichlorobenzene	1 U		
1,3-Dichloropropane	1 U		
1,4-Dichlorobenzene	11	13.6	9.79 - 16.7
1,4-Dioxane	50 U		
2,2-Dichloropropane	1 U		
2-Butanone	5 U		
2-Chloroethyl vinyl ether	1 U		
2-Chlorotoluene	1 U		
2-Hexanone	5 U		
4-Chlorotoluene	1 U		
4-Isopropyltoluene	1 U		
4-Methyl-2-pentanone	5 U		
Acetone	5 U		
Acrolein	5 U		
Acrylonitrile	1 U		
Allyl chloride	1 U		
Benzene	11	12.5	9.82 - 15.1
Bromobenzene	1 U		
Bromochloromethane	1 U		
Bromodichloromethane	1 U		
Bromoform	1 U		
Bromomethane	1 U *		
Carbon disulfide	1 U		
Carbon tetrachloride	9.1	10.9	7.48 - 13.7
Chlorobenzene	14	16.4	12.8 - 20.0
Chloroethane	1 U		
Chloroform	1 U		
Chloromethane	0.3 J B		
Chloroprene	1 U		
cis-1,2-Dichloroethene	23	25	18.7 - 30.8

Groundwater Sampling SDG: 200-12228-1

Parameter	ML160-PD-W1 TA Analysis VOCs Method 8260B Routine Level	Lot No. S174-703 ID No. 0820-12-01.2 Certified Value	QC Performance Acceptance Limits
cis-1,3-Dichloropropene	1 U		
Dibromochloromethane	1 U		
Dibromomethane	1 U		
Dichlorodifluoromethane	1 U		
Ethyl methacrylate	1 U		
Ethylbenzene	16	19.2	14.6 - 23.8
Freon TF	1 U		
Hexachlorobutadiene	1 U		
Isobutyl alcohol	50 U		
Isopropylbenzene	1 U		
m&p-Xylene	4.9	5.75	4.35 - 7.13
Methacrylonitrile	1 U		
Methyl iodide	1 U		
Methyl methacrylate	1 U		
Methyl t-butyl ether	1 U		
Methylene Chloride	16 B	18.4	12.8 - 23.6
Naphthalene	0.52 J B		
n-Butylbenzene	1 U		
n-Propylbenzene	1 U		
o-Xylene	3.8	4.23	3.20 - 5.24
Propionitrile	4 U		
sec-Butylbenzene	1 U		
Styrene	5	6.01	4.51 - 7.57
tert-Butylbenzene	1 U		
Tetrachloroethene	11	14.2	9.71 - 17.2
Tetrahydrofuran	14 U		
Toluene	17	19.2	14.9 - 23.2
trans-1,2-Dichloroethene	13	14.2	10.6 - 17.8
trans-1,3-Dichloropropene	1 U		
trans-1,4-Dichloro-2-butene	1 U *		
Trichloroethene	17	20	14.8 - 23.8
Trichlorofluoromethane	1 U		
Vinyl acetate	1 U		
Vinyl chloride	7.5 *	8.60	5.08 - 12.6
1,2-Dichlorobenzene-d4	23		
1,2-Dichloroethane-d4	24		
Bromofluorobenzene	24		
Toluene-d8	24		
1,2-Dichloroethene, Total	36		
Xylenes, Total	8.6	9.98	7.54 - 12.4

Notes:

TA = Test America in South Burlington, VT

The Certified Values are the actual 'made to' concentrations confirmed by ERA analytical verification.

The QC Performance Acceptance Limits (QC PALs) based on actual historical dta collected in ERA's Prificiency Testing program. QC PALs reflect any inherent biases in the methods used to establish the limits and closely approximate a 95% conficence interval of the performance that experienced laboratories should achieve using accepted environmental methods.

XI. ACCURACY CHECK (Performance Evaluation Results)

SDG No.: 200-12228-1

Are more than one-half of the PES analytes within criteria for each parameter. [Y] N

PE Sample No./ ERA ID No,	Lot No.	Parameter	Type of PES	Matrix	Analyte	ML160-PD-W1 TA Analysis (ug/l)	Non-EPA PES Scores**	Samples Affected	Action
ML160-PD-W1/ ID No. 0802-12-01.2	S174703	VOCs	VOA	Aqueous					

* For Region I PESs indicate the Region I PES Score Report Result: Action High; Action Low; TCL MISS; TCL CONTAMINANT; TIC HIT; TIC MISS; TIC CONTAMINANT

** For Non-EPA PESs indicate the Non-EPA PES Score: PES Compound MISS; PES Compound CONTAMINANT; PES Compound HIT (Range)

TIC Tentatively Identifiable Compound

Validator: Ann Marie Petrucci

Date: 12/11/2012

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 200-12228-1

Job Description: Burgess Brother's Sanitary Landfill

For:
Environmental Partners Group
1900 Crown Colony Drive
Suite 402
Quincy, MA 02169

Attention: Ms. Ann Marie Petricca

Sara Goff

Approved for release.
Sara S Goff
Project Manager I
12/10/2012 11:02 AM

Sara S Goff
Project Manager I
sara.goff@testamericainc.com
12/10/2012
Revision: 2

The test results in this report relate only to sample(s) as received by the laboratory. These test results were derived under a quality system that adheres to the requirements of NELAC. Pursuant to NELAC, this report may not be produced in full without written approval from the laboratory

TestAmerica Laboratories, Inc.
TestAmerica Burlington 30 Community Drive, Suite 11, South Burlington, VT 05403
Tel (802) 660-1990 Fax (802) 660-1919 www.testamericainc.com

12/10/2012

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CASE NARRATIVE

Client: Environmental Partners Group

Project: Burgess Brother's Sanitary Landfill

Report Number: 200-12228-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

This data package was revised in order to correct reported results for sample PZ161-PD-S1. The initial weight and final volume of the sample has been corrected.

RECEIPT

The samples were received on 08/14/2012, 08/16/2012, 08/21/2012 and 08/23/2012; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 0.6° C, 3.6° C, 5.0° C and 5.8° C.

The Chain of Custody was received without date of sample collection for sample TB153-PD-W1. The relinquished date was used.

The container label for sample PZ12-PD-S1(2') did not match the information listed on the Chain-of-Custody (COC). The container labels list a sample collection time of 0915 while the COC lists a time of 0920. Sample logged in per the COC.

VOLATILE ORGANIC COMPOUNDS (GC-MS)

Samples PZ3-PD-S3(26'), PZ12-PD-S1(2'), PZ160-PD-S1(9'), PZ12-PD-S2(9'), PZ14-PD-S1(2') and PZ161-PD-S1 were analyzed for volatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8260B. The samples were prepared on 08/21/2012, 08/23/2012 and 08/31/2012 and analyzed on 08/22/2012, 08/29/2012, 08/30/2012, 09/04/2012 and 09/05/2012.

Bromomethane and Methyl iodide were detected in method blanks MB 200-43846/5-A, MB 200-43846/7-A, MB 200-43846/9-A at levels exceeding the reporting limit. If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Several analytes were detected in method blanks at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged.

The initial calibration curve was outside acceptance criteria for Methyl iodide. The continuing calibration verification (CCV) for analytical batch 43890 exceeded control criteria for Dichlorodifluoromethane and Methyl iodide.

The initial calibration curve was outside acceptance criteria for Bromomethane, 2-Chloroethyl vinyl ether, Methyl iodide, and 1,2,3-Trichloropropane. The initial calibration verification (ICV) was outside acceptance criteria for Bromomethane and Acrolein. The continuing calibration verification (CCV) for analytical batch 44169 exceeded control criteria for Methyl iodide and 2-Chloroethyl vinyl ether. The continuing calibration verification (CCV) for analytical batch 44296 exceeded control criteria for Bromomethane, Chloromethane, and Methyl iodide. The continuing calibration verification (CCV) for analytical batch 44299 exceeded control criteria for Chloromethane, Bromomethane, Methyl iodide, and trans-1,4-Dichloro-2-butene. The data have been qualified and reported. The continuing calibration verification (CCV) for analytical batch 44459 exceeded control criteria for Dichlorodifluoromethane, Bromomethane, Methyl iodide. The data have been qualified and reported. The continuing calibration verification (CCV) for analytical batch 44514 exceeded control criteria for Hexachlorobutadiene, Bromomethane, and 1,4-Dioxane. The data have been qualified and reported.

Bromomethane and or Vinyl acetate failed the recovery criteria high for laboratory control samples 200-44169/3, 200-44296/3, 200-44459/3, and 200-44514/3. Methyl t-butyl ether failed the recovery criteria low for laboratory control samples 200-44514/3. Refer to the QC report for details.

Chloroethane and Isobutyl alcohol failed the recovery criteria low for the matrix spike and matrix spike duplicate of sample PZ14-PD-S1(2') and Methyl iodide failed only in the matrix spike.

No other difficulties were encountered during the volatiles analyses. All other quality control parameters were within the acceptance limits.

VOLATILE ORGANIC COMPOUNDS (GC-MS)

Samples ML2-PD-W4(23'-25'), ML2-PD-W5(28'-30'), ML4-PD-W1(13'-15'), ML4-PD-W2(18'-20'), TB153-PD-W1, ML160-PD-W1, and

TB154-PD-W1 were analyzed for volatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8260B. The samples were analyzed on 08/22/2012, 08/23/2012 and 08/30/2012.

Several analytes were detected in method blanks at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged.

The initial calibration curve was outside acceptance criteria for Methyl iodide. The continuing calibration verification (CCV) for analytical batch 43890 exceeded control criteria for Dichlorodifluoromethane and Methyl iodide. The continuing calibration verification (CCV) for analytical batch 43899 exceeded control criteria for Dichlorodifluoromethane, Trichlorofluoromethane, Methyl iodide.

The initial calibration curve was outside acceptance criteria for Bromomethane, 2-Chloroethyl vinyl ether, Methyl iodide, and 1,2,3-Trichloropropane. The initial calibration verification (ICV) was outside acceptance criteria for Bromomethane and Acrolein. The continuing calibration verification (CCV) for analytical batch 44296 exceeded control criteria for Bromomethane, Chloromethane, and Methyl iodide. The data have been qualified and reported.

2-Butanone, 2-Hexanone, Acetone and Vinyl acetate failed the recovery criteria high for LCS 200-43890/4. Acrolein and Carbon disulfide failed the recovery criteria low for LCS 200-43899/3. 2-Butanone, 2-Hexanone and Acetone failed the recovery criteria high. Bromomethane, trans-1,4-Dichloro-2-butene and Vinyl chloride failed the recovery criteria high for LCS 200-44299/3. Refer to the QC report for details.

Samples ML2-PD-W4(23'-25')[147X], ML2-PD-W5(28'-30')[69X], ML4-PD-W1(13'-15')[5X] and ML4-PD-W2(18'-20')[13X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No other difficulties were encountered during the volatiles analyses. All other quality control parameters were within the acceptance limits.

December 11, 2012

Mr. Terrence Connelly
Remedial Project Manager
US Environmental Protection Agency – Region 1
5 Post Office Square, Suite 100
Boston, MA 02109-3912

Re: SDG 200-12228-1
TestAmerica Laboratories, Inc.
Burgess Brothers Superfund Site
Pre-Design Investigation
Tier I Organics Data Validation – Soil Samples

Volatiles: 4 / Soil / PZ3-PD-S3(26'), PZ12-PD-S1(2'), PZ12-PD-S2(9'), PZ14-PD-S1(2')

1 / Soilds PES / PZ161-PD-S1

Dear Mr. Connelly:

A Tier I data validation, in accordance with Region I, EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses, December 1996 criteria, and criteria required under the Pre-Design Investigation (PDI) Quality Assurance Project Plan (QAPP), dated July 2012, was performed on the organic analytical data for 4 Soil Samples and 1 Solid PES collected by Environmental Partners Group, Inc. from the Burgess Brothers Superfund Site. The volatile soil samples and PES were analyzed using the EPA SW-846 Method 8260B Volatile Organic Statement of Work. In accordance with the PDI QAPP, Tier I Data Validation was deemed sufficient for the soil samples at this time.

Attached is a summary of the laboratory analytical results for this SDG, including method reporting limits and dilution factors, is attached as Table 1.

A Tier I data validation is based on the following parameters:

- Complete Sample Delivery Group Files (CFS) Completeness Evidence Audit
- Evaluation of Performance Evaluation Sample (PES) Results

A CFS Completeness Evidence Audit was performed for this Sample Delivery Group (SDG) 200-12228-1 soils data. All criteria were met for this parameter. The attached Lab Report Table of Contents and Narrative provide the completeness information for this SDG.

The solids PES results were evaluated for this SDG data and are summarized in Table 2. All compounds were within performance acceptance limits except for 4-isopropyltoluene, which was measured in sample PZ-161-PD-S1, but is not present in the PES. If a Tier II or Tier IIII validation were performed, the following actions would be applied to the data, for the compound 4-isopropyltoluene:

- all positive detects in all samples associated with this PES would be estimated (J) to indicate potential high bias and
- all quantitation limits for non-detects in all samples associated with this PES would be accepted

A XI Accuracy Check (PE Results) Form is also attached. 4-Isopropyltoluene has never been detected in groundwater at the Site and is not a contaminant of concern at the Site.

Environmental Partners recommends that the organics soil data in this SDG be accepted and that no further data validation be performed. Please contact Ann Marie Petricca at (617) 657-0299 should you have any questions or comments regarding this report.

Sincerely,

Ann Marie Petricca

Ann Marie Petricca, CPG
Data Validator

Attachments:
1. Data Summary Table
2. PES Summary Table
3. Completeness Evidence Audit

cc: Geoffrey Seibel, *de maximis, inc.*

Table 1: Soil Analytical Data
Test America SDG 200-12228-1
Volatile Organic Compounds SW-846 EPA Method 8260B
Burgess Brothers Superufund Site, Woodford and Bennington, VT

						DUP PZ12-PD-S1(2')			PE Sample
Analyte	Units	Reports To	Basis	200-12228-1 PZ3-PD-S3(26') 8/13/2012 1:35 PM	200-12340-1 PZ12-PD-S1(2') 8/20/2012 9:20 AM	200-12340-2 PZ160-PD-S1(9') 8/20/2012 9:45 AM	200-12340-3 PZ12-PD-S2(9') 8/20/2012 9:45 AM	200-12340-4 PZ14-PD-S1(2') 8/20/2012 2:10 PM	200-12384-2 PZ161-PD-S1 8/22/2012 12:00 PM
Bromodichloromethane	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	17000
Dichlorodifluoromethane	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
Chloromethane	ug/Kg	MRL	Total	130 U	52 J B	51 J B	55 J B	36 J B	82 J B
Vinyl chloride	ug/Kg	MRL	Total	93 J	130 U	110 U	130 U	95 U	280 U
Bromomethane	ug/Kg	MRL	Total	130 U	110 J B	150 B	120 J * B	69 J * B	280 U *
Chloroethane	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
Trichlorofluoromethane	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
Acrolein	ug/Kg	MRL	Total	670 U	660 U	530 U	660 U	480 U	1400 U
1,1-Dichloroethene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	7600
Freon TF	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
Acetone	ug/Kg	MRL	Total	670 U *	660 U	530 U	660 U	480 U	61000
Methyl iodide	ug/Kg	MRL	Total	57 J B	180 B	140 B	130 U	100 B	140 J B
Carbon disulfide	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
Allyl chloride	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
Methylene Chloride	ug/Kg	MRL	Total	74 J B	57 J B	41 J B	58 J B	38 J B	2300 B
Acrylonitrile	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
trans-1,2-Dichloroethene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	10000
1,2-Dichloroethene, Total	ug/Kg	MRL	Total	360	130	110	160	200	10000
Methyl t-butyl ether	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	19000 *
1,1-Dichloroethane	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
Vinyl acetate	ug/Kg	MRL	Total	130 U *	130 U *	110 U *	130 U *	95 U *	280 U *
Chloroprene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
2,2-Dichloropropane	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
cis-1,2-Dichloroethene	ug/Kg	MRL	Total	360	130	110	160	200	76 J
2-Butanone	ug/Kg	MRL	Total	670 U *	660 U	530 U	660 U	480 U	34000
Propionitrile	ug/Kg	MRL	Total	540 U	530 U	420 U	530 U	380 U	1100 U
Bromochloromethane	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
Methacrylonitrile	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
Tetrahydrofuran	ug/Kg	MRL	Total	1900 U *	1900 U	1500 U	1800 U	1300 U	3900 U
Chloroform	ug/Kg	MRL	Total	310	130 U	110 U	130 U	95 U	6700
1,1,1-Trichloroethane	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	11000
1,1-Dichloropropene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
Carbon tetrachloride	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
Isobutyl alcohol	ug/Kg	MRL	Total	6700 U	6600 U	5300 U	6600 U	4800 U	14000 U
Benzene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	16000
1,2-Dichloroethane	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	11000
Trichloroethene	ug/Kg	MRL	Total	280	410	450	630	130	7900
1,2-Dichloropropane	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	4700
Dibromomethane	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
Methyl methacrylate	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
1,4-Dioxane	ug/Kg	MRL	Total	6700 U	6600 U	5300 U	6600 U	4800 U	14000 U
1,2,3-Trichlorobenzene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
2-Chloroethyl vinyl ether	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
cis-1,3-Dichloropropene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
4-Methyl-2-pentanone	ug/Kg	MRL	Total	670 U	660 U	530 U	660 U	480 U	21000
Toluene	ug/Kg	MRL	Total	130 U	40 J	37 J	48 J	32 J	3200
trans-1,3-Dichloropropene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
Ethyl methacrylate	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
1,1,2-Trichloroethane	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
Tetrachloroethene	ug/Kg	MRL	Total	2300	550	620	1100	260	6500
1,3-Dichloropropane	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
2-Hexanone	ug/Kg	MRL	Total	670 U *	660 U	530 U	660 U	480 U	1400 U
Dibromochloromethane	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	17000
1,2-Dibromoethane	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	4100
Chlorobenzene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	4000
1,1,1,2-Tetrachloroethane	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	17000
Ethylbenzene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	18000
m&p-Xylene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	13000
o-Xylene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	12000
Xylenes, Total	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	25000
Styrene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
Bromoform	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	5900
Isopropylbenzene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
Bromobenzene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
1,1,2,2-Tetrachloroethane	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	6300
1,2,3-Trichloropropane	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	10000
trans-1,4-Dichloro-2-butene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
n-Propylbenzene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
2-Chlorotoluene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
4-Chlorotoluene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
1,3,5-Trimethylbenzene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
tert-Butylbenzene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
1,2,4-Trimethylbenzene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
sec-Butylbenzene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
1,3-Dichlorobenzene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
4-Isopropyltoluene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	120 J
1,4-Dichlorobenzene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	10000
1,2-Dichlorobenzene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	12000
n-Butylbenzene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
1,2-Dibromo-3-Chloropropane	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
1,2,4-Trichlorobenzene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	9700
Hexachlorobutadiene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	280 U
Naphthalene	ug/Kg	MRL	Total	130 U	130 U	110 U	130 U	95 U	12000
Percent Solids	%	MRL	Total	82.2	83.8	89	88.5	84.8	
Dilution Factor				1	1	1	1	1	1
Data Analyzed				8/22/2012	8/29/2012	8/29/2012	7/30/2012	8/30/2012	9/4/2012

Notes:
All values reported in micrograms per liter (ug/l)
B=Compound was found in the Blank and the Sample.
U=Not detected above the reporting limit
J=Estimated value.

Table 2: Summary of Performance Evaluation Sample (PES) Results

Pre-Design Investigation
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont
Soil Sampling SDG: 200-12228-1

	PZ-161-PD-S1 *TA Analysis*	*Lot No. D077-721* *ID No. 0820-12-01.1*	
Parameter	*VOCs Method 8260B High Level*	*Certified Value*	*QC Performance Acceptance Limits*
Solid (ug/Kg)			
PZ-161-PD-S1			
1,1,1,2-Tetrachloroethane	8400	8050	6050 - 10200
1,1,1-Trichloroethane	5300	4880	3500 - 6340
1,1,2,2-Tetrachloroethane	3200	3280	2200 - 4300
1,1,2-Trichloroethane	140 U	<1000	
1,1-Dichloroethane	140 U	<1000	
1,1-Dichloroethene	3800	3220	2340 - 4660
1,1-Dichloropropene	140 U		
1,2,3-Trichlorobenzene	140 U		
1,2,3-Trichloropropane	5100	5600	2880 - 7950
1,2,4-Trichlorobenzene	4800	4990	3000 - 6640
1,2,4-Trimethylbenzene	140 U		
1,2-Dibromo-3-Chloropropane	140 U	<1000	
1,2-Dibromoethane	2100	2160	1630 - 2720
1,2-Dichlorobenzene	5800	5550	3620 - 7160
1,2-Dichloroethane	5600	5800	4280 - 7420
1,2-Dichloropropane	2300	2470	1920 - 3040
1,3,5-Trimethylbenzene	140 U	15800	6380 - 22100
1,3-Dichlorobenzene	140 U	<1000	
1,3-Dichloropropane	140 U		
1,4-Dichlorobenzene	5100	5050	3260 - 6410
1,4-Dioxane	7000 U		
2,2-Dichloropropane	140 U		
2-Butanone	17000	15800	6380 - 22100
2-Chloroethyl vinyl ether	140 U	<1000	
2-Chlorotoluene	140 U		
2-Hexanone	700 U	<1000	
4-Chlorotoluene	140 U	<1000	
4-Isopropyltoluene	58 J		
4-Methyl-2-pentanone	10000	12200	7280 - 16500
Acetone	30000	31300	4980 - 48500
Acrolein	700 U	<1000	
Acrylonitrile	140 U		
Allyl chloride	140 U		
Benzene	8000	7650	5670 - 9490
Bromobenzene	140 U	<1000	
Bromochloromethane	140 U		
Bromodichloromethane	8300	8200	6260 - 10600
Bromoform	2900	2900	2020 - 3850
Bromomethane	140 U *	<1000	
Carbon disulfide	140 U	<1000	
Carbon tetrachloride	140 U	<1000	
Chlorobenzene	2000	2000	1480 - 2470
Chloroethane	140 U	<1000	
Chloroform	3300	3020	2260 - 3840
Chloromethane	41 J B	<1000	
Chloroprene	140 U		
cis-1,2-Dichloroethene	38 J	<1000	

Soil Sampling SDG: 200-12228-1

Parameter	PZ-161-PD-S1 TA Analysis VOCs Method 8260B High Level	Lot No. D077-721 ID No. 0820-12-01.1 Certified Value	QC Performance Acceptance Limits
cis-1,3-Dichloropropene	140 U	<1000	
Dibromochloromethane	8700	8200	6260 - 10600
Dibromomethane	140 U	<1000	
Dichlorodifluoromethane	140 U	<1000	
Ethyl methacrylate	140 U		
Ethylbenzene	8900	8300	5920 - 10500
Freon TF	140 U		
Hexachlorobutadiene	140 U		
Isobutyl alcohol	7000 U		
Isopropylbenzene	140 U	<1000	
m&p-Xylene	6500	6500	4400 - 8390
Methacrylonitrile	140 U		
Methyl iodide	71 J B		
Methyl methacrylate	140 U		
Methyl t-butyl ether	9300 *	9850	7430 - 12900
Methylene Chloride	1100 B	1160	725 - 1490
Naphthalene	6200	6600	4100 - 8650
n-Butylbenzene	140 U		
n-Propylbenzene	140 U		
o-Xylene	6100	6100	4130 - 7870
Propionitrile	560 U		
sec-Butylbenzene	140 U		
Styrene	140 U	<1000	
tert-Butylbenzene	140 U		
Tetrachloroethene	3200	2980	1890 - 3910
Tetrahydrofuran	2000 U		
Toluene	1600	1640	1200 - 2030
trans-1,2-Dichloroethene	5000	4540	3460 - 5990
trans-1,3-Dichloropropene	140 U	<1000	
trans-1,4-Dichloro-2-butene	140 U		
Trichloroethene	3900	3760	2690 - 4770
Trichlorofluoromethane	140 U	<1000	
Vinyl acetate	140 U *	<1000	
Vinyl chloride	140 U	<1000	

Notes:

TA = Test America in South Burlington, VT

The Certified Values are the actual 'made to' concentrations confirmed by ERA analytical verification.

The QC Performance Acceptance Limits (QC PALs) based on actual historical dta collected in ERA's Prificiency Testing program. QC PALs reflect any inherent biases in the methods used to establish the limits and closely approximate a 95% conficence interval of the performance that experienced laboratories should achieve using accepted environmental methods.

XI. ACCURACY CHECK (Performance Evaluation Results)

SDG No.: 200-12228-1

Are more than one-half of the PES analytes within criteria for each parameter. Y N

PE Sample No./ ERA ID No,	Lot No.	Parameter	Type of PES	Matrix	Analyte	PZ161-PD-S1 TA Analysis (ug/l)	Non-EPA PES Scores**	Samples Affected	Action
PZ161-PD-S1/ ID No. 0802-12-01.1	D007721	VOCs	VOA	Solid	4-Isopropyltoluene	58 J	ND	PZ3-PD-S3(26'), PZ12-PD-S1(2'), PZ160-PD-S1(9'), PZ12-PD-S2(9'), PZ14-PD-S1(2')	J

* For Region I PESs indicate the Region I PES Score Report Result: Action High; Action Low; TCL MISS; TCL CONTAMINANT; TIC HIT; TIC MISS; TIC CONTAMINANT

** For Non-EPA PESs indicate the Non-EPA PES Score: PES Compound MISS; PES Compound CONTAMINANT; PES Compound HIT (Range)

TIC Tentatively Identifiable Compound

Validator: Ann Marie Petrucci

Date: 12/11/2012

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 200-12228-1

Job Description: Burgess Brother's Sanitary Landfill

For:
Environmental Partners Group
1900 Crown Colony Drive
Suite 402
Quincy, MA 02169

Attention: Ms. Ann Marie Petricca

Sara Goff

Approved for release.
Sara S Goff
Project Manager I
12/10/2012 11:02 AM

Sara S Goff
Project Manager I
sara.goff@testamericainc.com
12/10/2012
Revision: 2

The test results in this report relate only to sample(s) as received by the laboratory. These test results were derived under a quality system that adheres to the requirements of NELAC. Pursuant to NELAC, this report may not be produced in full without written approval from the laboratory

TestAmerica Laboratories, Inc.
TestAmerica Burlington 30 Community Drive, Suite 11, South Burlington, VT 05403
Tel (802) 660-1990 Fax (802) 660-1919 www.testamericainc.com

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CASE NARRATIVE

Client: Environmental Partners Group

Project: Burgess Brother's Sanitary Landfill

Report Number: 200-12228-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

This data package was revised in order to correct reported results for sample PZ161-PD-S1. The initial weight and final volume of the sample has been corrected.

RECEIPT

The samples were received on 08/14/2012, 08/16/2012, 08/21/2012 and 08/23/2012; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 0.6° C, 3.6° C, 5.0° C and 5.8° C.

The Chain of Custody was received without date of sample collection for sample TB153-PD-W1. The relinquished date was used.

The container label for sample PZ12-PD-S1(2') did not match the information listed on the Chain-of-Custody (COC). The container labels list a sample collection time of 0915 while the COC lists a time of 0920. Sample logged in per the COC.

VOLATILE ORGANIC COMPOUNDS (GC-MS)

Samples PZ3-PD-S3(26'), PZ12-PD-S1(2'), PZ160-PD-S1(9'), PZ12-PD-S2(9'), PZ14-PD-S1(2') and PZ161-PD-S1 were analyzed for volatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8260B. The samples were prepared on 08/21/2012, 08/23/2012 and 08/31/2012 and analyzed on 08/22/2012, 08/29/2012, 08/30/2012, 09/04/2012 and 09/05/2012.

Bromomethane and Methyl iodide were detected in method blanks MB 200-43846/5-A, MB 200-43846/7-A, MB 200-43846/9-A at levels exceeding the reporting limit. If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Several analytes were detected in method blanks at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged.

The initial calibration curve was outside acceptance criteria for Methyl iodide. The continuing calibration verification (CCV) for analytical batch 43890 exceeded control criteria for Dichlorodifluoromethane and Methyl iodide.

The initial calibration curve was outside acceptance criteria for Bromomethane, 2-Chloroethyl vinyl ether, Methyl iodide, and 1,2,3-Trichloropropane. The initial calibration verification (ICV) was outside acceptance criteria for Bromomethane and Acrolein. The continuing calibration verification (CCV) for analytical batch 44169 exceeded control criteria for Methyl iodide and 2-Chloroethyl vinyl ether. The continuing calibration verification (CCV) for analytical batch 44296 exceeded control criteria for Bromomethane, Chloromethane, and Methyl iodide. The continuing calibration verification (CCV) for analytical batch 44299 exceeded control criteria for Chloromethane, Bromomethane, Methyl iodide, and trans-1,4-Dichloro-2-butene. The data have been qualified and reported. The continuing calibration verification (CCV) for analytical batch 44459 exceeded control criteria for Dichlorodifluoromethane, Bromomethane, Methyl iodide. The data have been qualified and reported. The continuing calibration verification (CCV) for analytical batch 44514 exceeded control criteria for Hexachlorobutadiene, Bromomethane, and 1,4-Dioxane. The data have been qualified and reported.

Bromomethane and or Vinyl acetate failed the recovery criteria high for laboratory control samples 200-44169/3, 200-44296/3, 200-44459/3, and 200-44514/3. Methyl t-butyl ether failed the recovery criteria low for laboratory control samples 200-44514/3. Refer to the QC report for details.

Chloroethane and Isobutyl alcohol failed the recovery criteria low for the matrix spike and matrix spike duplicate of sample PZ14-PD-S1(2') and Methyl iodide failed only in the matrix spike.

No other difficulties were encountered during the volatiles analyses. All other quality control parameters were within the acceptance limits.

VOLATILE ORGANIC COMPOUNDS (GC-MS)

Samples ML2-PD-W4(23'-25'), ML2-PD-W5(28'-30'), ML4-PD-W1(13'-15'), ML4-PD-W2(18'-20'), TB153-PD-W1, ML160-PD-W1, and

TB154-PD-W1 were analyzed for volatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8260B. The samples were analyzed on 08/22/2012, 08/23/2012 and 08/30/2012.

Several analytes were detected in method blanks at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged.

The initial calibration curve was outside acceptance criteria for Methyl iodide. The continuing calibration verification (CCV) for analytical batch 43890 exceeded control criteria for Dichlorodifluoromethane and Methyl iodide. The continuing calibration verification (CCV) for analytical batch 43899 exceeded control criteria for Dichlorodifluoromethane, Trichlorofluoromethane, Methyl iodide.

The initial calibration curve was outside acceptance criteria for Bromomethane, 2-Chloroethyl vinyl ether, Methyl iodide, and 1,2,3-Trichloropropane. The initial calibration verification (ICV) was outside acceptance criteria for Bromomethane and Acrolein. The continuing calibration verification (CCV) for analytical batch 44296 exceeded control criteria for Bromomethane, Chloromethane, and Methyl iodide. The data have been qualified and reported.

2-Butanone, 2-Hexanone, Acetone and Vinyl acetate failed the recovery criteria high for LCS 200-43890/4. Acrolein and Carbon disulfide failed the recovery criteria low for LCS 200-43899/3. 2-Butanone, 2-Hexanone and Acetone failed the recovery criteria high. Bromomethane, trans-1,4-Dichloro-2-butene and Vinyl chloride failed the recovery criteria high for LCS 200-44299/3. Refer to the QC report for details.

Samples ML2-PD-W4(23'-25')[147X], ML2-PD-W5(28'-30')[69X], ML4-PD-W1(13'-15')[5X] and ML4-PD-W2(18'-20')[13X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No other difficulties were encountered during the volatiles analyses. All other quality control parameters were within the acceptance limits.

Groundwater Chemical Data

December 11, 2012

Mr. Terrence Connelly
Remedial Project Manager
US Environmental Protection Agency – Region 1
5 Post Office Square, Suite 100
Boston, MA 02109-3912

Re: SDG 200-12007-1
TestAmerica Laboratories, Inc.
Burgess Brothers Superfund Site
Pre-Design Investigation
Tier I Organics Data Validation – Aqueous Samples

Volatiles: 11 / Aqueous / W09S1-PD-1, PZ-4D-PD-1, PZ-5D-PD-1, PZ-4S-PD-1, PZ-6S-PD-1, W09TD-PD-1, W150-PD-1, PZ5S-PD-1, WO4T-PD-1, WO4D-PD-1, and PZ6D-PD-1

2 / Aqueous Trip Blanks / TB-160-PD-1, TB-161-PD1

1 / Aqueous Equipment Blank / EB-150-PD-1

1 / Aqueous PES / W151-PD-1

Dear Mr. Connelly:

A Tier I data validation, in accordance with Region I, EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses, December 1996 criteria, and criteria required under the Pre-Design Investigation (PDI) Quality Assurance Project Plan (QAPP), dated July 2012, was performed on organic analytical data for 11 Aqueous Samples, 2 Trip Blanks, 1 Aqueous Equipment Blank, and 1 Aqueous PES collected by Environmental Partners Group, Inc. from the Burgess Brothers Superfund Site. The volatile aqueous samples, blanks and PESs were analyzed using the EPA SW-846 Method 8260B Volatile Organic Statement of Work. In accordance with the PDI QAPP, Tier I data validation was deemed sufficient for the groundwater samples at this time.

A summary of the laboratory analytical results for this SDG, including method reporting limits and dilution factors, is attached as Table 1.

A Tier I data validation is based on the following parameters:

- Complete Sample Delivery Group Files (CFS) Completeness Evidence Audit
- Evaluation of Performance Evaluation Sample (PES) Results

A CFS Completeness Evidence Audit was performed for this Sample Delivery Group (SDG) 200-12007-1 aqueous data. All criteria were met for this parameter. The attached Lab Report Table of Contents and Narrative provide the completeness information for this SDG.

Page 2

The PES results were evaluated for this SDG aqueous data and are summarized in attached Table 2. All compounds were within performance acceptance limits. A XI Accuracy Check (PE Results) Form is also attached.

Environmental Partners recommends that the organics aqeous data in this SDG be accepted and that no further data validation be performed. Please contact Ann Marie Petricca at (617) 657-0299 should you have any questions or comments regarding this report.

Sincerely,

Ann Marie Petricca

Ann Marie Petricca, CPG
Data Validator

Attachments:
1. Data Summary Table
2. Accuracy Check/PES Score Report
3. Completeness Evidence Audit

cc: Geoffrey Seibel, *de maximis, inc.*

Table 1: Groundwater Analytical Data
Test America SDG 200-12007-1
Volatile Organic Compounds SW-846 EPA Method 8260B
Burgess Brothers Superfund Site, Woodford and Bennington, VT

Analyte	Units	Reports To	Basis	200-12100-1 PZ-4S-PD-1 8/2/2012 3:30 PM	200-12082-3 PZ-4D-PD-1 8/1/2012 8:00 AM	200-12174-2 PZ5S-PD-1 8/6/2012 4:50 PM	200-12082-7 PZ-5D-PD-1 8/2/2012 12:00 PM	200-12100-3 PZ-6S-PD-1 8/2/2012 3:30 PM	200-12174-7 PZ6D-PD-1 8/7/2012 1:30 PM	200-12174-6 WO4D-PD-1 8/7/2012 9:30 AM	200-12174-5 WO4T-PD-1 8/7/2012 9:30 AM	200-12082-2 W09S1-PD-1 8/1/2012 8:00 AM	200-12100-5 W09TD-PD-1 8/2/2012 3:00 PM
4-Isopropyltoluene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
1,2,4-Trimethylbenzene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
1,3-Dichlorobenzene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
1,2-Dibromoethane	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
sec-Butylbenzene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
1,4-Dichlorobenzene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Hexachlorobutadiene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
tert-Butylbenzene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Dichlorodifluoromethane	ug/L	MRL	Total	21 J	16 J	1.0 U	1.5 U	1.0 U	0.47 J	170 U	42 J	1.9 J	7.4 J
Carbon tetrachloride	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
trans-1,3-Dichloropropene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
1,3-Dichloropropane	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Toluene	ug/L	MRL	Total	25 J	37 U	1.0 U	0.30 J	0.45 J	1.5 U	170 U	170 U	3.1 U	11 U
Tetrachloroethene	ug/L	MRL	Total	**3200**	**3200**	0.41 J	**110**	**1.9**	**110**	**7200**	**10000**	**260**	**880**
4-Methyl-2-pentanone	ug/L	MRL	Total	220 U	180 U	5.0 U	7.5 U	5.0 U	7.5 U	850 U	850 U	16 U	54 U
2-Hexanone	ug/L	MRL	Total	220 U	180 U	5.0 U	7.5 U	5.0 U	7.5 U	850 U	850 U	16 U	54 U
Dibromochloromethane	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Ethylbenzene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Chlorobenzene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
1,1,1,2-Tetrachloroethane	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Naphthalene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
trans-1,2-Dichloroethene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	0.79 J	11 U
Methyl iodide	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Acrylonitrile	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Acrolein	ug/L	MRL	Total	220 U	180 U	5.0 U	7.5 U	5.0 U	7.5 U *	850 U *	850 U *	16 U	54 U
Methylene Chloride	ug/L	MRL	Total	21 J B	18 J B	0.54 J B	1.2 J B	0.46 J B	0.90 J B	76 J B	88 J B	1.5 J B	4.9 J B
Chloromethane	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Vinyl chloride	ug/L	MRL	Total	**320**	**460**	1.0 U	1.5 U	1.0 U	0.40 J	**190**	**480**	**7.9**	**110**
Bromomethane	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Carbon disulfide	ug/L	MRL	Total	44 U	37 U	1.0 U *	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Allyl chloride	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
n-Butylbenzene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
1,2-Dibromo-3-Chloropropane	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
1,2-Dichlorobenzene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
1,2,3-Trichlorobenzene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
1,2,4-Trichlorobenzene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Chloroethane	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Trichlorofluoromethane	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Acetone	ug/L	MRL	Total	220 U	180 U	2.9 J	5.4 J	3.5 J	3.3 J	850 U	850 U	16 U	54 U
1,1-Dichloroethene	ug/L	MRL	Total	25 J	34 J	1.0 U	0.78 J	1.0 U	**1.5**	170 U	170 U	2.6 J	**17**
Freon TF	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
1,1,2-Trichloroethane	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Vinyl acetate	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U *	170 U *	170 U *	3.1 U	11 U
Chloroprene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Methyl methacrylate	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
1,2-Dichloropropane	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Dibromomethane	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
1,1-Dichloroethane	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
cis-1,2-Dichloroethene	ug/L	MRL	Total	**1300**	**1800**	1.0 U	**36**	0.90 J	**36**	**2200**	**3200**	**120**	**630**
Methyl t-butyl ether	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
2,2-Dichloropropane	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
1,2-Dichloroethene, Total	ug/L	MRL	Total	**1300**	**1800**	1.0 U	**36**	0.90 J	**36**	**2200**	**3200**	**120**	**630**
1,1,1-Trichloroethane	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
1,1-Dichloropropene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
1,2-Dichloroethane	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	3.2 J
Isobutyl alcohol	ug/L	MRL	Total	2200 U	1800 U	50 U	75 U	50 U	75 U	8500 U	8500 U	160 U	540 U
Benzene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	0.28 J	170 U	170 U	3.1 U	11 U
Bromodichloromethane	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
2-Chloroethyl vinyl ether	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
1,4-Dioxane	ug/L	MRL	Total	2200 U	1800 U	50 U	75 U	50 U	75 U	8500 U	8500 U	160 U	540 U
1,3,5-Trimethylbenzene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Trichloroethene	ug/L	MRL	Total	**1300**	**2000**	1.0 U	**61**	**1.6**	**72**	**840**	**2700**	**190**	**910**
Methacrylonitrile	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
n-Propylbenzene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
2-Chlorotoluene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Bromobenzene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
o-Xylene	ug/L	MRL	Total	44 U	8.1 J	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Xylenes, Total	ug/L	MRL	Total	44 U	8.1 J	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
trans-1,4-Dichloro-2-butene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Ethyl methacrylate	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
1,2,3-Trichloropropane	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
4-Chlorotoluene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
1,1,2,2-Tetrachloroethane	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Propionitrile	ug/L	MRL	Total	180 U	150 U	4.0 U	6.0 U	4.0 U	6.0 U	680 U	680 U	12 U	43 U
Bromochloromethane	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
2-Butanone	ug/L	MRL	Total	220 U	180 U	5.0 U	7.5 U	5.0 U	7.5 U	850 U	850 U	16 U	54 U
Tetrahydrofuran	ug/L	MRL	Total	620 U	510 U	14 U	21 U	14 U	21 U	2400 U	2400 U	43 U	150 U
Chloroform	ug/L	MRL	Total	44 U	37 U	0.45 J	**10**	0.46 J	**3.7**	170 U	170 U	3.1 U	11 U
Isopropylbenzene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
m&p-Xylene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Bromoform	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
cis-1,3-Dichloropropene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Styrene	ug/L	MRL	Total	44 U	37 U	1.0 U	1.5 U	1.0 U	1.5 U	170 U	170 U	3.1 U	11 U
Dilution Factor				**44**	**36.7**	**1**	**1.5**	**1**	**1.5**	**169.2**	**169.2**	**3.1**	**10.7**

Notes:
All values reported in micrograms per liter (ug/l)
B=Compound was found in the Blank and the Sample.
U=Not detected above the reporting limit
J=Estimated value.

Table 1: Groundwater Analytical Data
Test America SDG 200-12007-1
Volatile Organic Compounds SW-846 EPA Method 8260B
Burgess Brothers Superufund Site, Woodford and Bennington, VT

				Dup W-09TD-PD-1	PE Sample	Equipment Blank	Trip Blanks	
Analyte	Units	Reports To	Basis	200-12100-6 W150-PD-1 8/2/2012 3:00 PM	200-12100-4 W151-PD-1 8/2/2012 12:00 PM	200-12082-6 EB150-PD-1 8/1/2012 10:30 AM	200-12100-7 TB-160-PD-1 8/2/2012 12:00 AM	200-12174-4 TB-161-PD1 8/6/2012 12:00 AM
4-Isopropyltoluene	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
1,3-Dichlorobenzene	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromoethane	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
sec-Butylbenzene	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	ug/L	MRL	Total	8.5 U	**12**	1.0 U	1.0 U	1.0 U
Hexachlorobutadiene	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
tert-Butylbenzene	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
Dichlorodifluoromethane	ug/L	MRL	Total	6.6 J	2.0 U	1.0 U	1.0 U	1.0 U
Carbon tetrachloride	ug/L	MRL	Total	8.5 U	**9.1**	1.0 U	1.0 U	1.0 U
trans-1,3-Dichloropropene	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
1,3-Dichloropropane	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
Toluene	ug/L	MRL	Total	8.5 U	**18**	1.0 U	1.0 U	1.0 U
Tetrachloroethene	ug/L	MRL	Total	**770**	**12**	**15**	**1**	1.0 U
4-Methyl-2-pentanone	ug/L	MRL	Total	43 U	10 U	5.0 U	5.0 U	5.0 U
2-Hexanone	ug/L	MRL	Total	43 U	10 U	5.0 U	5.0 U	5.0 U
Dibromochloromethane	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
Ethylbenzene	ug/L	MRL	Total	8.5 U	**17**	1.0 U	1.0 U	1.0 U
Chlorobenzene	ug/L	MRL	Total	8.5 U	**16**	1.0 U	1.0 U	1.0 U
1,1,1,2-Tetrachloroethane	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
Naphthalene	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	ug/L	MRL	Total	8.5 U	**13**	1.0 U	1.0 U	1.0 U
Methyl Iodide	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
Acrylonitrile	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
Acrolein	ug/L	MRL	Total	43 U	10 U	5.0 U	5.0 U	5.0 U
Methylene Chloride	ug/L	MRL	Total	4.1 J B	**18** B	0.43 J B	0.54 J B	0.52 J B
Chloromethane	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	0.26 J	1.0 U
Vinyl chloride	ug/L	MRL	Total	**110**	**7.1**	0.26 J	1.0 U	1.0 U
Bromomethane	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
Carbon disulfide	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U *
Allyl chloride	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
n-Butylbenzene	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromo-3-Chloropropane	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	ug/L	MRL	Total	8.5 U	**14**	1.0 U	1.0 U	1.0 U
1,2,3-Trichlorobenzene	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trichlorobenzene	ug/L	MRL	Total	8.5 U	**4.7**	1.0 U	1.0 U	1.0 U
Chloroethane	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
Trichlorofluoromethane	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
Acetone	ug/L	MRL	Total	43 U	10 U	1.8 J	5.0 U	5.0 U
1,1-Dichloroethene	ug/L	MRL	Total	**15**	**7**	1.0 U	1.0 U	1.0 U
Freon TF	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	ug/L	MRL	Total	8.5 U	**3.8**	1.0 U	1.0 U	1.0 U
Vinyl acetate	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
Chloroprene	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
Methyl methacrylate	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloropropane	ug/L	MRL	Total	8.5 U	**12**	1.0 U	1.0 U	1.0 U
Dibromomethane	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	ug/L	MRL	Total	**610**	**25**	0.84 J	**1.9**	0.28 J
Methyl t-butyl ether	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
2,2-Dichloropropane	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethene, Total	ug/L	MRL	Total	**610**	**38**	0.84 J	**1.9**	1.0 U
1,1,1-Trichloroethane	ug/L	MRL	Total	8.5 U	**10**	1.0 U	1.0 U	1.0 U
1,1-Dichloropropene	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	ug/L	MRL	Total	3.2 J	**6.3**	1.0 U	1.0 U	1.0 U
Isobutyl alcohol	ug/L	MRL	Total	430 U	100 U	50 U	50 U	50 U
Benzene	ug/L	MRL	Total	8.5 U	**12**	1.0 U	1.0 U	1.0 U
Bromodichloromethane	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
2-Chloroethyl vinyl ether	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
1,4-Dioxane	ug/L	MRL	Total	430 U	100 U	50 U	50 U	50 U
1,3,5-Trimethylbenzene	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	ug/L	MRL	Total	**830**	**18**	**3.6**	**1.4**	1.0 U
Methacrylonitrile	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
n-Propylbenzene	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
2-Chlorotoluene	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
Bromobenzene	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
o-Xylene	ug/L	MRL	Total	8.5 U	**4**	1.0 U	1.0 U	1.0 U
Xylenes, Total	ug/L	MRL	Total	8.5 U	**9.4**	1.0 U	1.0 U	1.0 U
trans-1,4-Dichloro-2-butene	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
Ethyl methacrylate	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichloropropane	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
4-Chlorotoluene	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
Propionitrile	ug/L	MRL	Total	34 U	8.0 U	4.0 U	4.0 U	4.0 U
Bromochloromethane	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
2-Butanone	ug/L	MRL	Total	43 U	10 U	5.0 U	5.0 U	5.0 U
Tetrahydrofuran	ug/L	MRL	Total	120 U	28 U	14 U	14 U	14 U
Chloroform	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
Isopropylbenzene	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
m&p-Xylene	ug/L	MRL	Total	8.5 U	**5.3**	1.0 U	1.0 U	1.0 U
Bromoform	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
cis-1,3-Dichloropropene	ug/L	MRL	Total	8.5 U	2.0 U	1.0 U	1.0 U	1.0 U
Styrene	ug/L	MRL	Total	8.5 U	**4.7**	1.0 U	1.0 U	1.0 U
Dilution Factor				**8.5**	**2**	**1**	**1**	**1**

Notes:
All values reported in micrograms per liter (ug/l) U=Not detec
B=Compound was found in the Blank and the Sample. J=Estimated

Table 2: Summary of Performance Evaluation Sample (PES) Results

Pre-Design Investigation
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont
Groundwater Sampling SDG: 200-12007-1

	W-151-PD-W1	*Lot No. S174-703*	
	TA Analysis	*ID No. 0703-12-05.1*	
Parameter	*VOCs Method 8260B*	*Certified Value*	*QC Performance Acceptance Limits*
Aqueous (ug/L)			
1,1,1,2-Tetrachloroethane	2 U		
1,1,1-Trichloroethane	10	11.7	8.42 - 14.5
1,1,2,2-Tetrachloroethane	2 U		
1,1,2-Trichloroethane	3.8	3.94	3.04 - 4.85
1,1-Dichloroethane	2 U		
1,1-Dichloroethene	7	7.06	4.88 - 9.25
1,1-Dichloropropene	2 U		
1,2,3-Trichlorobenzene	2 U		
1,2,3-Trichloropropane	2 U		
1,2,4-Trichlorobenzene	4.7	6.41	4.11 - 8.08
1,2,4-Trimethylbenzene	2 U		
1,2-Dibromo-3-Chloropropane	2 U		
1,2-Dibromoethane	2 U		
1,2-Dichlorobenzene	14	14.2	10.8 - 17.3
1,2-Dichloroethane	6.3	6.71	5.21 - 8.39
1,2-Dichloropropane	12	12.5	9.66 - 15.4
1,3,5-Trimethylbenzene	2 U		
1,3-Dichlorobenzene	2 U		
1,3-Dichloropropane	2 U		
1,4-Dichlorobenzene	12	13.6	9.79 - 16.7
1,4-Dioxane	100 U		
2,2-Dichloropropane	2 U		
2-Butanone	10 U		
2-Chloroethyl vinyl ether	2 U		
2-Chlorotoluene	2 U		
2-Hexanone	10 U		
4-Chlorotoluene	2 U		
4-Isopropyltoluene	2 U		
4-Methyl-2-pentanone	10 U		
Acetone	10 U		
Acrolein	10 U		
Acrylonitrile	2 U		
Allyl chloride	2 U		
Benzene	12	12.5	9.82 - 15.1
Bromobenzene	2 U		
Bromochloromethane	2 U		
Bromodichloromethane	2 U		
Bromoform	2 U		
Bromomethane	2 U		
Carbon disulfide	2 U		
Carbon tetrachloride	9.1	10.9	7.48 - 13.7
Chlorobenzene	16	16.4	12.8 - 20.0
Chloroethane	2 U		
Chloroform	2 U		
Chloromethane	2 U		
Chloroprene	2 U		
cis-1,2-Dichloroethene	25	25	18.7 - 30.8
cis-1,3-Dichloropropene	2 U		
Dibromochloromethane	2 U		
Dibromomethane	2 U		

Groundwater Sampling SDG: 200-12007-1

Parameter	W-151-PD-W1 TA Analysis VOCs Method 8260B	Lot No. S174-703 ID No. 0703-12-05.1 Certified Value	QC Performance Acceptance Limits
Dichlorodifluoromethane	2 U		
Ethyl methacrylate	2 U		
Ethylbenzene	17	19.2	14.6 - 23.8
Freon TF	2 U		
Hexachlorobutadiene	2 U		
Isobutyl alcohol	100 U		
Isopropylbenzene	2 U		
m&p-Xylene	5.3	5.75	3.9 - 7.13
Methacrylonitrile	2 U		
Methyl iodide	2 U		
Methyl t-butyl ether	2 U		
Methylene Chloride	18 B	18.4	12.8 - 23.6
Naphthalene	2 U		
n-Butylbenzene	2 U		
n-Propylbenzene	2 U		
o-Xylene	4		
Propionitrile	8 U		
sec-Butylbenzene	2 U		
Styrene	4.7	6.01	4.51 - 7.57
tert-Butylbenzene	2 U		
Tetrachloroethene	12	14.2	9.71 - 17.2
Tetrahydrofuran	28 U		
Toluene	18	19.2	14.9 - 23.2
trans-1,2-Dichloroethene	13	14.2	10.6 - 17.8
trans-1,3-Dichloropropene	2 U		
trans-1,4-Dichloro-2-butene	2 U		
Trichloroethene	18	20	14.8 - 23.8
Trichlorofluoromethane	2 U		
Vinyl acetate	2 U		
Vinyl chloride	7.1	8.60	5.08 - 12.6
1,2-Dichlorobenzene-d4	48		
1,2-Dichloroethane-d4	46		
Bromofluorobenzene	51		
Toluene-d8	50		
1,2-Dichloroethene, Total	38		
Xylenes, Total	9.4	9.98	7.45 - 12.4

Notes

TA = Test America in South Burlington, VT

The QC Performance Acceptance Limits (QC PALs) based on actual historical dta collected in ERA's Prificiency Testing program. QC PALs reflect any inherent biases in the methods used to establish the limits and closely approximate a 95% conficence interval of the performance that experienced laboratories should achieve using accepted environmental methods.

XI. ACCURACY CHECK (Performance Evaluation Results)

SDG No.: 200-12007-1

Are more than one-half of the PES analytes within criteria for each parameter. [Y] N

PE Sample No./ ERA ID No,	Lot No.	Parameter	Type of PES	Matrix	Analyte	W151-PD-W1 TA Analysis (ug/l)	Non-EPA PES Scores**	Samples Affected	Action
W151-PD-W1/ ID No. 0703-12-05.1	S171703	VOCs	VOA	Aq.					

* For Region I PESs indicate the Region I PES Score Report Result: Action High; Action Low; TCL MISS; TCL CONTAMINANT; TIC HIT; TIC MISS; TIC CONTAMINANT

** For Non-EPA PESs indicate the Non-EPA PES Score: PES Compound MISS; PES Compound CONTAMINANT; PES Compound HIT (Range)

TIC Tentatively Identifiable Compound

Validator: Ann Marie Petrucci

Date: 12/11/2012

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 200-12007-1

SDG Number: 200-12007

Job Description: Burgess Brother's Sanitary Landfill

For:
Environmental Partners Group
1900 Crown Colony Drive
Suite 402
Quincy, MA 02169

Attention: Ms. Ann Marie Petricca

Sara Goff

Approved for release.
Sara S Goff
Project Manager I
8/31/2012 12:41 PM

Sara S Goff
Project Manager I
sara.goff@testamericainc.com
08/31/2012

The test results in this report relate only to sample(s) as received by the laboratory. These test results were derived under a quality system that adheres to the requirements of NELAC. Pursuant to NELAC, this report may not be produced in full without written approval from the laboratory

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CASE NARRATIVE

Client: Environmental Partners Group

Project: Burgess Brother's Sanitary Landfill

Report Number: 200-12007-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT

The samples were received on 08/01/2012, 08/02/2012, 08/02/2012, 08/03/2012, 08/03/2012, 08/03/2012, 08/04/2012, 08/07/2012, 08/08/2012, 08/08/2012, 08/08/2012, 08/09/2012, 08/09/2012 and 08/09/2012; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 0.2° C, 0.4° C, 1.0° C, 1.0° C, 1.2° C, 1.6° C, 2.0° C, 2.2° C, 2.9° C, 3.6° C, 3.8° C and 5.6° C.

Several samples had a range of sample collection times noted on each container. Times of collection from the Chain of Custody used for sample login.

The following samples were received unpreserved and were preserved upon receipt to the laboratory: W09TD-PD-1 and W150-PD-1. Laboratory waited 24-hour from the time of preservation with Nitric acid to the time of digestion. The following samples were received unpreserved and were preserved upon receipt to the laboratory: W151-PD-1. The sample was preserved with Sulfuric Acid. The following sample appears to have been collected in containers that are not readily traceable as certified containers: W151-PD-1. Containers were not provided by the laboratory.

The cooler received on August 8th was received without any tape or custody seals sealing the cooler. Per client request analysis of the samples proceeded.

VOLATILE ORGANIC COMPOUNDS (GC-MS)

Samples W09S1-PD-1, PZ-4D-PD-1, EB150-PD-1, PZ-5D-PD-1, PZ-4S-PD-1, PZ-6S-PD-1, W151-PD-1, W09TD-PD-1, W150-PD-1, TB-160-PD-1, PZ5S-PD-1, TB-161-PD1, WO4T-PD-1, WO4D-PD-1, and PZ6D-PD-1 were analyzed for volatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8260B. The samples were analyzed on 08/11/2012, 08/12/2012, 08/13/2012, 08/14/2012, 08/18/2012 and 08/20/2012.

Methylene Chloride was detected in method blank MB 200-43370/5 at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Methylene Chloride was detected in method blank MB 200-43371/5 at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Methyl iodide and Methylene Chloride were detected in method blank MB 200-43436/5 at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Methylene Chloride was detected in method blank MB 200-43538/5 at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Methylene Chloride was detected in method blank MB 200-43677/4 at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Methylene Chloride was detected in method blank MB 200-43772/5 at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

Sample TB-160-PD-1 was reported with cis-1,2-Dichloroethene, Trichloroethene, and Tetrachloroethene over the reporting limit. Previous sample in sequence had these analytes over the calibration range. Reanalysis was not possible for sample TB-160-PD-1 because only one sample volume was provided for analysis.

The initial calibration curve was outside acceptance criteria for Methyl iodide. The continuing calibration verification (CCV) for analytical batch 43370 exceeded control criteria for Vinyl acetate and 1,4-Dioxane. The continuing calibration verification (CCV) for analytical batch 43371 exceeded control criteria for Bromomethane and Vinyl acetate. The continuing calibration verification (CCV) for analytical batch

43436 exceeded control criteria for Methyl iodide, Vinyl acetate, 1,4-Dioxane, and Isobutyl alcohol. The continuing calibration verification (CCV) for analytical batch 43538 exceeded control criteria for Vinyl acetate. The continuing calibration verification (CCV) for 1,4-Dioxane associated with batch 43677 recovered above the upper control limit. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported.

Carbon disulfide failed the recovery criteria low for laboratory control sample 200-43677/2. Acrolein failed the recovery criteria low for laboratory control sample 200-43772/3. Vinyl acetate failed the recovery criteria high. Refer to the QC report for details.

2-Chloroethyl vinyl ether failed the recovery criteria low for the matrix spike and matrix spike duplicate of sample W09TD-PD-1 in batch 200-43370. Refer to the QC report for details.

Samples PZ-4S-PD-1[44X], W09S1-PD-1[3X], PZ-4D-PD-1[37X], W151-PD-1[2X], W09TD-PD-1[11X], WO4T-PD-1[169X], WO4D-PD-1[169X], W150-PD-1[9X], PZ-5D-PD-1[2X] and PZ6D-PD-1[2X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No other difficulties were encountered during the volatiles analyses. All other quality control parameters were within the acceptance limits.

DISSOLVED CATIONS (ICP)

Samples PZ-5D-PD-1, PZ2S-PD-1, PZ7S-PD-1, WO4T-PD-1, and PZ6D-PD-1 were analyzed for dissolved cations in accordance with EPA SW-846 Method 6010C. The samples were prepared on 08/08/2012 and 08/16/2012 and analyzed on 08/16/2012 and 08/18/2012.

Calcium failed the recovery criteria low for the matrix spike of sample PZ7S-PD-1 in batch 200-43682. The associated laboratory control sample (LCS) recovery met acceptance criteria. Refer to the QC report for details.

No other difficulties were encountered during the metals analyses. All other quality control parameters were within the acceptance limits.

CATIONS (ICP)

Samples PZ-4S-PD-1, W09S1-PD-1, PZ-4D-PD-1, EB150-PD-1, PZ-5D-PD-1, PZ-6S-PD-1, W151-PD-1, W09TD-PD-1, W150-PD-1, WO4D-PD1, PZ5S-PD-1, WO4T-PD-1, PZ6D-PD-1, PZ2D-PD-1, and PZ2S-PD-1 were analyzed for Cations in accordance with EPA SW-846 Method 6010C. The samples were prepared on 08/08/2012 and 08/16/2012 and analyzed on 08/16/2012 and 08/18/2012.

Silicon was detected in method blank MB 200-43114/1-A at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

No other difficulties were encountered during the metals analyses. All other quality control parameters were within the acceptance limits.

METALS (ICPMS)

Sample WO4T-PD-1 was analyzed for metals (ICPMS) in accordance with EPA SW-846 Method 6020A. The samples were prepared on 08/17/2012 and analyzed on 08/18/2012.

No difficulties were encountered during the metals analysis. All quality control parameters were within the acceptance limits.

METALS (ICPMS)

Samples W151-PD-1, PZ-4S-PD-1, W09S1-PD-1, PZ-4D-PD-1, W09TD-PD-1, W150-PD-1, EB150-PD-1, WO4D-PD1, P19-PD-1, and WO4T-PD-1 were analyzed for metals (ICPMS) in accordance with EPA SW-846 Method 6020A. The samples were prepared on 08/08/2012 and 08/17/2012 and analyzed on 08/14/2012, 08/16/2012 and 08/18/2012.

Several analytes were detected in method blank MB 200-43117/1-A at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Lead, Silver and Thallium were detected in method blank MB 200-43613/1-A at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

The serial dilution performed for the following sample associated with batch 43739 was outside control limits for Silver. The post digestion spike percent recovery for sample W04D-PD1 associated with batch 43739 was outside of control limits for Selenium.

No other difficulties were encountered during the metals analyses. All other quality control parameters were within the acceptance limits.

HEXAVALENT CHROMIUM

Samples W04D-PD-1, W04T-PD-1 and P19-PD-1, W09S1-PD-1, W09TD-PD-1, PZ04D-PD-1, W150-PD-1, PZ45-PD-1, EB150-PD-1, and W151-PD-1 were analyzed for hexavalent chromium in accordance with EPA SW-846 Method 7196A. The samples were analyzed on 08/01/2012, 08/02/2012 and 08/07/2012.

The matrix spike and matrix spike duplicate analysis of sample W09TD-PD-1 was performed outside of analytical holding time.

No difficulties were encountered during the hexavalent chromium analyses. All quality control parameters were within the acceptance

limits.

TOTAL MERCURY
Samples PZ-4S-PD-1, W09S1-PD-1, PZ-4D-PD-1, W150-PD-1 and EB150-PD-1, WO4D-PD1, P19-PD-1 and WO4T-PD-1, W151-PD-1, and W09TD-PD-1 were analyzed for total mercury in accordance with EPA SW-846 Methods 7470A. The samples were prepared on 08/21/2012 and analyzed on 08/22/2012.

Mercury was detected in method blank MB 200-43761/11-A at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

No other difficulties were encountered during the mercury analyses. All other quality control parameters were within the acceptance limits.

ALKALINITY
Samples W150-PD-1, W151-PD-1, EB150-PD-1, W09TD-PD-1, W09S1-PD-1, PZ4D-PD-1, W151-PD-1, PZ7S-PD-1, W03-PD-1, W25S1-PD-1, W152-PD-1, PZ-2D-PD-1, PZ-5S-PD-1, WO4T-PD-1, WO4D-PD-1, PZ-2S-PD-1, W06D-PD-1, PZ-5D-PD-1, PZ-4S-PD-1, and PZ-6S-PD-1 were analyzed for alkalinity in accordance with SM20 2320B. The samples were analyzed on 08/08/2012, 08/09/2012 and 08/13/2012.

The duplicate analysis of sample W09TD-PD-1 was performed outside of analytical holding time.

No difficulties were encountered during the alkalinity analyses. All quality control parameters were within the acceptance limits.

TOTAL DISSOLVED SOLIDS
Samples PZ-4S-PD-1, W09S1-PD-1, PZ-4D-PD-1, W09TD-PD-1, W150-PD-1, EB150-PD-1, PZ-5D-PD-1, PZ5S-PD-1, WO4T-PD-1, WO4D-PD-1, PZ6D-PD-1, PZ-6S-PD-1, W151-PD-1, PZ2D-PD-1, PZ2S-PD-1, and PZ7S-PD-1 were analyzed for total dissolved solids in accordance with SM20 2540C. The samples were analyzed on 08/06/2012 and 08/10/2012.

No difficulties were encountered during the TDS analyses. All quality control parameters were within the acceptance limits.

ORTHOPHOSPHATE AS P
Samples PZ-5D-PD-1, PZ-6S-PD-1, PZ2S-PD-1, W06D-PD-1, W04D-PD-1, W04T-PD-1, PZ2D-PD-1, PZ5S-PD-1, PZ45-PD-1, EB150-PD-1, W151-PD-1, W09S1-PD-1, W09TD-PD-1, PZ04D-PD-1, W150-PD-1, PZ7S-PD-1, W-03-PD-1, W25S1-PD-1, and W152-PD-1 were analyzed for orthophosphate as P in accordance with SM20 4500 P E. The samples were analyzed on 08/01/2012, 08/02/2012, 08/03/2012, 08/08/2012 and 08/10/2012.

Sample W151-PD-1[5X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No difficulties were encountered during the orthophosphate analyses. All quality control parameters were within the acceptance limits.

ANIONS (Chloride and Sulfate)
Samples PZ-5D-PD-1, PZ-4S-PD-1, PZ-6S-PD-1, PZ-2D-PD-1, PZ-5S-PD-1, WO4T-PD-1, WO4D-PD-1, PZ-2S-PD-1, W06D-PD-1, W150-PD-1, W151-PD-1, EB150-PD-1, W09TD-PD-1, W09S1-PD-1, PZ4D-PD-1, W151-PD-1, PZ7S-PD-1, W03-PD-1, W25S1-PD-1, and W152-PD-1 were analyzed for anions, Chloride and Sulfate, in accordance with EPA SW-846 Method 9056. The samples were analyzed on 08/20/2012.

No difficulties were encountered during the anions analyses. All quality control parameters were within the acceptance limits.

ANIONS (Nitrate and Nitrite)
Samples PZ7S-PD-1, W03-PD-1, W25S1-PD-1, W152-PD-1, PZ-5D-PD-1, PZ-4S-PD-1, PZ-6S-PD-1, PZ-2D-PD-1, PZ-5S-PD-1, WO4T-PD-1, WO4D-PD-1, PZ-2S-PD-1, W06D-PD-1, W150-PD-1, W151-PD-1, EB150-PD-1, W09TD-PD-1, W09S1-PD-1, PZ4D-PD-1, and W151-PD-1 were analyzed for anions, Nitrate and Nitrite, in accordance with EPA SW-846 Method 9056A. The samples were analyzed on 08/02/2012, 08/03/2012, 08/08/2012, 08/09/2012 and 08/10/2012.

No difficulties were encountered during the anions analyses. All quality control parameters were within the acceptance limits.

TOTAL ORGANIC CARBON
Samples PZ5S-PD-1, WO4T-PD-1, WO4D-PD-1, PZ6D-PD-1, PZ-4S-PD-1, W09S1-PD-1, PZ-4D-PD-1, W09TD-PD-1, W150-PD-1, EB150-PD-1, PZ-5D-PD-1, PZ2D-PD-1, PZ2S-PD-1, PZ7S-PD-1, PZ-6S-PD-1, and W151-PD-1 were analyzed for total organic carbon in accordance with EPA SW-846 Method 9060A. The samples were analyzed on 08/09/2012, 08/16/2012 and 08/22/2012.

No difficulties were encountered during the TOC analyses. All quality control parameters were within the acceptance limits.

DISSOLVED ORGANIC
Samples PZ-4S-PD-1, PZ-6S-PD-1, W09TD-PD-1, W150-PD-1, W09S1-PD-1, PZ-4D-PD-1, EB150-PD-1, PZ-5D-PD-1, PZ5S-PD-1, WO4T-PD-1, WO4D-PD-1, PZ6D-PD-1, PZ2D-PD-1, PZ2S-PD-1, and PZ7S-PD-1 were analyzed for Dissolved Organic Carbon in accordance with 9060. The samples were analyzed on 08/10/2012 and 08/17/2012.

No difficulties were encountered during the DOC analyses. All quality control parameters were within the acceptance limits.

December 11, 2012

Terrence Connelly
Remedial Project Manager
US Environmental Protection Agency – Region 1
5 Post Office Square, Suite 100
Boston, MA 02109-3912

Re: SDG 200-12007-1
TestAmerica Laboratories, Inc.
Burgess Brothers Superfund Site
Pre-Design Investigation
Tier I Inorganics, TOC/DOC Data Validation – Aqueous Samples

Cations:	PZ-4S-PD-1, W09S1-PD-1, PZ-4D-PD-1, EB150-PD-1, PZ-5D-PD-1, PZ-6S-PD-1, W151-PD-1, W09TD-PD-1, W150-PD-1, WO4D-PD1, PZ5S-PD-1, WO4T-PD-1, PZ6D-PD-1, PZ2D-PD-1, and PZ2S-PD-1
Dissolved Cations:	PZ-5D-PD-1, PZ2S-PD-1, PZ7S-PD-1, WO4T-PD-1, PZ6D-PD-1
Metals ICP/MS:	WO4T-PD-1
Hex Chrome:	W04D-PD-1, W04T-PD-1 and P19-PD-1, W09S1-PD-1, W09TD-PD-1, PZ04D-PD-1, W150-PD-1, PZ45-PD-1
Anions and Ortho-P:	PZ-5D-PD-1, PZ-4S-PD-1, PZ-6S-PD-1, PZ-2D-PD-1, PZ-5S-PD-1, WO4T-PD-1, WO4D-PD-1, PZ-2S-PD-1, W06D-PD-1, W150-PD-1, W151-PD-1, EB150-PD-1, W09TD-PD-1, W09S1-PD-1, PZ4D-PD-1, PZ7S-PD-1, W03-PD-1, W25S1-PD-1, W152-PD-1
TDS	PZ-4S-PD-1, W09S1-PD-1, PZ-4D-PD-1, W09TD-PD-1, W150-PD-1, PZ-5D-PD-1, PZ5S-PD-1, WO4T-PD-1,WO4D-PD-1, PZ6D-PD-1, PZ-6S-PD-1, PZ2D-PD-1, PZ2S-PD-1, PZ7S-PD-1
TOC/DOC:	PZ5S-PD-1, WO4T-PD-1, WO4D-PD-1, PZ6D-PD-1, PZ-4S-PD-1, W09S1-PD-1, PZ-4D-PD-1, W09TD-PD-1, W150-PD-1, PZ-5D-PD-1, PZ2D-PD-1, PZ2S-PD-1, PZ7S-PD-1, PZ-6S-PD-1
Alkalinity:	W150-PD-1, W151-PD-1, W09TD-PD-1, W09S1-PD-1, PZ4D-PD-1, PZ7S-PD-1, W03-PD-1, W25S1-PD-1, W152-PD-1, PZ-2D-PD-1, PZ-5S-PD-1, WO4T-PD-1, WO4D-PD-1, PZ-2S-PD-1, W06D-PD-1, PZ-5D-PD-1, PZ-4S-PD-1, PZ-6S-PD-1

1 / Aqueous Equipment Blank / EB150-PD-1

1 / Aqueous PES / W151-PD-1

Dear Mr. Connelly:

A Tier I data validation, in accordance with Region I, EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses, December 1996 criteria, and criteria required under the Pre-Design Investigation (PDI) Quality Assurance Project Plan (QAPP), dated July 2012, was performed on the inorganic, TOC and DOC analytical data for the above listed aqueous samples, 1 aqueous equipment blank, and 1 aqueous PES collected by Environmental Partners Group, Inc. from the Burgess Brothers Superfund Site. These inorganic aqueous samples and PES were analyzed for the following parameters:

- Priority Pollutant 13 Metals EPA SW-846 Methods 6020A, 7470, and 7196A
- Hexavalent Chromium Method 7196A
- Anions EPA SW-846 Method 9056A
- Orthophosphate Method 365.4
- Cations EPA SW-846 Method 6010C
- Alkalinity SM 2320B
- Total Dissolved Solids SM 2540C
- Total Organic Carbon/Dissolved Organic Carbon EPA SW-846 Method 9060A

In accordance with the PDI QAPP, Tier I Data Validation was deemed sufficient for the groundwater samples at this time, except for Priority Pollutant 13 Metals and hexavalent chromium, for which a Tier II data validation is also performed. The sample for alkalinity from piezometer PZ6D-PD-W1 was mislabeled in the field as W06D-PD-W1.

A summary of the laboratory analytical results for this SDG, including method reporting limits and dilution factors, is attached as Table 1.

A Tier I data validation is based on the following parameters:

- Complete Sample Delivery Group Files (CFS) Completeness Evidence Audit
- Evaluation of Performance Evaluation Sample (PES) Results

A CFS Completeness Evidence Audit was performed for this Sample Delivery Group (SDG) 200-12007-1 aqueous data. All criteria were met for this parameter. The attached Lab Report Table of Contents and Narrative provide the completeness information for this SDG.

The PES results were evaluated for this SDG aqueous data and are summarized in Table 2. All criteria were not met. The laboratory quantitation for cadmium, selenium and orthophosphate was outside the lower limit of the vendor's documented acceptance limits; this is less than one-half of the PES analytes. If a Tier II or Tier IIII validation were performed, the following actions would be applied to the data:

- Estimate (J) the compound when detected in any compound to indicate potential low bias
- Reject (R) the quantitation limit in all samples to indicate that the data are unusable due to the possibility of false negatives

A XI Accuracy Check (PE Results) Form is also attached. Selenium and silver are not contaminants of concern in groundwater at the Site. The PES for orthophosphate required a 5 times dilution prior to analysis. The orthophosphate laboratory QC parameters were within acceptable limits. Orthophosphate is one of several parameters used to evaluate potential passivation effects associated with a zero-valent iron (ZVI) remedy. Additional data validation should be performed for the orthophosphate data if a ZVI remedy is selected.

Environmental Partners recommends that the inorganics aqueous data in this SDG be accepted and that no further data validation be performed. Please contact Ann Marie Petricca at (617) 657-0299 should you have any questions or comments regarding this report.

Sincerely,

Ann Marie Petricca

Ann Marie Petricca, CPG
Data Validator

Attachments:
1. Data Summary Table
2. Accuracy Check/PES Score Report
3. Completeness Evidence Audit

cc: Geoffrey Seibel, *de maximis, inc.*

Table 1: Groundwater Analytical Data
Test America SDG 200-12007-1
Inorganic Analyses
Burgess Brothers Superufund Site, Woodford and Bennington, VT

Analyte	Units	Reports To	Basis	200-12167-2 PZ2S-PD-1 8/7/2012	200-12167-1 PZ2D-PD-1 8/6/2012	200-12100-1 PZ-4S-PD-1 8/2/2012	200-12082-3 PZ-4D-PD-1 8/1/2012	200-12174-2 PZ5S-PD-1 8/6/2012	200-12082-7 PZ-5D-PD-1 8/2/2012	200-12100-3 PZ-6S-PD-1 8/2/2012	200-12174-7 PZ6D-PD-1 8/7/2012	200-12167-3 PZ7S-PD-1 8/8/2012	200-12161-2 W-03-PD-1 8/8/2012
Total Dissolved Solids	mg/L	MRL	Total	298	343	492	428	108	150	124	94	104	
Orthophosphate	mg/L	MRL	Total	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Total Organic Carbon	mg/L	MRL	Total	7	1.4	8.8	2.8	1.8	4.3	1.0 U	1.3	1.9	
TOC Result 1	mg/L	MRL	Total	7.3	1.3	8.8	2.8	1.8	4.3	1.0 U	1.8	2.2	
TOC Result 2	mg/L	MRL	Total	6.9	1.4	8.9	2.7	1.8	4.3	1.0 U	1.2	1.8	
TOC Result 3	mg/L	MRL	Total	6.9	1.3	8.8	2.8	1.8	4.4	1.0 U	1.1	1.7	
TOC Result 4	mg/L	MRL	Total	6.9	1.4	8.8	2.7	1.8	4.3	1.0 U	1.1	1.7	
Dissolved Organic Carbon	mg/L	MRL	Dissolved	8.3	1.6	8.9	4.9	9.7	4.3	13.2	1.2	1.6	
DOC Result 1	mg/L	MRL	Dissolved	8.4	1.8	9	4.9	9.7	4.2	12.8	1.6	1.6	
DOC Result 2	mg/L	MRL	Dissolved	8.3	1.6	8.9	4.9	9.5	4.2	15.5	1.1	1.6	
DOC Result 3	mg/L	MRL	Dissolved	8.3	1.5	8.9	5	9.7	4.4	12.2	1.1	1.5	
DOC Result 4	mg/L	MRL	Dissolved	8.2	1.5	8.9	4.8	9.8	4.3	12.4	1	1.5	
Chloride	mg/L	MRL	Total	7.9	4.9 J	18.4	14	5.0 U	2.5 J	1.0 J	2.9 J	1.1 J	10.9
Nitrite as N	mg/L	MRL	Total	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Nitrate as N	mg/L	MRL	Total	0.25 U	0.25 U	0.25 U	0.25 U	0.093 J	0.25 U	0.25 U	0.088 J	0.078 J	0.25 U
Sulfate	mg/L	MRL	Total	6.8	9	16.9	11.4	5	5.2	4.5 J	5.2	6.8	6.9
Alkalinity	mg/L	MRL	Total	206	344	400	373	85	110	90.2	80.3	98.4	475
Calcium	ug/L	MRL	Total	37600	78400	86700	97400	28500	29900	26600	21300		
Iron	ug/L	MRL	Total	3930	221	2350	200 U	197 J	103 J	2090	279		
Magnesium	ug/L	MRL	Total	14500	47600	42700	45500	8760	8480	8370	7910		
Manganese	ug/L	MRL	Total	6850	117	1300	1290	242	550	856	125		
Potassium	ug/L	MRL	Total	32200	2870 J	8100	5340	664 J	727 J	897 J	1100 J		
Silicon	ug/L	MRL	Total	5290	6970	7010 B	7250 B	2440	2360 B	3100 B	3370		
Calcium	ug/L	MRL	Dissolved	39900					31300		21900	25800	
Iron	ug/L	MRL	Dissolved	3430					200 U		200 U	547	
Magnesium	ug/L	MRL	Dissolved	15300					8580		8000	6120	
Manganese	ug/L	MRL	Dissolved	7420					592		129	986	
Potassium	ug/L	MRL	Dissolved	33800					778 J		1180 J	672 J	
Silicon	ug/L	MRL	Dissolved	6140					2110 B		2930	2600	
Arsenic	ug/L	MRL	Total			1.1 J B	0.81 J B						
Antimony	ug/L	MRL	Total			0.33 J B	0.30 J B						
Beryllium	ug/L	MRL	Total			2.0 U	2.0 U						
Cadmium	ug/L	MRL	Total			0.11 J B	0.15 J B						
Chromium	ug/L	MRL	Total			4.0 U	0.26 J						
Copper	ug/L	MRL	Total			0.97 J B	1.2 J B						
Lead	ug/L	MRL	Total			0.28 J B	0.32 J B						
Mercury	ug/L	MRL	Total			0.20 U	0.20 U						
Nickel	ug/L	MRL	Total			52.2	19.9 J						
Silver	ug/L	MRL	Total			2.0 U	2.0 U						
Selenium	ug/L	MRL	Total			2.0 U	2.0 U						
Thallium	ug/L	MRL	Total			0.30 J B	0.31 J B						
Zinc	ug/L	MRL	Total			2.6 J B	1.9 J B						
Chromium (hexavalent)	mg/L	MRL	Total			0.0050 U							
Antimony	ug/L	MRL	Dissolved										
Arsenic	ug/L	MRL	Dissolved										
Beryllium	ug/L	MRL	Dissolved										
Cadmium	ug/L	MRL	Dissolved										
Chromium	ug/L	MRL	Dissolved										
Copper	ug/L	MRL	Dissolved										
Lead	ug/L	MRL	Dissolved										
Nickel	ug/L	MRL	Dissolved										
Selenium	ug/L	MRL	Dissolved										
Silver	ug/L	MRL	Dissolved										
Thallium	ug/L	MRL	Dissolved										
Zinc	ug/L	MRL	Dissolved										
Dilution Factor				1/5*	1/5*	1/5*	1/5*	1/5*	1/5*	1/5*	1/5*	1/5*	1/5*

Notes:
All values reported in micrograms per liter (ug/l)
B=Compound was found in the Blank and the Sample.
U=Not detected above the reporting limit
J=Estimated value.
1/5* Dilution factor is 1.0 except for chloride, nitrate, nitrite, and sulfate

Table 1: Groundwater Analytical Data
Test America SDG 200-12007-1
Inorganic Analyses
Burgess Brothers Superufund Site, Woodford and Benning

Analyte	Units	Reports To	Basis	200-12174-6 WO4D-PD-1 8/7/2012	200-12174-5 WO4T-PD-1 8/7/2012	200-12082-2 W09S1-PD-1 8/1/2012	200-12100-5 W09TD-PD-1 8/2/2012	200-12100-6 W150-PD-1 8/1-2/2012	200-12161-3 W2SS1-PD-1 8/8/2012	200-12174-3 P19-PD-1 8/6/2012	200-12082-6 EB150-PD-1 8/1/2012	200-12100-4 W151-PD-1 8/2/2012	200-12161-4 W152-PD-1 8/8/2012
Total Dissolved Solids	mg/L	MRL	Total	442	452	89	52	235			7	559	
Orthophosphate	mg/L	MRL	Total	0.26	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	2.1	0.10 U
Total Organic Carbon	mg/L	MRL	Total	8.6	3.2	1.5	1.6	1.2			1.0 U	6.4	
TOC Result 1	mg/L	MRL	Total	9.1	3.2	2	2.1	1.4			1.0 U	6.6	
TOC Result 2	mg/L	MRL	Total	8.4	3.1	1.5	1.5	1.1			1.0 U	6.5	
TOC Result 3	mg/L	MRL	Total	8.3	3.1	1.3	1.4	1.1			1.0 U	6.4	
TOC Result 4	mg/L	MRL	Total	8.4	3.2	1.3	1.4	1.1			1.0 U	6.3	
Dissolved Organic Carbon	mg/L	MRL	Dissolved	10.2	3.5	12.9	3.5	1.7			1.0 U		
DOC Result 1	mg/L	MRL	Dissolved	10.1	3.6	12.3	3.6	1.9			1.4		
DOC Result 2	mg/L	MRL	Dissolved	10.5	3.4	13.1	3.5	1.7			1.0 U		
DOC Result 3	mg/L	MRL	Dissolved	10.3	3.6	13.2	3.3	1.7			1.0 U		
DOC Result 4	mg/L	MRL	Dissolved	10.1	3.6	13.2	3.4	1.6			1.0 U		
Chloride	mg/L	MRL	Total	17.7	19.5	3.1 J	3.4 J	3.3 J	1.8 J		5.0 U	71.2	1.7 J
Nitrite as N	mg/L	MRL	Total	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U		0.25 U	0.25 U	0.25 U
Nitrate as N	mg/L	MRL	Total	1.7	0.25 U	0.58	0.8	0.81	2.1		0.25 U	7.6	2.1
Sulfate	mg/L	MRL	Total	5.0 U	4.6 J	9	16.4	16.1	35.6		5.0 U	115	35.5
Alkalinity	mg/L	MRL	Total	338	402	60.3	176	174	81.8		5.0 U	88.2	82.8
Calcium	ug/L	MRL	Total	113000	108000	18600	43000	42100			5000 U	5000 U	
Iron	ug/L	MRL	Total	1360	2510	125 J	200 U	200 U			200 U	782	
Magnesium	ug/L	MRL	Total	18100	41700	6840	27800	27100			5000 U	5000 U	
Manganese	ug/L	MRL	Total	1600	995	20.8	4.6 J	15.0 U			15.0 U	530	
Potassium	ug/L	MRL	Total	34500	16100	547 J	997 J	993 J			5000 U	5000 U	
Silicon	ug/L	MRL	Total	2140	7490	2740 B	4490 B	4380 B			36.1 J B	61.9 J B	
Calcium	ug/L	MRL	Dissolved		101000								
Iron	ug/L	MRL	Dissolved		1830								
Magnesium	ug/L	MRL	Dissolved		42700								
Manganese	ug/L	MRL	Dissolved		908								
Potassium	ug/L	MRL	Dissolved		13800								
Silicon	ug/L	MRL	Dissolved		3390								
Arsenic	ug/L	MRL	Total	0.56 J	1.9 J	0.60 J B	2.0 U	0.41 J B		1.8 J	0.18 J B	2.0 U	
Antimony	ug/L	MRL	Total	0.16 J	20.0 U	0.35 J B	0.27 J B	0.26 J B		20.0 U	0.25 J B	0.25 J B	
Beryllium	ug/L	MRL	Total	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U		2.0 U	2.0 U	2.0 U	
Cadmium	ug/L	MRL	Total	0.086 J	0.070 J	0.18 J B	0.12 J B	0.11 J B		0.082 J	0.13 J B	0.091 J B	
Chromium	ug/L	MRL	Total	4.0 U	0.20 J	0.69 J	0.53 J	4.0 U		0.31 J	0.19 J	4.0 U	
Copper	ug/L	MRL	Total	3.0 J	0.92 J	2.4 J B	0.68 J B	0.67 J B		0.89 J	0.82 J B	0.79 J B	
Lead	ug/L	MRL	Total	0.43 J B	0.65 J B	0.38 J B	0.23 J B	0.22 J B		0.63 J B	0.21 J B	0.24 J B	
Mercury	ug/L	MRL	Total	0.20 U	0.18 J B	0.20 U	0.20 U	0.20 U		0.20 U	0.20 U	0.20 U	
Nickel	ug/L	MRL	Total	119	33.1	2.0 J	20.0 U	20.0 U		20.0 U	20.0 U	20.0 U	
Silver	ug/L	MRL	Total	0.82 J B	0.11 J B	0.16 J	2.0 U	2.0 U		0.072 J B	2.0 U	2.0 U	
Selenium	ug/L	MRL	Total	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U		2.0 U	2.0 U	2.0 U	
Thallium	ug/L	MRL	Total	0.28 J B	0.18 J B	0.23 J B	0.20 J B	0.21 J B		0.18 J B	0.20 J B	0.20 J B	
Zinc	ug/L	MRL	Total	8.9 J	0.73 J	16.3 J B	1.8 J B	1.3 J B		3.5 J	1.4 J B	0.96 J B	
Chromium (hexavalent)	mg/L	MRL	Total	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U		0.0050 U	0.0050 U	0.021	
Antimony	ug/L	MRL	Dissolved		20.0 U								
Arsenic	ug/L	MRL	Dissolved		1.7 J								
Beryllium	ug/L	MRL	Dissolved		2.0 U								
Cadmium	ug/L	MRL	Dissolved		0.054 J								
Chromium	ug/L	MRL	Dissolved		4.0 U								
Copper	ug/L	MRL	Dissolved		0.35 J								
Lead	ug/L	MRL	Dissolved		0.14 J B								
Nickel	ug/L	MRL	Dissolved		31.6								
Selenium	ug/L	MRL	Dissolved		2.0 U								
Silver	ug/L	MRL	Dissolved		0.067 J B								
Thallium	ug/L	MRL	Dissolved		0.16 J B								
Zinc	ug/L	MRL	Dissolved		20.0 U								
Dilution Factor				1/5*	1/5*	1/5*	1/5*	1/5*	1/5*	1/5*	1/5*	1/5*	1/5*

Notes:
All values reported in micrograms per liter (ug/l)
B=Compound was found in the Blank and the Sample.
U=Not detected above the reporting limit
J=Estimated value.
1/5* Dilution factor is 1.0 except for chloride, nitrate, nitrite, and

Table 2: Summary of Performance Evaluation Sample (PES) Results

Pre-Design Investigation
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont
Groundwater Sampling SDG: 200-12007-1

Parameter	W-151-PD-W1 TA Analysis Method	Certified Value	QC Performance Acceptance Limits
Aqueous (ug/L)		*ID No. 0703-12-05.2 Lot No. S187-697*	
Antimony	36.4	38.7	35.9-43.0
Arsenic	24.7	28.0	24.9-32.3
Beryllium	14.7	16.0	14.7-17.1
Cadmium	12.1	13.6	12.4-14.3
Chromium	180 B	188	175-201
Copper	1510	1540	1410-1630
Lead	32.2	32.4	28.8-36.0
Nickel	251	264	242-282
Selenium	59 *	75.2	67.0-83.4
Silver	55.4	58.3	52.4-63.8
Thallium	8.9	8.72	7.92-9.45
Zinc	780	793	738-864
Mercury	0.2 U		
		ID No. 0703-12-05.3/10 Lot No. S189-658	
Chromium (hexavalent)	0.021	0.019	0.0167 - 0.0208
		Catalog No. 092 Custom Standard Lot No. 0703-12-05.4	
Calcium	32300	32000	28800 - 34800
Iron	279	254	223 - 284
Magnesium	9890	9960	895 - 11000
Manganese	836	876	799 - 958
Potassium	15100	15000	13000 - 16900
Silicon **	9140 B	9445	8182 - 10473
Aqueous (mg/L)		*Lot No. 0703-12-05.5 Lot No. S189-698*	
Total Dissolved Solids	559	560	497 - 586
Nitrate as N	7.6	7.89	6.99 - 8.19
Nitrite as N	0.25 U		
Chloride	71.2	75.6	68.7 - 78.4
Sulfate	115	124	109 - 130
Alkalinity	88.2	91.5	84.5 - 96.9
		ID No. 0703-12-05.6 Lot No. S184-667	
Orthophosphate	2.1	3.90	3.42 - 4.38
		ID No. 0703-12-05.8 Lot No. S187-669	
TOC Result 1	6.6	6.26	5.56 - 7.08
TOC Result 2	6.5	6.26	5.56 - 7.08
TOC Result 3	6.4	6.26	5.56 - 7.08
TOC Result 4	6.3	6.26	5.56 - 7.08
Total Organic Carbon	6.4	6.26	5.56 - 7.08

Notes

** Lab analysis is for silicon. PES reports results as silica. Silica PES values converted to silicon (silica/2.13879 = silicon)

TA = Test America in South Burlington, VT

The QC Performance Acceptance Limits (QC PALs) based on actual historical dta collected in ERA's Prificiency Testing program. QC PALs reflect any inherent biases in the methods used to establish the limits and closely approximate a 95% confidence interval of the performance that experienced laboratories should achieve using accepted environmental methods.

XI. ACCURACY CHECK (Performance Evaluation Results)

SDG No.: 200-12007-1

Are more than one-half of the PES analytes within criteria for each parameter. Y N

PE Sample No./ ERA ID No,	Lot No.	Parameter	Type of PES	Matrix	Analyte	W-151-PD-W1 TA Analysis (mg/l)	Non-EPA PES Scores**	Samples Affected	Action
W-151-PD-W1/ ID No. 0703-12-05.6	S184667	Orthophosphate	Inoranic	Aq.	Orthophosphate	2.1	Action Low 3.9 (3.42-4.38)	PZ-5D-PD-1, PZ-4S-PD-1, PZ-6S-PD-1, PZ-2D-PD-1, PZ-5S-PD-1, WO4T-PD-1, WO4D-PD-1, PZ-2S-PD-1, W06D-PD-1, W150-PD-1, W151-PD-1, EB150-PD-1, W09TD-PD-1, W09S1-PD-1, PZ4D-PD-1, PZ7S-PD-1, W03-PD-1, W25S1-PD-1, W152-PD-1	R, J
W-151-PD-W1/ ID No. 0703-12-05.4	Catalog No. 092	Cations	Inoranic	Aq.	Cadmium	2.1	Action Low 3.9 (3.42-4.38)	PZ-4S-PD-1, W09S1-PD-1, PZ-4D-PD-1, EB150-PD-1, PZ-5D-PD-1, PZ-6S-PD-1, W151-PD-1, W09TD-PD-1, W150-PD-1, WO4D-PD1, PZ5S-PD-1, WO4T-PD-1, PZ6D-PD-1, PZ2D-PD-1, PZ2S-PD-1, PZ7S-PD-1	R, J
W-151-PD-W1/ ID No. 0703-12-05.4	Catalog No. 092	Cations	Inoranic	Aq.	Selenium	59	Action Low 75.2 (67.0-83.4)	PZ-4S-PD-1, W09S1-PD-1, PZ-4D-PD-1, EB150-PD-1, PZ-5D-PD-1, PZ-6S-PD-1, W151-PD-1, W09TD-PD-1, W150-PD-1, WO4D-PD1, PZ5S-PD-1, WO4T-PD-1, PZ6D-PD-1, PZ2D-PD-1, PZ2S-PD-1, PZ7S-PD-1	R, J

* For Region I PESs indicate the Region I PES Score Report Result: Action High; Action Low; TCL MISS; TCL CONTAMINANT; TIC HIT; TIC MISS; TIC CONTAMINANT

** For Non-EPA PESs indicate the Non-EPA PES Score: PES Compound MISS; PES Compound CONTAMINANT; PES Compound HIT (Range)

TIC Tentatively Identifiable Compound

Validator: Ann Marie Petrucci

Date: 12/11/2012

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 200-12007-1

SDG Number: 200-12007

Job Description: Burgess Brother's Sanitary Landfill

For:
Environmental Partners Group
1900 Crown Colony Drive
Suite 402
Quincy, MA 02169

Attention: Ms. Ann Marie Petricca

Sara Goff

Approved for release.
Sara S Goff
Project Manager I
8/31/2012 12:41 PM

Sara S Goff
Project Manager I
sara.goff@testamericainc.com
08/31/2012

The test results in this report relate only to sample(s) as received by the laboratory. These test results were derived under a quality system that adheres to the requirements of NELAC. Pursuant to NELAC, this report may not be produced in full without written approval from the laboratory

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CASE NARRATIVE

Client: Environmental Partners Group

Project: Burgess Brother's Sanitary Landfill

Report Number: 200-12007-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT

The samples were received on 08/01/2012, 08/02/2012, 08/02/2012, 08/03/2012, 08/03/2012, 08/03/2012, 08/04/2012, 08/07/2012, 08/08/2012, 08/08/2012, 08/08/2012, 08/09/2012, 08/09/2012 and 08/09/2012; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 0.2° C, 0.4° C, 1.0° C, 1.0° C, 1.2° C, 1.6° C, 2.0° C, 2.2° C, 2.9° C, 3.6° C, 3.8° C and 5.6° C.

Several samples had a range of sample collection times noted on each container. Times of collection from the Chain of Custody used for sample login.

The following samples were received unpreserved and were preserved upon receipt to the laboratory: W09TD-PD-1 and W150-PD-1. Laboratory waited 24-hour from the time of preservation with Nitric acid to the time of digestion. The following samples were received unpreserved and were preserved upon receipt to the laboratory: W151-PD-1. The sample was preserved with Sulfuric Acid. The following sample appears to have been collected in containers that are not readily traceable as certified containers: W151-PD-1. Containers were not provided by the laboratory.

The cooler received on August 8th was received without any tape or custody seals sealing the cooler. Per client request analysis of the samples proceeded.

VOLATILE ORGANIC COMPOUNDS (GC-MS)

Samples W09S1-PD-1, PZ-4D-PD-1, EB150-PD-1, PZ-5D-PD-1, PZ-4S-PD-1, PZ-6S-PD-1, W151-PD-1, W09TD-PD-1, W150-PD-1, TB-160-PD-1, PZ5S-PD-1, TB-161-PD1, WO4T-PD-1, WO4D-PD-1, and PZ6D-PD-1 were analyzed for volatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8260B. The samples were analyzed on 08/11/2012, 08/12/2012, 08/13/2012, 08/14/2012, 08/18/2012 and 08/20/2012.

Methylene Chloride was detected in method blank MB 200-43370/5 at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Methylene Chloride was detected in method blank MB 200-43371/5 at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Methyl iodide and Methylene Chloride were detected in method blank MB 200-43436/5 at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Methylene Chloride was detected in method blank MB 200-43538/5 at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Methylene Chloride was detected in method blank MB 200-43677/4 at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Methylene Chloride was detected in method blank MB 200-43772/5 at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

Sample TB-160-PD-1 was reported with cis-1,2-Dichloroethene, Trichloroethene, and Tetrachloroethene over the reporting limit. Previous sample in sequence had these analytes over the calibration range. Reanalysis was not possible for sample TB-160-PD-1 because only one sample volume was provided for analysis.

The initial calibration curve was outside acceptance criteria for Methyl iodide. The continuing calibration verification (CCV) for analytical batch 43370 exceeded control criteria for Vinyl acetate and 1,4-Dioxane. The continuing calibration verification (CCV) for analytical batch 43371 exceeded control criteria for Bromomethane and Vinyl acetate. The continuing calibration verification (CCV) for analytical batch

43436 exceeded control criteria for Methyl iodide, Vinyl acetate, 1,4-Dioxane, and Isobutyl alcohol. The continuing calibration verification (CCV) for analytical batch 43538 exceeded control criteria for Vinyl acetate. The continuing calibration verification (CCV) for 1,4-Dioxane associated with batch 43677 recovered above the upper control limit. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported.

Carbon disulfide failed the recovery criteria low for laboratory control sample 200-43677/2. Acrolein failed the recovery criteria low for laboratory control sample 200-43772/3. Vinyl acetate failed the recovery criteria high. Refer to the QC report for details.

2-Chloroethyl vinyl ether failed the recovery criteria low for the matrix spike and matrix spike duplicate of sample W09TD-PD-1 in batch 200-43370. Refer to the QC report for details.

Samples PZ-4S-PD-1[44X], W09S1-PD-1[3X], PZ-4D-PD-1[37X], W151-PD-1[2X], W09TD-PD-1[11X], WO4T-PD-1[169X], WO4D-PD-1[169X], W150-PD-1[9X], PZ-5D-PD-1[2X] and PZ6D-PD-1[2X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No other difficulties were encountered during the volatiles analyses. All other quality control parameters were within the acceptance limits.

DISSOLVED CATIONS (ICP)

Samples PZ-5D-PD-1, PZ2S-PD-1, PZ7S-PD-1, WO4T-PD-1, and PZ6D-PD-1 were analyzed for dissolved cations in accordance with EPA SW-846 Method 6010C. The samples were prepared on 08/08/2012 and 08/16/2012 and analyzed on 08/16/2012 and 08/18/2012.

Calcium failed the recovery criteria low for the matrix spike of sample PZ7S-PD-1 in batch 200-43682. The associated laboratory control sample (LCS) recovery met acceptance criteria. Refer to the QC report for details.

No other difficulties were encountered during the metals analyses. All other quality control parameters were within the acceptance limits.

CATIONS (ICP)

Samples PZ-4S-PD-1, W09S1-PD-1, PZ-4D-PD-1, EB150-PD-1, PZ-5D-PD-1, PZ-6S-PD-1, W151-PD-1, W09TD-PD-1, W150-PD-1, WO4D-PD1, PZ5S-PD-1, WO4T-PD-1, PZ6D-PD-1, PZ2D-PD-1, and PZ2S-PD-1were analyzed for Cations in accordance with EPA SW-846 Method 6010C. The samples were prepared on 08/08/2012 and 08/16/2012 and analyzed on 08/16/2012 and 08/18/2012.

Silicon was detected in method blank MB 200-43114/1-A at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

No other difficulties were encountered during the metals analyses. All other quality control parameters were within the acceptance limits.

METALS (ICPMS)

Sample WO4T-PD-1 was analyzed for metals (ICPMS) in accordance with EPA SW-846 Method 6020A. The samples were prepared on 08/17/2012 and analyzed on 08/18/2012.

No difficulties were encountered during the metals analysis. All quality control parameters were within the acceptance limits.

METALS (ICPMS)

Samples W151-PD-1, PZ-4S-PD-1, W09S1-PD-1, PZ-4D-PD-1, W09TD-PD-1, W150-PD-1, EB150-PD-1, WO4D-PD1, P19-PD-1, and WO4T-PD-1 were analyzed for metals (ICPMS) in accordance with EPA SW-846 Method 6020A. The samples were prepared on 08/08/2012 and 08/17/2012 and analyzed on 08/14/2012, 08/16/2012 and 08/18/2012.

Several analytes were detected in method blank MB 200-43117/1-A at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Lead, Silver and Thallium were detected in method blank MB 200-43613/1-A at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

The serial dilution performed for the following sample associated with batch 43739 was outside control limits for Silver. The post digestion spike percent recovery for sample W04D-PD1 associated with batch 43739 was outside of control limits for Selenium.

No other difficulties were encountered during the metals analyses. All other quality control parameters were within the acceptance limits.

HEXAVALENT CHROMIUM

Samples W04D-PD-1, W04T-PD-1 and P19-PD-1, W09S1-PD-1, W09TD-PD-1, PZ04D-PD-1, W150-PD-1, PZ45-PD-1, EB150-PD-1, and W151-PD-1 were analyzed for hexavalent chromium in accordance with EPA SW-846 Method 7196A. The samples were analyzed on 08/01/2012, 08/02/2012 and 08/07/2012.

The matrix spike and matrix spike duplicate analysis of sample W09TD-PD-1 was performed outside of analytical holding time.

No difficulties were encountered during the hexavalent chromium analyses. All quality control parameters were within the acceptance

limits.

TOTAL MERCURY
Samples PZ-4S-PD-1, W09S1-PD-1, PZ-4D-PD-1, W150-PD-1 and EB150-PD-1, WO4D-PD1, P19-PD-1 and WO4T-PD-1, W151-PD-1, and W09TD-PD-1 were analyzed for total mercury in accordance with EPA SW-846 Methods 7470A. The samples were prepared on 08/21/2012 and analyzed on 08/22/2012.

Mercury was detected in method blank MB 200-43761/11-A at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

No other difficulties were encountered during the mercury analyses. All other quality control parameters were within the acceptance limits.

ALKALINITY
Samples W150-PD-1, W151-PD-1, EB150-PD-1, W09TD-PD-1, W09S1-PD-1, PZ4D-PD-1, W151-PD-1, PZ7S-PD-1, W03-PD-1, W25S1-PD-1, W152-PD-1, PZ-2D-PD-1, PZ-5S-PD-1, WO4T-PD-1, WO4D-PD-1, PZ-2S-PD-1, W06D-PD-1, PZ-5D-PD-1, PZ-4S-PD-1, and PZ-6S-PD-1 were analyzed for alkalinity in accordance with SM20 2320B. The samples were analyzed on 08/08/2012, 08/09/2012 and 08/13/2012.

The duplicate analysis of sample W09TD-PD-1 was performed outside of analytical holding time.

No difficulties were encountered during the alkalinity analyses. All quality control parameters were within the acceptance limits.

TOTAL DISSOLVED SOLIDS
Samples PZ-4S-PD-1, W09S1-PD-1, PZ-4D-PD-1, W09TD-PD-1, W150-PD-1, EB150-PD-1, PZ-5D-PD-1, PZ5S-PD-1, WO4T-PD-1, WO4D-PD-1, PZ6D-PD-1, PZ-6S-PD-1, W151-PD-1, PZ2D-PD-1, PZ2S-PD-1, and PZ7S-PD-1 were analyzed for total dissolved solids in accordance with SM20 2540C. The samples were analyzed on 08/06/2012 and 08/10/2012.

No difficulties were encountered during the TDS analyses. All quality control parameters were within the acceptance limits.

ORTHOPHOSPHATE AS P
Samples PZ-5D-PD-1, PZ-6S-PD-1, PZ2S-PD-1, W06D-PD-1, W04D-PD-1, W04T-PD-1, PZ2D-PD-1, PZ5S-PD-1, PZ45-PD-1, EB150-PD-1, W151-PD-1, W09S1-PD-1, W09TD-PD-1, PZ04D-PD-1, W150-PD-1, PZ7S-PD-1, W-03-PD-1, W25S1-PD-1, and W152-PD-1 were analyzed for orthophosphate as P in accordance with SM20 4500 P E. The samples were analyzed on 08/01/2012, 08/02/2012, 08/03/2012, 08/08/2012 and 08/10/2012.

Sample W151-PD-1[5X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No difficulties were encountered during the orthophosphate analyses. All quality control parameters were within the acceptance limits.

ANIONS (Chloride and Sulfate)
Samples PZ-5D-PD-1, PZ-4S-PD-1, PZ-6S-PD-1, PZ-2D-PD-1, PZ-5S-PD-1, WO4T-PD-1, WO4D-PD-1, PZ-2S-PD-1, W06D-PD-1, W150-PD-1, W151-PD-1, EB150-PD-1, W09TD-PD-1, W09S1-PD-1, PZ4D-PD-1, W151-PD-1, PZ7S-PD-1, W03-PD-1, W25S1-PD-1, and W152-PD-1 were analyzed for anions, Chloride and Sulfate, in accordance with EPA SW-846 Method 9056. The samples were analyzed on 08/20/2012.

No difficulties were encountered during the anions analyses. All quality control parameters were within the acceptance limits.

ANIONS (Nitrate and Nitrite)
Samples PZ7S-PD-1, W03-PD-1, W25S1-PD-1, W152-PD-1, PZ-5D-PD-1, PZ-4S-PD-1, PZ-6S-PD-1, PZ-2D-PD-1, PZ-5S-PD-1, WO4T-PD-1, WO4D-PD-1, PZ-2S-PD-1, W06D-PD-1, W150-PD-1, W151-PD-1, EB150-PD-1, W09TD-PD-1, W09S1-PD-1, PZ4D-PD-1, and W151-PD-1 were analyzed for anions, Nitrate and Nitrite, in accordance with EPA SW-846 Method 9056A. The samples were analyzed on 08/02/2012, 08/03/2012, 08/08/2012, 08/09/2012 and 08/10/2012.

No difficulties were encountered during the anions analyses. All quality control parameters were within the acceptance limits.

TOTAL ORGANIC CARBON
Samples PZ5S-PD-1, WO4T-PD-1, WO4D-PD-1, PZ6D-PD-1, PZ-4S-PD-1, W09S1-PD-1, PZ-4D-PD-1, W09TD-PD-1, W150-PD-1, EB150-PD-1, PZ-5D-PD-1, PZ2D-PD-1, PZ2S-PD-1, PZ7S-PD-1, PZ-6S-PD-1, and W151-PD-1 were analyzed for total organic carbon in accordance with EPA SW-846 Method 9060A. The samples were analyzed on 08/09/2012, 08/16/2012 and 08/22/2012.

No difficulties were encountered during the TOC analyses. All quality control parameters were within the acceptance limits.

DISSOLVED ORGANIC
Samples PZ-4S-PD-1, PZ-6S-PD-1, W09TD-PD-1, W150-PD-1, W09S1-PD-1, PZ-4D-PD-1, EB150-PD-1, PZ-5D-PD-1, PZ5S-PD-1, WO4T-PD-1, WO4D-PD-1, PZ6D-PD-1, PZ2D-PD-1, PZ2S-PD-1, and PZ7S-PD-1 were analyzed for Dissolved Organic Carbon in accordance with 9060. The samples were analyzed on 08/10/2012 and 08/17/2012.

No difficulties were encountered during the DOC analyses. All quality control parameters were within the acceptance limits.

December 11, 2012

Mr. Terrence Connelly
Remedial Project Manager
US Environmental Protection Agency – Region 1
5 Post Office Square, Suite 100
Boston, MA 02109-3912

Re: SDG 200-12187-1
TestAmerica Laboratories, Inc.
Burgess Brothers Superfund Site
Pre-Design Investigation
Tier I Organics Data Validation – Aqueous Samples

Volatiles: 12 / Aqueous / W-03-PD-1, W152-PD-1, W25S1-PD-1, PZ9S-PD-1, PZ9D-PD-1, P13-PD-1, P14-PD-1, PZ2D-PD-1, PZ2S-PD-1, PZ7S-PD-1, ML2-PD-W2(10-12) and ML2-PD-W3(17-19)

1 / Aqueous Trip Blanks / TB162-PD-1

1 / Aqueous PES / W153-PD-1

Dear Mr. Connelly:

A Tier I data validation, in accordance with Region I, EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses, December 1996 criteria, and criteria required under the Pre-Design Investigation (PDI) Quality Assurance Project Plan (QAPP), dated July 2012, was performed on organic analytical data for 12 Aqueous Samples, 1 Trip Blanks, and 1 Aqueous PES collected by Environmental Partners Group, Inc. from the Burgess Brothers Superfund Site. The volatile aqueous samples, blanks and PESs were analyzed using the EPA SW-846 Method 8260B Volatile Organic Statement of Work. In accordance with the PDI QAPP, Tier I data validation was deemed sufficient for the groundwater samples at this time.

A summary of the laboratory analytical results for this SDG, including method reporting limits and dilution factors, is attached as Table 1.

A Tier I data validation is based on the following parameters:

- Complete Sample Delivery Group Files (CFS) Completeness Evidence Audit
- Evaluation of Performance Evaluation Sample (PES) Results

A CFS Completeness Evidence Audit was performed for this Sample Delivery Group (SDG) 200-12187-1 aqueous data. All criteria were met for this parameter. The attached Lab Report Table of Contents and Narrative provide the completeness information for this SDG.

Page 2

The PES results were evaluated for this SDG aqueous data and are summarized in Table 2. All compounds were within performance acceptance limits. A XI Accuracy Check (PE Results) Form is also attached.

Environmental Partners recommends that the organics aqueous data in this SDG be accepted and that no further data validation be performed. Please contact Ann Marie Petricca at (617) 657-0299 should you have any questions or comments regarding this report.

Sincerely,

Ann Marie Petricca

Ann Marie Petricca, CPG
Data Validator

Attachments:
1. Data Summary Table
2. Accuracy Check/PES Score Report
3. Completeness Evidence Audit

cc: Geoffrey Seibel, *de maximis, inc.*

Table 1: Groundwater Analytical Data
Volatile Organic Compounds SW-846 EPA Method 8260B
Burgess Brothers Superufund Site, Woodford and Bennington, VT
Test America SDG 200-12187-1

Analyte	Units	Reports To	Basis	200-12187-13 ML2-PD-W2(10-12) 8/9/2012 10:15 AM	200-12187-14 ML2-PD-W3(17-19) 8/8/2012 2:20 PM	200-12187-10 PZ2S-PD-1 8/7/2012 11:05 AM	200-12187-9 PZ2D-PD-1 8/6/2012 4:45 PM	200-12187-12 PZ7S-PD-1 8/8/2012 10:30 AM	200-12187-4 PZ9S-PD-1 8/9/2012 11:30 AM	200-12187-5 PZ9D-PD-1 8/9/2012 9:00 AM	200-12187-6 P13-PD-1 8/9/2012 12:00 PM
Naphthalene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Isobutyl alcohol	ug/L	MRL	Total	9200 U	17000 U	22000 U	1800 U	50 U	50 U	50 U	50 U
1,2,4-Trichlorobenzene	ug/L	MRL	Total	58 J	340 U	440 U	37 U	1.0 U	0.32 J	1.0 U	1.0 U
1,3-Dichlorobenzene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Hexachlorobutadiene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromo-3-Chloropropane	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Isopropyltoluene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichlorobenzene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
sec-Butylbenzene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
tert-Butylbenzene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Chlorotoluene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Chlorotoluene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Propylbenzene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,4-Dichloro-2-butene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichloropropane	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Butylbenzene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromobenzene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Dichlorodifluoromethane	ug/L	MRL	Total	180 U	340 U	440 U	28 J	1.0 U	1.0 U	1.0 U	1.0 U
Vinyl chloride	ug/L	MRL	Total	**350**	**430**	400 J	**330**	1.0 U	0.33 J	1.0 U	1.0 U
Freon TF	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane	ug/L	MRL	Total	180 U	340 U	440 U	37 U	0.40 J	1.0 U	1.0 U	0.28 J
Chloroethane	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichlorofluoromethane	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethene	ug/L	MRL	Total	180 U	340 U	440 U	25 J	1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Acrolein	ug/L	MRL	Total	920 U	1700 U	2200 U	180 U	5.0 U	5.0 U	5.0 U	5.0 U
Acetone	ug/L	MRL	Total	920 U	1700 U	2200 U	180 U	5.0 U	**5.3**	3.6 J	5.0 U
Methyl iodide	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon disulfide	ug/L	MRL	Total	180 U *	340 U *	440 U *	37 U *	1.0 U *	1.0 U *	1.0 U *	1.0 U *
Allyl chloride	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene Chloride	ug/L	MRL	Total	94 J B	150 J B	210 J B	16 J B	0.50 J B	0.68 J B	0.38 J B	0.40 J B
Acrylonitrile	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	0.39 J	1.0 U	1.0 U
1,2-Dichloroethene, Total	ug/L	MRL	Total	**2200**	**2600**	**2200**	**1300**	**3.9**	**60**	0.51 J	1.0 U
Methyl t-butyl ether	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Ethyl methacrylate	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
2,2-Dichloropropane	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Vinyl acetate	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Butanone	ug/L	MRL	Total	920 U	1700 U	2200 U	180 U	5.0 U	5.0 U	5.0 U	5.0 U
1,1,1-Trichloroethane	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	ug/L	MRL	Total	**2200**	**2600**	**2200**	**1300**	**3.9**	**60**	0.51 J	1.0 U
Methacrylonitrile	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Propionitrile	ug/L	MRL	Total	730 U	1400 U	1800 U	150 U	4.0 U	4.0 U	4.0 U	4.0 U
Chloroform	ug/L	MRL	Total	180 U	340 U	440 U	37 U	0.68 J	**3.4**	**1.8**	1.0 U
Chloroprene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrahydrofuran	ug/L	MRL	Total	2600 U	4700 U	6200 U	510 U	14 U	14 U	14 U	14 U
1,1-Dichloropropene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon tetrachloride	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Isopropylbenzene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Benzene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	ug/L	MRL	Total	**1600**	**1600**	**2100**	**1200**	**9.5**	**42**	0.23 J	1.0 U
1,2-Dichloropropane	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromomethane	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Methyl methacrylate	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dioxane	ug/L	MRL	Total	9200 U	17000 U	22000 U	1800 U	50 U	50 U	50 U	50 U
Bromochloromethane	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,3-Dichloropropene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	0.28 J	1.0 U	1.0 U
2-Hexanone	ug/L	MRL	Total	920 U	1700 U	2200 U	180 U	5.0 U	5.0 U	5.0 U	5.0 U
4-Methyl-2-pentanone	ug/L	MRL	Total	920 U	1700 U	2200 U	180 U	5.0 U	5.0 U	5.0 U	5.0 U
1,1,2-Trichloroethane	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,3-Dichloropropene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-Dichloropropane	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Chloroethyl vinyl ether	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethene	ug/L	MRL	Total	**12000**	**24000**	**33000**	**3700**	**9.8**	**48**	**1.2**	**1.7**
Dibromochloromethane	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromoethane	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Chlorobenzene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1,2-Tetrachloroethane	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Ethylbenzene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
m&p-Xylene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
o-Xylene	ug/L	MRL	Total	180 U	340 U	440 U	9.7 J	1.0 U	1.0 U	1.0 U	1.0 U
Xylenes, Total	ug/L	MRL	Total	180 U	340 U	440 U	9.7 J	1.0 U	1.0 U	1.0 U	1.0 U
Styrene	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	ug/L	MRL	Total	180 U	340 U	440 U	37 U	1.0 U	1.0 U	1.0 U	1.0 U
Dilution Factor											

Notes:
All values reported in micrograms per liter (ug/l)
B=Compound was found in the Blank and the Sample.
U=Not detected above the reporting limit
J=Estimated value.

Table 1: Groundwater Analytical Data
Volatile Organic Compounds SW-846 EPA Method 8260B
Burgess Brothers Superufund Site, Woodford and Bennington, V
Test America SDG 200-12187-1

							Dup W25S1-PD-1	PE Sample	Trip Blank
Analyte	**Units**	**Reports To**	**Basis**	**200-12187-7 P14-PD-1 8/9/2012 12:20 PM**	**200-12187-1 W-03-PD-1 8/8/2012 11:45 AM**	**200-12187-3 W25S1-PD-1 8/8/2012 4:00 PM**	**200-12187-2 W152-PD-1 8/8/2012 4:00 PM**	**200-12187-8 W153-PD-1 8/9/2012 2:00 PM**	**200-12187-11 TB162-PD-1 8/9/2012 12:00 AM**
Naphthalene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
Isobutyl alcohol	ug/L	MRL	Total	50 U	650 U	50 U	50 U	50 U	50 U
1,2,4-Trichlorobenzene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	**11**	1.0 U
1,3-Dichlorobenzene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
Hexachlorobutadiene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	**18**	1.0 U
1,2-Dibromo-3-Chloropropane	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Isopropyltoluene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichlorobenzene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	**8.6**	1.0 U
sec-Butylbenzene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
tert-Butylbenzene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Chlorotoluene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Chlorotoluene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Propylbenzene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,4-Dichloro-2-butene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichloropropane	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Butylbenzene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromobenzene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
Dichlorodifluoromethane	ug/L	MRL	Total	1.0 U	4.5 J	0.39 J	0.47 J	1.0 U	1.0 U
Vinyl chloride	ug/L	MRL	Total	1.0 U	**210**	**2.2**	**2.1**	**1.6**	1.0 U
Freon TF	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichlorofluoromethane	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethene	ug/L	MRL	Total	1.0 U	**19**	1.0 U	1.0 U	**3.5**	1.0 U
Bromomethane	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
Acrolein	ug/L	MRL	Total	5.0 U	65 U	5.0 U	5.0 U	5.0 U	5.0 U
Acetone	ug/L	MRL	Total	5.0 U	65 U	1.2 J	1.8 J	5.0 U	5.0 U
Methyl iodide	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon disulfide	ug/L	MRL	Total	1.0 U *	13 U *	1.0 U *	1.0 U *	1.0 U *	1.0 U *
Allyl chloride	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene Chloride	ug/L	MRL	Total	0.43 J B	6.3 J B	0.42 J B	0.46 J B	**9.2** B	0.53 J B
Acrylonitrile	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	ug/L	MRL	Total	1.0 U	7.6 J	1.0 U	1.0 U	**27**	1.0 U
1,2-Dichloroethene, Total	ug/L	MRL	Total	1.0 U	**1200**	**8.3**	**8.2**	**54**	1.0 U
Methyl t-butyl ether	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
Ethyl methacrylate	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
2,2-Dichloropropane	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
Vinyl acetate	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Butanone	ug/L	MRL	Total	5.0 U	65 U	5.0 U	5.0 U	5.0 U	5.0 U
1,1,1-Trichloroethane	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	**16**	1.0 U
cis-1,2-Dichloroethene	ug/L	MRL	Total	1.0 U	**1200**	**8.3**	**8.2**	**27**	1.0 U
Methacrylonitrile	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
Propionitrile	ug/L	MRL	Total	4.0 U	52 U	4.0 U	4.0 U	4.0 U	4.0 U
Chloroform	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	0.21 J	1.0 U
Chloroprene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrahydrofuran	ug/L	MRL	Total	14 U	180 U	14 U	14 U	14 U	14 U
1,1-Dichloropropene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon tetrachloride	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	**11**	1.0 U
Isopropylbenzene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
Benzene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	**10**	1.0 U
1,2-Dichloroethane	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	**12**	1.0 U
Trichloroethene	ug/L	MRL	Total	1.0 U	**670**	**14**	**14**	**9.7**	1.0 U
1,2-Dichloropropane	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	**12**	1.0 U
Dibromomethane	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
Methyl methacrylate	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dioxane	ug/L	MRL	Total	50 U	650 U	50 U	50 U	50 U	50 U
Bromochloromethane	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,3-Dichloropropene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	**4.7**	1.0 U
2-Hexanone	ug/L	MRL	Total	5.0 U	65 U	5.0 U	5.0 U	5.0 U	5.0 U
4-Methyl-2-pentanone	ug/L	MRL	Total	5.0 U	65 U	5.0 U	5.0 U	5.0 U	5.0 U
1,1,2-Trichloroethane	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	**8.9**	1.0 U
trans-1,3-Dichloropropene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-Dichloropropane	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Chloroethyl vinyl ether	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethene	ug/L	MRL	Total	1.0 U	**520**	**1.3**	**1.3**	**7.9**	1.0 U
Dibromochloromethane	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromoethane	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
Chlorobenzene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	**30**	1.0 U
1,1,1,2-Tetrachloroethane	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
Ethylbenzene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	**8.2**	1.0 U
m&p-Xylene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	**13**	1.0 U
o-Xylene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	**9.9**	1.0 U
Xylenes, Total	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	**23**	1.0 U
Styrene	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	**6**	1.0 U
Bromoform	ug/L	MRL	Total	1.0 U	13 U	1.0 U	1.0 U	1.0 U	1.0 U
Dilution Factor									

Notes:
All values reported in micrograms per liter (ug/l)
B=Compound was found in the Blank and the Sample.

Table 2: Summary of Performance Evaluation Sample (PES) Results

Pre-Design Investigation
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont
Groundwater Sampling SDG: 200-12187-1

	W-153-PD-1 TA Analysis	ID No. 0803-12-04.1 Lot No. S171-703	
Parameter	VOCs Method 8260B Routine Level	Certified Value	QC Performance Acceptance Limits
Aqueous (ug/L)			
W-153-PD-1			
1,1,1,2-Tetrachloroethane	1 U		
1,1,1-Trichloroethane	16	18.7	13.5 - 23.2
1,1,2,2-Tetrachloroethane	1 U		
1,1,2-Trichloroethane	8.9	8.86	6.84 - 10.9
1,1-Dichloroethane	1 U		
1,1-Dichloroethene	3.5	3.77	2.60 - 4.94
1,1-Dichloropropene	1 U		
1,2,3-Trichlorobenzene	1 U		
1,2,3-Trichloropropane	1 U		
1,2,4-Trichlorobenzene	11	13.4	8.59 - 16.9
1,2,4-Trimethylbenzene	1 U		
1,2-Dibromo-3-Chloropropane	1 U		
1,2-Dibromoethane	1 U		
1,2-Dichlorobenzene	18	18.0	13.7 - 22.0
1,2-Dichloroethane	12	13.2	10.3 - 16.5
1,2-Dichloropropane	12	11.5	8.89 - 14.1
1,3,5-Trimethylbenzene	1 U		
1,3-Dichlorobenzene	1 U		
1,3-Dichloropropane	1 U		
1,4-Dichlorobenzene	8.6	9.06	6.52 - 11.1
1,4-Dioxane	50 U		
2,2-Dichloropropane	1 U		
2-Butanone	5 U		
2-Chloroethyl vinyl ether	1 U		
2-Chlorotoluene	1 U		
2-Hexanone	5 U		
4-Chlorotoluene	1 U		
4-Isopropyltoluene	1 U		
4-Methyl-2-pentanone	5 U		
Acetone	5 U		
Acrolein	5 U		
Acrylonitrile	1 U		
Allyl chloride	1 U		
Benzene	10	9.69	7.62 - 11.7
Bromobenzene	1 U		
Bromochloromethane	1 U		
Bromodichloromethane	1 U		
Bromoform	1 U		
Bromomethane	1 U		
Carbon disulfide	1 U *		
Carbon tetrachloride	11	13.6	9.33 - 17.1
Chlorobenzene	30	30.2	23.6 - 36.8
Chloroethane	1 U		

Parameter	W-153-PD-1 TA Analysis VOCs Method 8260B Routine Level	ID No. 0803-12-04.1 Lot No. S171-703 Certified Value	QC Performance Acceptance Limits
Chloroform	0.21 J		
Chloromethane	1 U		
Chloroprene	1 U		
cis-1,2-Dichloroethene	27	26.6	19.9 - 32.7
cis-1,3-Dichloropropene	1 U		
Dibromochloromethane	1 U		
Dibromomethane	1 U		
Dichlorodifluoromethane	1 U		
Ethyl methacrylate	1 U		
Ethylbenzene	8.2	8.45	6.42 - 10.5
Freon TF	1 U		
Hexachlorobutadiene	1 U		
Isobutyl alcohol	50 U		
Isopropylbenzene	1 U		
m&p-Xylene	13	13.66	10.33 - 16.94
Methacrylonitrile	1 U		
Methyl iodide	1 U		
Methyl methacrylate	1 U		
Methyl t-butyl ether	1 U		
Methylene Chloride	9.2 B	8.96	6.23 - 11.5
Naphthalene	1 U		
n-Butylbenzene	1 U		
n-Propylbenzene	1 U		
o-Xylene	9.9	8.82	7.42 - 12.2
Propionitrile	4 U		
sec-Butylbenzene	1 U		
Styrene	6	6.44	4.83 - 8.11
tert-Butylbenzene	1 U		
Tetrachloroethene	7.9	9.03	6.18 - 10.9
Tetrahydrofuran	14 U		
Toluene	4.7	4.77	3.69 - 5.77
trans-1,2-Dichloroethene	27	27.80	20.7 - 34.8
trans-1,3-Dichloropropene	1 U		
trans-1,4-Dichloro-2-butene	1 U		
Trichloroethene	9.7	10.3	7.63 - 12.3
Trichlorofluoromethane	1 U		
Vinyl acetate	1 U		
Vinyl chloride	1.6	2	1.18 - 2.94
1,2-Dichloroethene, Total	54		
Xylenes, Total	23	23.5	17.8 - 29.1

Notes

TA = Test America in South Burlington, VT

The Certified Values are the actual 'made to' concentrations confirmed by ERA analytical verification.

The QC Performance Acceptance Limits (QC PALs) based on actual historical dta collected in ERA's Prificiency Testing program. QC PALs reflect any inherent biases in the methods used to establish the limits and closely approximate a 95% conficence interval of the performance that experienced laboratories should achieve using accepted environmental methods.

XI. ACCURACY CHECK (Performance Evaluation Results)

SDG No.: 200-12187

Are more than one-half of the PES analytes within criteria for each parameter. Y N

PE Sample No./ ERA ID No,	Lot No.	Parameter	Type of PES	Matrix	Analyte	W-153-PD-W1 TA Analysis (ug/l)	Non-EPA PES Scores**	Samples Affected	Action
W153-PD-W1/ ID No. 0803-12-	S171703	VOCs	VOA	Aq.					

* For Region I PESs indicate the Region I PES Score Report Result: Action High; Action Low; TCL MISS; TCL CONTAMINANT; TIC HIT; TIC MISS; TIC CONTAMINANT

** For Non-EPA PESs indicate the Non-EPA PES Score: PES Compound MISS; PES Compound CONTAMINANT; PES Compound HIT (Range)

TIC Tentatively Identifiable Compound

Validator: Ann Marie Petrucci

Date: 12/11/2012

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 200-12187-1

Job Description: Burgess Brother's Sanitary Landfill

For:
Environmental Partners Group
1900 Crown Colony Drive
Suite 402
Quincy, MA 02169

Attention: Ms. Ann Marie Petricca

Sara Goff

Approved for release.
Sara S Goff
Project Manager I
8/31/2012 12:58 PM

Sara S Goff
Project Manager I
sara.goff@testamericainc.com
08/31/2012

The test results in this report relate only to sample(s) as received by the laboratory. These test results were derived under a quality system that adheres to the requirements of NELAC. Pursuant to NELAC, this report may not be produced in full without written approval from the laboratory

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CASE NARRATIVE

Client: Environmental Partners Group

Project: Burgess Brother's Sanitary Landfill

Report Number: 200-12187-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT

The samples were received on 08/10/2012 and 08/10/2012; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 1.6° C and 2.8° C.

The following sample(s) was improperly preserved in the field: W153-PD-1. The sample arrived unpreserved. The volume was decanted into a 250mL Sulfuric Acid preserved container upon login.

The following sample(s) was received at the laboratory without a sample collection date or time documented on the chain of custody: TB162-PD-1. As a result, a sample collection time of 12:00 a.m. on the date of relinquishing was used.

VOLATILE ORGANIC COMPOUNDS (GC-MS)

Samples W-03-PD-1, W152-PD-1, W25S1-PD-1, PZ9S-PD-1, PZ9D-PD-1, P13-PD-1, P14-PD-1, W153-PD-1, PZ2D-PD-1, PZ2S-PD-1, TB162-PD-1, PZ7S-PD-1, ML2-PD-W2(10-12) and ML2-PD-W3(17-19) were analyzed for volatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8260B. The samples were analyzed on 08/18/2012 and 08/19/2012.

Methylene Chloride was detected in method blank MB 200-43677/4 at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Methylene Chloride was detected in method blank MB 200-43747/5 at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

The initial calibration curve was outside acceptance criteria for Methyl iodide. The continuing calibration verification (CCV) for analytical batch 43677 exceeded control criteria for 1,4-Dioxane. The continuing calibration verification (CCV) for analytical batch 43747 exceeded control criteria for Bromomethane. The data have been qualified and reported.

Carbon disulfide failed the recovery criteria low for laboratory control samples 200-43677/2 and LCS 200-43747/3. Refer to the QC report for details.

2-Chloroethyl vinyl ether and Carbon disulfide failed the recovery criteria low for the matrix spike and matrix spike duplicate of sample PZ7S-PD-1. Tetrachloroethene failed the recovery criteria high for the matrix spike. Refer to the QC report for details.

Samples W-03-PD-1[13X], PZ2D-PD-1[37X], PZ2S-PD-1[440X], ML2-PD-W2(10-12)[183X] and ML2-PD-W3(17-19)[338X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No other difficulties were encountered during the volatiles analyses. All other quality control parameters were within the acceptance limits.

DISSOLVED METALS (ICP)

Samples W-03-PD-1, W152-PD-1, W25S1-PD-1, PZ9S-PD-1, and PZ9D-PD-1 were analyzed for dissolved metals (ICP) in accordance with EPA SW-846 Method 6010C. The samples were prepared on 08/16/2012 and analyzed on 08/18/2012.

No difficulties were encountered during the metals analyses. All quality control parameters were within the acceptance limits.

METALS (ICP)

Samples W-03-PD-1, W152-PD-1, W25S1-PD-1, and W153-PD-1 were analyzed for Metals (ICP)in accordance with EPA SW-846 Method 6010C. The samples were prepared on 08/16/2012 and analyzed on 08/18/2012.

No difficulties were encountered during the metals analyses. All quality control parameters were within the acceptance limits.

ALKALINITY
Samples PZ9S-PD-1, PZ9D-PD-1, and W153-PD-1 were analyzed for alkalinity in accordance with SM20 2320B. The samples were analyzed on 08/14/2012.

No difficulties were encountered during the alkalinity analyses. All quality control parameters were within the acceptance limits.

TOTAL DISSOLVED SOLIDS
Samples W-03-PD-1, W152-PD-1, W25S1-PD-1, PZ9S-PD-1, PZ9D-PD-1, and W153-PD-1 were analyzed for total dissolved solids in accordance with SM20 2540C. The samples were analyzed on 08/14/2012.

No difficulties were encountered during the TDS analyses. All quality control parameters were within the acceptance limits.

ORTHOPHOSPHATE AS P
Samples PZ-9D-PD-1, PZ-9S-PD-1, and W153-PD-1 were analyzed for orthophosphate as P in accordance with SM20 4500 P E. The samples were analyzed on 08/10/2012.

Sample W153-PD-1[5X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No difficulties were encountered during the orthophosphate analyses. All quality control parameters were within the acceptance limits.

ANIONS (Chloride and Sulfate)
Samples PZ9S-PD-1, PZ9D-PD-1, and W153-PD-1 were analyzed for anions, Chloride and Sulfate, in accordance with EPA SW-846 Method 9056. The samples were analyzed on 08/20/2012.

No difficulties were encountered during the anions analyses. All quality control parameters were within the acceptance limits.

ANIONS (Nitrate and Nitrite)
Samples PZ9S-PD-1, PZ9D-PD-1, and W153-PD-1 were analyzed for anions, Nitrate and Nitrite, in accordance with EPA SW-846 Method 9056A. The samples were analyzed on 08/10/2012 and 08/11/2012.

No difficulties were encountered during the anions analyses. All quality control parameters were within the acceptance limits.

TOTAL ORGANIC CARBON
Samples W-03-PD-1, W152-PD-1, W25S1-PD-1, PZ9S-PD-1, PZ9D-PD-1, and W153-PD-1 were analyzed for total organic carbon in accordance with EPA SW-846 Method 9060A. The samples were analyzed on 08/16/2012.

No difficulties were encountered during the TOC analyses. All quality control parameters were within the acceptance limits.

DISSOLVED ORGANIC CARBON
Samples W-03-PD-1, W152-PD-1, W25S1-PD-1, PZ9S-PD-1, and PZ9D-PD-1 were analyzed for Dissolved Organic Carbon in accordance with 9060. The samples were analyzed on 08/17/2012.

No difficulties were encountered during the DOC analyses. All quality control parameters were within the acceptance limits.

December 11, 2012

Terrence Connelly
Remedial Project Manager
US Environmental Protection Agency – Region 1
5 Post Office Square, Suite 100
Boston, MA 02109-3912

Re: SDG 200-12187-1
TestAmerica Laboratories, Inc.
Burgess Brothers Superfund Site
Pre-Design Investigation
Tier I Inorganics, TOC/DOC Data Validation – Aqueous Samples

Cations:	W-03-PD-1, W152-PD-1, W25S1-PD-1
Dissolved Cations:	W-03-PD-1, W152-PD-1, W25S1-PD-1, PZ9S-PD-1, PZ9D-PD-1
TDS	W-03-PD-1, W152-PD-1, W25S1-PD-1, PZ9S-PD-1, PZ9D-PD-1
TOC/DOC:	W-03-PD-1, W152-PD-1, W25S1-PD-1, PZ9S-PD-1, PZ9D-PD-1
Alkalinity:	PZ9S-PD-1, PZ9D-PD-1
Ortho-P:	PZ-9D-PD-1, PZ-9S-PD-1
Anions:	PZ9S-PD-1, PZ9D-PD-1

1 / Aqueous PES / W153-PD-1

Dear Mr. Connelly:

A Tier I data validation, in accordance with Region I, EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses, December 1996 criteria, and criteria required under the Pre-Design Investigation (PDI) Quality Assurance Project Plan (QAPP), dated July 2012, was performed on the inorganic analytical data for 12 aqueous samples and 1 aqueous PES collected by Environmental Partners Group, Inc. from the Burgess Brothers Superfund Site. These inorganic aqueous samples and PES were analyzed for the following parameters:

- Cations EPA SW-846 Method 6010C
- Anions EPA SW-846 Method 9056A
- Orthophosphate Method 365.4
- Alkalinity SM 2320B
- Total Dissolved Solids SM 2540C
- Total Organic Carbon/Dissolved Organic Carbon EPA SW-846 Method 9060A

In accordance with the PDI QAPP, Tier I Data Validation was deemed sufficient for the groundwater samples at this time.

A summary of the laboratory analytical results for this SDG, including method reporting limits and dilution factors, is attached as Table 1.

A Tier I data validation is based on the following parameters:

- Complete Sample Delivery Group Files (CFS) Completeness Evidence Audit
- Evaluation of Performance Evaluation Sample (PES) Results

A CFS Completeness Evidence Audit was performed for this Sample Delivery Group (SDG) 200-12187-1 aqueous data. All criteria were met for this parameter. The attached Lab Report Table of Contents and Narrative provide the completeness information for this SDG.

The PES results were evaluated for this SDG aqueous data and are summarized in Table 2. All criteria were not met. The laboratory quantitation for alkalinity and orthophosphate was outside the lower limit of the vendor's documented acceptance limits; this is less than one-half of the PES analytes. If a Tier II or Tier IIII validation were performed, the following actions would be applied to the data:

- Estimate (J) the compound when detected in any compound to indicate potential low bias
- Reject (R) the quantitation limit in all samples to indicate that the data are unusable due to the possibility of false negatives

A XI Accuracy Check (PE Results) Form for PES W-153-PD-W1 is also attached. The laboratory QC parameters for orthophosphate and alkalinity were within acceptable limits. The PE sample for orthophosphate required a 5 times dilution. Alkalinity and orthophosphate is two of several parameters used to evaluate potential passivation effects associated with a zero-valent iron (ZVI) remedy. Additional data validation should be performed for the alkalinity and orthophosphate date if a ZVI remedy is selected.

Environmental Partners recommends that the inorganics soil data in this SDG be accepted and that no further data validation be performed. Please contact Ann Marie Petricca at (617) 657-0299 should you have any questions or comments regarding this report.

Sincerely,

Ann Marie Petricca

Ann Marie Petricca, CPG
Data Validator

Attachments:
1. Data Summary Table
2. Accuracy Check/PES Score Report
3. Completeness Evidence Audit

cc: Geoffrey Seibel, *de maximis, inc.*

Table 1: Groundwater Analytical Data
Inorganics
Burgess Brothers Superufund Site, Woodford and Bennington, VT
Test America SDG 200-12187-1

									Dup W25S1-PD-1	PE Sample
Analyte	**Specific Method**	**Units**	**Reports To**	**Basis**	**200-12187-4 PZ9S-PD-1 8/9/2012 11:30 AM**	**200-12187-5 PZ9D-PD-1 8/9/2012 9:00 AM**	**200-12187-1 W-03-PD-1 8/8/2012 11:45 AM**	**200-12187-3 W25S1-PD-1 8/8/2012 4:00 PM**	**200-12187-2 W152-PD-1 8/8/2012 4:00 PM**	**200-12189-3 W153-PD-1 8/9/2012 2:00 PM**
Total Dissolved Solids	Solids, Total Dissolved (TDS)	mg/L	MRL	Total	205	128	586	195	197	537
Orthophosphate	Orthophosphate	mg/L	MRL	Total	0.10 U	0.10 U				1.3
Total Organic Carbon	Organic Carbon, Total (TOC)	mg/L	MRL	Total	3.1	1.3	4.6	14	14.2	5.6
TOC Result 4	Organic Carbon, Total (TOC)	mg/L	MRL	Total	3.1	1.2	4.5	13.9	13.9	5.5
TOC Result 3	Organic Carbon, Total (TOC)	mg/L	MRL	Total	3	1.2	4.5	13.9	14.1	5.5
TOC Result 2	Organic Carbon, Total (TOC)	mg/L	MRL	Total	3.1	1.2	4.6	14	14	5.5
TOC Result 1	Organic Carbon, Total (TOC)	mg/L	MRL	Total	3.1	1.4	4.8	14.3	15.1	5.7
Dissolved Organic Carbon	Organic Carbon, Dissolved (DOC)	mg/L	MRL	Dissolved	3.3	1.9	8.6	14.9	14.2	
DOC Result 4	Organic Carbon, Dissolved (DOC)	mg/L	MRL	Dissolved	3.1	1.7	8.9	14.8	14	
DOC Result 3	Organic Carbon, Dissolved (DOC)	mg/L	MRL	Dissolved	3.1	1.7	8.5	14.7	13.9	
DOC Result 2	Organic Carbon, Dissolved (DOC)	mg/L	MRL	Dissolved	3.1	1.7	8.5	14.8	14.1	
DOC Result 1	Organic Carbon, Dissolved (DOC)	mg/L	MRL	Dissolved	3.7	2.4	8.4	15.3	14.8	
Calcium	Metals (ICP)	ug/L	MRL	Total			126000	7680	8110	32700
Iron	Metals (ICP)	ug/L	MRL	Total			1340	2110	2670	272
Magnesium	Metals (ICP)	ug/L	MRL	Total			36800	8850	9100	10100
Manganese	Metals (ICP)	ug/L	MRL	Total			2190	1350	1360	837
Potassium	Metals (ICP)	ug/L	MRL	Total			22300	9800	9840	15300
Silicon	Metals (ICP)	ug/L	MRL	Total			9490	5930	6200	8260
Calcium	Metals (ICP)	ug/L	MRL	Dissolved	32900	24800	126000	7620	7760	
Iron	Metals (ICP)	ug/L	MRL	Dissolved	200 U	200 U	748	696	690	
Magnesium	Metals (ICP)	ug/L	MRL	Dissolved	9540	9070	36600	8730	8920	
Manganese	Metals (ICP)	ug/L	MRL	Dissolved	427	186	2260	1260	1340	
Potassium	Metals (ICP)	ug/L	MRL	Dissolved	2850 J	2340 J	22700	11400	10200	
Silicon	Metals (ICP)	ug/L	MRL	Dissolved	2190	1860	9180	6740	6760	
Nitrate as N	Anions, Ion Chromatography	mg/L	MRL	Total	0.25 U	0.25 U				7.9
Nitrite as N	Anions, Ion Chromatography	mg/L	MRL	Total	0.25 U	0.25 U				0.25 U
Chloride	Anions, Ion Chromatography	mg/L	MRL	Total	9.7	5.5				72.5
Sulfate	Anions, Ion Chromatography	mg/L	MRL	Total	20.1	13.9				118
Alkalinity	Alkalinity	mg/L	MRL	Total	108	85.7				74.8
Dilution Factor										

Notes:

All values reported in micrograms per liter (ug/l)

B=Compound was found in the Blank and the Sample.

U=Not detected above the reporting limit

J=Estimated value.

Table 2: Summary of Performance Evaluation Sample (PES) Results

Pre-Design Investigation
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont
Groundwater Sampling SDG: 200-12187-1

Parameter	*W-153-PD-1 TA Analysis VOCs Method 8260B Routine*	*Certified Value*	*QC Performance Acceptance Limits*
W153-PD-1			
Aqueous (ug/L)		***Catalog No. 092 Custom Standard Lot No. 0803-12-04.2***	
Calcium	32700	32000	28800 - 34800
Iron	272	254	223 - 284
Magnesium	10100	9960	895 - 11000
Manganese	837	876	799 - 958
Potassium	15300	15000	13000 - 16900
** Silicon	8260	9445	8182 - 10473
Aqueous (mg/L)		***ID No. 0803-12-04.6 Lot No. S189-698***	
Total Dissolved Solids	537	560	497 - 586
Nitrate as N	7.9	7.89	6.94 - 8.24
Nitrite as N	0.25 U		
Chloride	72.5	75.6	68.7 - 78.4
Sulfate	118	124	109 - 130
Alkalinity	74.8	91.5	84.5 - 96.9
		ID No. 0803-12-04.4/5 Lot No. S181-667	
Orthophosphate	1.3	1.7	1.5 - 1.85
		ID No. 0803-12-04.7 Lot No. S188-669	
TOC Result 1	5.7		
TOC Result 2	5.5		
TOC Result 3	5.5		
TOC Result 4	5.5		
Total Organic Carbon	5.6	5.41	4.57 - 6.24

Notes

** Lab analysis is for silicon. PES reports results as silica. Silica PES values converted to silicon (silica/2.13879 = silicon)

TA = Test America in South Burlington, VT

The Certified Values are the actual 'made to' concentrations confirmed by ERA analytical verification.

The QC Performance Acceptance Limits (QC PALs) based on actual historical dta collected in ERA's Prificiency Testing program. QC PALs reflect any inherent biases in the methods used to establish the limits and closely approximate a 95% conficence interval of the performance that experienced laboratories should achieve using accepted environmental methods.

XI. ACCURACY CHECK (Performance Evaluation Results)

SDG No.: 200-12187-1

Are more than one-half of the PES analytes within criteria for each parameter. Y N

PE Sample No./ ERA ID No,	Lot No.	Parameter	Type of PES	Matrix	Analyte	W-153-PD-W1 TA Analysis (mg/l)	Non-EPA PES Scores**	Samples Affected	Action
W-153-PD-W1/ ID No. 0803-12-04.4/5	S181667	Orthophosphate	Inoranic	Aq.	Orthophosphate	1.3	Action Low 1.7 (1.5-1.85)	PZ-9D-PD-1, PZ-9S-PD-1	R, J
W-153-PD-W1/ ID No. 0803-12-05.6	S189698	Anions	Inoranic	Aq.	Alkalinity	74.8	Action Low 91.5 (84.5-96.9)	PZ-9D-PD-1, PZ-9S-PD-1	R, J

* For Region I PESs indicate the Region I PES Score Report Result: Action High; Action Low; TCL MISS; TCL CONTAMINANT; TIC HIT; TIC MISS; TIC CONTAMINANT

** For Non-EPA PESs indicate the Non-EPA PES Score: PES Compound MISS; PES Compound CONTAMINANT; PES Compound HIT (Range)

TIC Tentatively Identifiable Compound

Validator: Ann Marie Petricca

Date: 12/11/2012

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 200-12187-1

Job Description: Burgess Brother's Sanitary Landfill

For:
Environmental Partners Group
1900 Crown Colony Drive
Suite 402
Quincy, MA 02169

Attention: Ms. Ann Marie Petricca

Sara Goff

Approved for release.
Sara S Goff
Project Manager I
8/31/2012 12:58 PM

Sara S Goff
Project Manager I
sara.goff@testamericainc.com
08/31/2012

The test results in this report relate only to sample(s) as received by the laboratory. These test results were derived under a quality system that adheres to the requirements of NELAC. Pursuant to NELAC, this report may not be produced in full without written approval from the laboratory

TestAmerica Laboratories, Inc.
TestAmerica Burlington 30 Community Drive, Suite 11, South Burlington, VT 05403
Tel (802) 660-1990 Fax (802) 660-1919 www.testamericainc.com

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CASE NARRATIVE

Client: Environmental Partners Group

Project: Burgess Brother's Sanitary Landfill

Report Number: 200-12187-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT
The samples were received on 08/10/2012 and 08/10/2012; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 1.6° C and 2.8° C.

The following sample(s) was improperly preserved in the field: W153-PD-1. The sample arrived unpreserved. The volume was decanted into a 250mL Sulfuric Acid preserved container upon login.

The following sample(s) was received at the laboratory without a sample collection date or time documented on the chain of custody: TB162-PD-1. As a result, a sample collection time of 12:00 a.m. on the date of relinquishing was used.

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Methylene Chloride was detected in method blank MB 200-43677/4 at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Methylene Chloride was detected in method blank MB 200-43747/5 at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

The initial calibration curve was outside acceptance criteria for Methyl iodide. The continuing calibration verification (CCV) for analytical batch 43677 exceeded control criteria for 1,4-Dioxane. The continuing calibration verification (CCV) for analytical batch 43747 exceeded control criteria for Bromomethane. The data have been qualified and reported.

Carbon disulfide failed the recovery criteria low for laboratory control samples 200-43677/2 and LCS 200-43747/3. Refer to the QC report for details.

2-Chloroethyl vinyl ether and Carbon disulfide failed the recovery criteria low for the matrix spike and matrix spike duplicate of sample PZ7S-PD-1. Tetrachloroethene failed the recovery criteria high for the matrix spike. Refer to the QC report for details.

Samples W-03-PD-1[13X], PZ2D-PD-1[37X], PZ2S-PD-1[440X], ML2-PD-W2(10-12)[183X] and ML2-PD-W3(17-19)[338X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No other difficulties were encountered during the volatiles analyses. All other quality control parameters were within the acceptance limits.

DISSOLVED METALS (ICP)
Samples W-03-PD-1, W152-PD-1, W25S1-PD-1, PZ9S-PD-1, and PZ9D-PD-1 were analyzed for dissolved metals (ICP) in accordance with EPA SW-846 Method 6010C. The samples were prepared on 08/16/2012 and analyzed on 08/18/2012.

No difficulties were encountered during the metals analyses. All quality control parameters were within the acceptance limits.

METALS (ICP)
Samples W-03-PD-1, W152-PD-1, W25S1-PD-1, and W153-PD-1 were analyzed for Metals (ICP)in accordance with EPA SW-846 Method 6010C. The samples were prepared on 08/16/2012 and analyzed on 08/18/2012.

No difficulties were encountered during the metals analyses. All quality control parameters were within the acceptance limits.

ALKALINITY
Samples PZ9S-PD-1, PZ9D-PD-1, and W153-PD-1 were analyzed for alkalinity in accordance with SM20 2320B. The samples were analyzed on 08/14/2012.

No difficulties were encountered during the alkalinity analyses. All quality control parameters were within the acceptance limits.

TOTAL DISSOLVED SOLIDS
Samples W-03-PD-1, W152-PD-1, W25S1-PD-1, PZ9S-PD-1, PZ9D-PD-1, and W153-PD-1 were analyzed for total dissolved solids in accordance with SM20 2540C. The samples were analyzed on 08/14/2012.

No difficulties were encountered during the TDS analyses. All quality control parameters were within the acceptance limits.

ORTHOPHOSPHATE AS P
Samples PZ-9D-PD-1, PZ-9S-PD-1, and W153-PD-1 were analyzed for orthophosphate as P in accordance with SM20 4500 P E. The samples were analyzed on 08/10/2012.

Sample W153-PD-1[5X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No difficulties were encountered during the orthophosphate analyses. All quality control parameters were within the acceptance limits.

ANIONS (Chloride and Sulfate)
Samples PZ9S-PD-1, PZ9D-PD-1, and W153-PD-1 were analyzed for anions, Chloride and Sulfate, in accordance with EPA SW-846 Method 9056. The samples were analyzed on 08/20/2012.

No difficulties were encountered during the anions analyses. All quality control parameters were within the acceptance limits.

ANIONS (Nitrate and Nitrite)
Samples PZ9S-PD-1, PZ9D-PD-1, and W153-PD-1 were analyzed for anions, Nitrate and Nitrite, in accordance with EPA SW-846 Method 9056A. The samples were analyzed on 08/10/2012 and 08/11/2012.

No difficulties were encountered during the anions analyses. All quality control parameters were within the acceptance limits.

TOTAL ORGANIC CARBON
Samples W-03-PD-1, W152-PD-1, W25S1-PD-1, PZ9S-PD-1, PZ9D-PD-1, and W153-PD-1 were analyzed for total organic carbon in accordance with EPA SW-846 Method 9060A. The samples were analyzed on 08/16/2012.

No difficulties were encountered during the TOC analyses. All quality control parameters were within the acceptance limits.

DISSOLVED ORGANIC CARBON
Samples W-03-PD-1, W152-PD-1, W25S1-PD-1, PZ9S-PD-1, and PZ9D-PD-1 were analyzed for Dissolved Organic Carbon in accordance with 9060. The samples were analyzed on 08/17/2012.

No difficulties were encountered during the DOC analyses. All quality control parameters were within the acceptance limits.

December 11, 2012

Mr. Terrence Connelly
Remedial Project Manager
US Environmental Protection Agency – Region 1
5 Post Office Square, Suite 100
Boston, MA 02109-3912

Re: SDG 200-12498-1
TestAmerica Laboratories, Inc.
Burgess Brothers Superfund Site
Pre-Design Investigation
Tier I Organics Data Validation – Aqueous Samples

Volatiles: 24 / Aqueous / PZ12D-PD-W1, PZ13D-PD-W1, PZ13S-PD-W1, PZ14D-PD-W1, PZ14S-PD-W1, PZ170-PD-W1, PZ10D-PD-W1, PZ7D-PD-W1, PZ10S-PD-W1, PZ12S-PD-W1, PZ24-PD-W1, SW-22-39, SW-21-39, SW-20-39, SW-19-39, P-01-39, P-21-39, P-22-39, P-08-39, P-02-39, P-19-39, P-20-39, ML2-PD-W6(25'-28'), ML2-PD-W7(4'-6')

3 / Aqueous Trip Blanks / TB155-PD-W1, TB156-PD-W1, TB-150-39

2 / Aqueous PES / W171-PD-W1, W-150-39

Dear Mr. Connelly:

A Tier I data validation, in accordance with Region I, EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses, December 1996 criteria, and criteria required under the Pre-Design Investigation (PDI) Quality Assurance Project Plan (QAPP), dated July 2012, was performed on organic analytical data for 24 Aqueous Samples, 3 Trip Blanks, and 2 Aqueous PES collected by Environmental Partners Group, Inc. from the Burgess Brothers Superfund Site. The volatile aqueous samples, blanks and PESs were analyzed using the EPA SW-846 Method 8260B Volatile Organic Statement of Work. In accordance with the PDI QAPP, Tier I data validation was deemed sufficient for the groundwater samples at this time.

A summary of the laboratory analytical results for this SDG, including method reporting limits and dilution factors, is attached as Table 1.

A Tier I data validation is based on the following parameters:

- Complete Sample Delivery Group Files (CFS) Completeness Evidence Audit
- Evaluation of Performance Evaluation Sample (PES) Results

A CFS Completeness Evidence Audit was performed for this Sample Delivery Group (SDG) 200-12498-1 aqueous data. The Organics CFS Inventory Sheet is included in Attachment A. All criteria were met for this parameter.

The PES results were evaluated for this SDG aqueous data and are summarized in Table 2. All compounds were within performance acceptance limits for PES W-171-PD-W1. Naphthalene was measured in sample W-150-39, but is not present in the PES. If a Tier II or Tier IIII validation were performed, the following actions would be applied to the data, for the compound naphthalene:

- all positive detects in all samples associated with this PES would be estimated (J) to indicate potential high bias and
- all quantitation limits for non-detects in all samples associated with this PES would be accepted

XI Accuracy Check (PE Results) Forms for W-171-PD-W1 and W-150-39 are included in Attachment A. Naphthalene has never been detected in groundwater at the Site and is not a contaminant of concern at the Site.

Environmental Partners recommends that the organics aqueous data in this SDG be accepted and that no further data validation be performed. Please contact Ann Marie Petricca at (617) 657-0299 should you have any questions or comments regarding this report.

Sincerely,

Ann Marie Petricca

Ann Marie Petricca, CPG
Data Validator

Attachments:
1. Data Summary Table
2. Accuracy Check/PES Score Report
3. Completeness Evidence Audit

cc: Geoffrey Seibel, *de maximis, inc.*

Groundwater Analytical Data
Volatile Organic Compounds SW-846 EPA Method 8260B
Burgess Brothers Superufund Site, Woodford and Bennington, VT
Test America SDG 200-12498-1

Analyte	Units	Reports To	200-12518-1 ML2-PD-W6(25'-28') 8/29/2012 2:00 PM	200-12518-2 ML2-PD-W7(4'-6') 8/30/2012 4:20 PM	200-12545-12 PZ7D-PD-W1 8/30/2012 12:45 PM	200-12545-13 PZ10S-PD-W1 8/30/2012 3:15 PM	200-12545-11 PZ10D-PD-W1 8/30/2012 7:30 AM	200-12545-14 PZ12S-PD-W1 8/31/2012 10:15 AM	200-12545-1 PZ12D-PD-W1 8/28/2012 5:15 PM	200-12545-3 PZ13S-PD-W1 8/29/2012 5:15 PM	200-12545-2 PZ13D-PD-W1 8/28/2012 5:00 PM	200-12545-8 PZ14S-PD-W1 8/30/2012 12:30 PM
Tetrachloroethene	ug/L	MRL	**10000**	**670**	**26**	1.0 U	**8.1**	**850**	**180**	**13**	**160**	**590**
1,3-Dichloropropane	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
1,1,2-Trichloroethane	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
trans-1,3-Dichloropropene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Ethyl methacrylate	ug/L	MRL	130 U *	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U *	1.0 U	2.4 U *	7.3 U *
Chlorobenzene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
1,1,1,2-Tetrachloroethane	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
1,2-Dichlorobenzene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
2-Hexanone	ug/L	MRL	630 U	74 U	5.0 U	5.0 U	5.0 U	44 U	19 U	5.0 U	12 U	37 U
Dibromochloromethane	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Methyl methacrylate	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
1,4-Dioxane	ug/L	MRL	6300 U	740 U	50 U	50 U	50 U	440 U	190 U	50 U	120 U	370 U
Dibromomethane	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Trichloroethene	ug/L	MRL	**3500**	**440**	**26**	1.0 U	**2.2**	**780**	**190**	**13**	**150**	**330**
1,2-Dichloropropane	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
4-Methyl-2-pentanone	ug/L	MRL	630 U	74 U	5.0 U	5.0 U	5.0 U	44 U	19 U	5.0 U	12 U	37 U
Toluene	ug/L	MRL	130 U	**15**	0.84 J	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
cis-1,3-Dichloropropene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Bromodichloromethane	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
2-Chloroethyl vinyl ether	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Ethylbenzene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
1,3,5-Trimethylbenzene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
tert-Butylbenzene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
4-Chlorotoluene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
n-Propylbenzene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
2-Chlorotoluene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
4-Isopropyltoluene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
1,4-Dichlorobenzene	ug/L	MRL	130 U	4.0 J	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
1,3-Dichlorobenzene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
1,2,4-Trimethylbenzene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
sec-Butylbenzene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Styrene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Bromoform	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Xylenes, Total	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
m&p-Xylene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
o-Xylene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
1,2,3-Trichloropropane	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
trans-1,4-Dichloro-2-butene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
1,1,2,2-Tetrachloroethane	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Isopropylbenzene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Bromobenzene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
1,2-Dichloroethane	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Acrolein	ug/L	MRL	630 U	74 U	5.0 U	5.0 U	5.0 U	44 U	19 U	5.0 U	12 U	37 U
1,1-Dichloroethene	ug/L	MRL	60 J	**21**	0.38 J	1.0 U	1.0 U	8.8 U	0.80 J	1.0 U	**2.5**	3.7 J
Trichlorofluoromethane	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Bromomethane	ug/L	MRL	130 U *	15 U *	1.0 U *	1.0 U *	1.0 U *	8.8 U *	3.7 U *	1.0 U *	2.4 U *	7.3 U *
Chloroethane	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Carbon disulfide	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Allyl chloride	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Methyl iodide	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Freon TF	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Acetone	ug/L	MRL	630 U	74 U	1.7 J	4.5 J	2.8 J	44 U	19 U	**6.4**	2.8 J	12 J
Hexachlorobutadiene	ug/L	MRL	130 U	15 U *	1.0 U *	1.0 U *	1.0 U *	8.8 U *	3.7 U	1.0 U *	2.4 U	7.3 U
1,2,4-Trichlorobenzene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Naphthalene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
1,2-Dibromoethane	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
1,2,3-Trichlorobenzene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Chloromethane	ug/L	MRL	130 U	15 U	0.41 J	0.38 J	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Vinyl chloride	ug/L	MRL	**1100**	**770**	0.49 J	1.0 U	1.0 U	**42**	**9.2**	0.38 J	2.3 J	**22**
Dichlorodifluoromethane	ug/L	MRL	34 J	10 J	0.29 J	1.0 U	1.0 U	2.0 J	0.79 J	1.0 U	1.6 J	7.3 U
1,2-Dibromo-3-Chloropropane	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
n-Butylbenzene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Methylene Chloride	ug/L	MRL	53 J B	6.3 J B	0.51 J B	0.45 J B	0.44 J B	3.7 J B	1.7 J B	0.47 J B	1.0 J B	3.0 J B
Tetrahydrofuran	ug/L	MRL	1800 U	210 U	14 U	14 U	14 U	120 U	52 U	14 U	34 U	100 U
Chloroform	ug/L	MRL	26 J	7.3 J B	**1.7** B	**1.6** B	0.29 J B	**15** B	2.9 J	**11** B	1.6 J	**8.8**
Methacrylonitrile	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Propionitrile	ug/L	MRL	500 U	59 U	4.0 U	4.0 U	4.0 U	35 U	15 U	4.0 U	9.6 U	29 U
Bromochloromethane	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Isobutyl alcohol	ug/L	MRL	6300 U	740 U	50 U	50 U	50 U	440 U	190 U	50 U	120 U	370 U
Benzene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Carbon tetrachloride	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
1,1,1-Trichloroethane	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
1,1-Dichloropropene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Methyl t-butyl ether	ug/L	MRL	130 U *	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U *	1.0 U	2.4 U *	7.3 U *
1,1-Dichloroethane	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
1,2-Dichloroethene, Total	ug/L	MRL	**3600**	**1100**	**11**	1.0 U	1.0 U	**240**	**53**	**7.6**	**82**	**610**
Acrylonitrile	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
trans-1,2-Dichloroethene	ug/L	MRL	130 U	5.6 J	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	4.7 J
cis-1,2-Dichloroethene	ug/L	MRL	**3600**	**1100**	**11**	1.0 U	0.24 J	**240**	**53**	**7.6**	**82**	**610**
2-Butanone	ug/L	MRL	220 J	74 U	5.0 U	5.0 U	5.0 U	44 U	19 U	5.0 U	5.6 J	37 U
2,2-Dichloropropane	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Vinyl acetate	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Chloroprene	ug/L	MRL	130 U	15 U	1.0 U	1.0 U	1.0 U	8.8 U	3.7 U	1.0 U	2.4 U	7.3 U
Dilution Factor												
Date Analyzed												

Notes:
All values reported in micrograms per liter (ug/l)
B=Compound was found in the Blank and the Sample.

Groundwater Analytical Data
Volatile Organic Compounds SW-846 EPA Method :
Burgess Brothers Superufund Site, Woodford and E
Test America SDG 200-12498-1

Analyte	Units	Reports To	200-12545-7 PZ14D-PD-W1 8/30/2012 11:15 AM	200-12545-15 PZ24-PD-W1 8/31/2012 12:15 PM	200-12545-10 PZ170-PD-W1 8/30/2012 7:40 AM	200-12545-16 W171-PD-W1 8/31/2012 12:00 PM	200-12518-3 TB155-PD-W1 8/29/2012 12:00 AM	200-12545-9 TB156-PD-W1 8/28/2012 12:00 AM	200-12694-1 SW-22-39 9/12/2012 5:30 PM	200-12694-2 SW-21-39 9/12/2012 5:45 PM	200-12694-3 SW-20-39 9/12/2012 5:53 PM	200-12694-4 SW-19-39 9/12/2012 6:00 PM	200-12694-5 P-01-39 9/12/2012 4:35 PM	200-12694-9 P-02-39 9/12/2012 3:45 PM
Tetrachloroethene	ug/L	MRL	1.0 U	1.0 U	29	8.2	1.0 U	1.0 U	1.0 U	0.33 J	1.1	2.2	210	7.5
1,3-Dichloropropane	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
1,1,2-Trichloroethane	ug/L	MRL	1.0 U	1.0 U	1.0 U	7.3	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
trans-1,3-Dichloropropene	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Ethyl methacrylate	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U *	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Chlorobenzene	ug/L	MRL	1.0 U	1.0 U	1.0 U	27	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
1,1,1,2-Tetrachloroethane	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
1,2-Dichlorobenzene	ug/L	MRL	1.0 U	1.0 U	1.0 U	16	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
2-Hexanone	ug/L	MRL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	17 U	5.0 U
Dibromochloromethane	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Methyl methacrylate	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.2 B *	1.2 B *	1.2 B *	1.2 B *	4.0 B *	3.7 * B
1,4-Dioxane	ug/L	MRL	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	170 U	50 U
Dibromomethane	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Trichloroethene	ug/L	MRL	1.0 U	1.0 U	10	9.4	1.0 U	1.0 U	1.0 U	0.28 J	0.79 J	1.5	210	7.3
1,2-Dichloropropane	ug/L	MRL	1.0 U	1.0 U	1.0 U	10	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
4-Methyl-2-pentanone	ug/L	MRL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	17 U	5.0 U
Toluene	ug/L	MRL	1.0 U	1.0 U	1.0 U	4.2	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
cis-1,3-Dichloropropene	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Bromodichloromethane	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
2-Chloroethyl vinyl ether	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Ethylbenzene	ug/L	MRL	1.0 U	1.0 U	1.0 U	7.8	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
1,3,5-Trimethylbenzene	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
tert-Butylbenzene	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
4-Chlorotoluene	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
n-Propylbenzene	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
2-Chlorotoluene	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
4-Isopropyltoluene	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
1,4-Dichlorobenzene	ug/L	MRL	1.0 U	1.0 U	1.0 U	7.8	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
1,3-Dichlorobenzene	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
1,2,4-Trimethylbenzene	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
sec-Butylbenzene	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Styrene	ug/L	MRL	1.0 U	1.0 U	1.0 U	5.5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Bromoform	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Xylenes, Total	ug/L	MRL	1.0 U	1.0 U	1.0 U	21	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
m&p-Xylene	ug/L	MRL	1.0 U	1.0 U	1.0 U	12	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
o-Xylene	ug/L	MRL	1.0 U	1.0 U	1.0 U	8.9	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
1,2,3-Trichloropropane	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
trans-1,4-Dichloro-2-butene	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
1,1,2,2-Tetrachloroethane	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Isopropylbenzene	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Bromobenzene	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
1,2-Dichloroethane	ug/L	MRL	1.0 U	1.0 U	1.0 U	12	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Acrolein	ug/L	MRL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	17 U	5.0 U
1,1-Dichloroethene	ug/L	MRL	1.0 U	1.0 U	1.0 U	4	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.4 J	1.0 U
Trichlorofluoromethane	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Bromomethane	ug/L	MRL	1.0 U *	1.0 U *	1.0 U *	1.0 U *	1.0 U *	1.0 U *	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Chloroethane	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Carbon disulfide	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Allyl chloride	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Methyl iodide	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Freon TF	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Acetone	ug/L	MRL	3.8 J	1.2 J	2.9 J	5.0 U	1.8 J	1.4 J	5.0 U	5.0 U	5.0 U	5.0 U	17 U	5.0 U
Hexachlorobutadiene	ug/L	MRL	1.0 U *	1.0 U *	1.0 U *	1.0 U *	1.0 U	1.0 U *	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
1,2,4-Trichlorobenzene	ug/L	MRL	1.0 U	1.0 U	1.0 U	11	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Naphthalene	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
1,2-Dibromoethane	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
1,2,3-Trichlorobenzene	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Chloromethane	ug/L	MRL	0.40 J	0.30 J	0.31 J	1.0 U	0.28 J B	0.27 J	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Vinyl chloride	ug/L	MRL	1.0 U	1.0 U	1.0 U	2.1	1.0 U	1.0 U	1.0 U	1.0 U	0.36 J	1.2	3.4 U	1.0 U
Dichlorodifluoromethane	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.0 J	1.0 U
1,2-Dibromo-3-Chloropropane	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
n-Butylbenzene	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Methylene Chloride	ug/L	MRL	0.41 J B	0.40 J B	0.43 J B	8.1 B	0.41 J B	0.42 J B	0.48 J B	0.48 J B	0.51 J B	0.50 J B	1.7 J B	0.49 J B
Tetrahydrofuran	ug/L	MRL	14 U	14 U	14 U	14 U	14 U	14 U	14 U *	14 U *	14 U *	14 U *	48 U *	14 U
Chloroform	ug/L	MRL	0.55 J B	1.1 B	0.28 J B	0.31 J B	1.0 U	0.20 J B	0.25 J B	0.27 J B	0.28 J B	0.27 J B	1.0 J B	0.25 J B
Methacrylonitrile	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Propionitrile	ug/L	MRL	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	14 U	4.0 U
Bromochloromethane	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Isobutyl alcohol	ug/L	MRL	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	170 U	50 U
Benzene	ug/L	MRL	1.0 U	1.0 U	1.0 U	8.9	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Carbon tetrachloride	ug/L	MRL	1.0 U	1.0 U	1.0 U	13	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
1,1,1-Trichloroethane	ug/L	MRL	1.0 U	1.0 U	1.0 U	18	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
1,1-Dichloropropene	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Methyl t-butyl ether	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U *	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
1,1-Dichloroethane	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
1,2-Dichloroethene, Total	ug/L	MRL	1.0 U	1.0 U	1.1	51	1.0 U	1.0 U	1.0 U	1.3	4.2	8.5	60	1.0 U
Acrylonitrile	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
trans-1,2-Dichloroethene	ug/L	MRL	1.0 U	1.0 U	1.0 U	27	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
cis-1,2-Dichloroethene	ug/L	MRL	1.0 U	1.0 U	1.1	25	1.0 U	1.0 U	0.29 J	1.3	4.2	8.5	60	0.29 J
2-Butanone	ug/L	MRL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	17 U	5.0 U
2,2-Dichloropropane	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Vinyl acetate	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Chloroprene	ug/L	MRL	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4 U	1.0 U
Dilution Factor														
Date Analyzed														

Notes:
All values reported in micrograms per liter (ug/l)
B=Compound was found in the Blank and the Sample.

Groundwater Analytical Data
Volatile Organic Compounds SW-846 EPA Method :
Burgess Brothers Superufund Site, Woodford and E
Test America SDG 200-12498-1

Analyte	Units	Reports To	200-12694-8 P-08-39 9/12/2012 4:20 PM	200-12694-10 P-19-39 9/13/2012 9:15 AM	200-12694-11 P-20-39 9/13/2012 9:45 AM	200-12694-6 P-21-39 9/12/2012 3:10 PM	200-12694-7 P-22-39 9/12/2012 3:20 PM	200-12710-1 W-150-39 9/13/2012 10:00 AM	200-12694-12 TB-150-39 9/11/2012 12:00 AM
Tetrachloroethene	ug/L	MRL	0.98 J	**98**	1.0 U	0.57 J	0.18 J	**12**	1.0 U
1,3-Dichloropropane	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	**3.6**	1.0 U
trans-1,3-Dichloropropene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Ethyl methacrylate	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chlorobenzene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	**15**	1.0 U
1,1,1,2-Tetrachloroethane	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	**14**	1.0 U
2-Hexanone	ug/L	MRL	5.0 U	11 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Dibromochloromethane	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methyl methacrylate	ug/L	MRL	**3.6 * B**	**8.5 * B**	**3.9 * B**	**1.3 B ***	**3.7 * B**	**1.4 * B**	**3.8 * B**
1,4-Dioxane	ug/L	MRL	50 U	110 U	50 U	50 U	50 U	50 U	50 U
Dibromomethane	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	ug/L	MRL	0.58 J	**120**	1.0 U	0.38 J	1.0 U	**18**	1.0 U
1,2-Dichloropropane	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	**12**	1.0 U
4-Methyl-2-pentanone	ug/L	MRL	5.0 U	11 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Toluene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	**18**	1.0 U
cis-1,3-Dichloropropene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Chloroethyl vinyl ether	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Ethylbenzene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	**17**	1.0 U
1,3,5-Trimethylbenzene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
tert-Butylbenzene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Chlorotoluene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Propylbenzene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Chlorotoluene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Isopropyltoluene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	**12**	1.0 U
1,3-Dichlorobenzene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
sec-Butylbenzene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Styrene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	**5.5**	1.0 U
Bromoform	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Xylenes, Total	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	**9.3**	1.0 U
m&p-Xylene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	**5.3**	1.0 U
o-Xylene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	**4**	1.0 U
1,2,3-Trichloropropane	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,4-Dichloro-2-butene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Isopropylbenzene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromobenzene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	**6.5**	1.0 U
Acrolein	ug/L	MRL	5.0 U	11 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,1-Dichloroethene	ug/L	MRL	1.0 U	0.84 J	1.0 U	1.0 U	1.0 U	**6.9**	1.0 U
Trichlorofluoromethane	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon disulfide	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Allyl chloride	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methyl iodide	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Freon TF	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Acetone	ug/L	MRL	5.0 U	11 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Hexachlorobutadiene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trichlorobenzene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	**6**	1.0 U
Naphthalene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	0.39 J	1.0 U
1,2-Dibromoethane	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichlorobenzene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Vinyl chloride	ug/L	MRL	1.0 U	1.4 J	1.0 U	1.0 U	1.0 U	**7.5**	1.0 U
Dichlorodifluoromethane	ug/L	MRL	1.0 U	**2.5**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromo-3-Chloropropane	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Butylbenzene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene Chloride	ug/L	MRL	0.47 J B	1.1 J B	0.48 J B	0.51 J B	0.49 J B	**16 B**	0.56 J B
Tetrahydrofuran	ug/L	MRL	14 U	31 U	14 U	14 U *	14 U	14 U	14 U
Chloroform	ug/L	MRL	0.25 J B	0.56 J B	0.25 J B	0.27 J B	0.26 J B	0.37 J B	0.26 J B
Methacrylonitrile	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Propionitrile	ug/L	MRL	4.0 U	8.8 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U
Bromochloromethane	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Isobutyl alcohol	ug/L	MRL	50 U	110 U	50 U	50 U	50 U	50 U	50 U
Benzene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	**12**	1.0 U
Carbon tetrachloride	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	**9.7**	1.0 U
1,1,1-Trichloroethane	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	**11**	1.0 U
1,1-Dichloropropene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methyl t-butyl ether	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethene, Total	ug/L	MRL	1.0 U	**45**	1.0 U	0.39 J	1.0 U	**37**	1.0 U
Acrylonitrile	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	**13**	1.0 U
cis-1,2-Dichloroethene	ug/L	MRL	1.0 U	**45**	1.0 U	0.39 J	1.0 U	**24**	1.0 U
2-Butanone	ug/L	MRL	5.0 U	11 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2,2-Dichloropropane	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Vinyl acetate	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroprene	ug/L	MRL	1.0 U	2.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dilution Factor									
Date Analyzed									

Notes:
All values reported in micrograms per liter (ug/l)
B=Compound was found in the Blank and the Sample.

Table 2: Summary of Performance Evaluation Sample (PES) Results

Pre-Design Investigation
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont
Groundwater Sampling SDG: 200-12498-1

	W-171-PD-W1 *TA Analysis*	*Lot No. S171-703* *ID No. 0822-12-02.1*	
Parameter	*VOCs Method 8260B High Level*	*Certified Value*	*QC Performance Acceptance Limits*
Aqueous (ug/L)			
1,1,1,2-Tetrachloroethane	1 U		
1,1,1-Trichloroethane	18	18.7	13.5 - 23.2
1,1,2,2-Tetrachloroethane	1 U		
1,1,2-Trichloroethane	7.3	8.86	6.84 - 10.9
1,1-Dichloroethane	1 U		
1,1-Dichloroethene	4	3.77	2.60 - 4.94
1,1-Dichloropropene	1 U		
1,2,3-Trichlorobenzene	1 U		
1,2,3-Trichloropropane	1 U		
1,2,4-Trichlorobenzene	11	13.4	8.59 - 16.9
1,2,4-Trimethylbenzene	1 U		
1,2-Dibromo-3-Chloropropane	1 U		
1,2-Dibromoethane	1 U		
1,2-Dichlorobenzene	16	18.0	13.7 - 22.0
1,2-Dichloroethane	12	13.2	10.3 - 16.5
1,2-Dichloropropane	10	11.5	8.89 - 14.1
1,3,5-Trimethylbenzene	1 U		
1,3-Dichlorobenzene	1 U		
1,3-Dichloropropane	1 U		
1,4-Dichlorobenzene	7.8	9.06	6.52 - 11.1
1,4-Dioxane	50 U		
2,2-Dichloropropane	1 U		
2-Butanone	5 U		
2-Chloroethyl vinyl ether	1 U		
2-Chlorotoluene	1 U		
2-Hexanone	5 U		
4-Chlorotoluene	1 U		
4-Isopropyltoluene	1 U		
4-Methyl-2-pentanone	5 U		
Acetone	5 U		
Acrolein	5 U		
Acrylonitrile	1 U		
Allyl chloride	1 U		
Benzene	8.9	9.69	7.62 - 11.7
Bromobenzene	1 U		
Bromochloromethane	1 U		
Bromodichloromethane	1 U		
Bromoform	1 U		
Bromomethane	1 U *		
Carbon disulfide	1 U		
Carbon tetrachloride	13	13.6	9.33 - 17.1
Chlorobenzene	27	30.2	23.6 - 36.8
cis-1,2-Dichloroethene	25	26.6	19.9 - 32.7
cis-1,3-Dichloropropene	1 U		
Dibromochloromethane	1 U		
Dibromomethane	1 U		
Dichlorodifluoromethane	1 U		

Parameter	W-171-PD-W1 TA Analysis VOCs Method 8260B High Level	Lot No. S171-703 ID No. 0822-12-02.1 Certified Value	QC Performance Acceptance Limits
Ethyl methacrylate	1 U		
Ethylbenzene	7.8	8.45	6.42 - 10.5
Freon TF	1 U		
Hexachlorobutadiene	1 U *		
Isobutyl alcohol	50 U		
Isopropylbenzene	1 U		
m&p-Xylene	12	13.66	10.33 - 16.94
Methacrylonitrile	1 U		
Methyl iodide	1 U		
Methyl methacrylate	1 U		
Methyl t-butyl ether	1 U		
Methylene Chloride	8.1 B	8.96	6.23 - 11.5
Naphthalene	1 U		
n-Butylbenzene	1 U		
n-Propylbenzene	1 U		
o-Xylene	8.9	9.82	7.42 - 12.2
Propionitrile	4 U		
sec-Butylbenzene	1 U		
Styrene	5.5	6.44	4.83 - 8.11
tert-Butylbenzene	1 U		
Tetrachloroethene	8.2	9.03	6.18 - 10.9
Tetrahydrofuran	14 U		
Toluene	4.2	4.77	3.69 - 5.77
trans-1,2-Dichloroethene	27	27.8	20.7 - 34.8
trans-1,3-Dichloropropene	1 U		
trans-1,4-Dichloro-2-butene	1 U		
Trichloroethene	9.4	10.3	7.63 - 12.3
Trichlorofluoromethane	1 U		
Vinyl acetate	1 U		
Vinyl chloride	2.1	2.00	1.18 - 2.94
1,2-Dichlorobenzene-d4	22		
1,2-Dichloroethane-d4	24		
Bromofluorobenzene	24		
Toluene-d8	24		
1,2-Dichloroethene, Total	51		
Xylenes, Total	21	23.5	17.8 - 29.1

Notes
TA = Test America in South Burlington, VT
verification.

The QC Performance Acceptance Limits (QC PALs) based on actual historical dta collected in ERA's Prificiency Testing program. QC PALs reflect any inherent biases in the methods used to establish the limits and closely approximate a 95% confidence interval of the performance that experienced laboratories should achieve using accepted environmental methods.

Table 2: Summary of Performance Evaluation Sample (PES) Results

Fall 2012 Post-Closure Environmental Monitoring
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont
Groundwater Sampling SDG: 200-12498-1

	W150-39 TA Analysis	*Lot No. S174-703 ID No. 0910-12-01*	
Parameter	*VOCs Method 8260B Routine Level*	*Certified Value*	*QC Performance Acceptance Limits*
Aqueous (ug/L)			
W150-39			
1,1,1,2-Tetrachloroethane	1 U		
1,1,1-Trichloroethane	11	11.7	8.42 - 14.5
1,1,2,2-Tetrachloroethane	1 U		
1,1,2-Trichloroethane	3.6	3.94	3.04 - 4.85
1,1-Dichloroethane	1 U		
1,1-Dichloroethene	6.9	7.06	4.88 - 9.25
1,1-Dichloropropene	1 U		
1,2,3-Trichlorobenzene	1 U		
1,2,3-Trichloropropane	1 U		
1,2,4-Trichlorobenzene	6	6.41	4.11 - 8.08
1,2,4-Trimethylbenzene	1 U		
1,2-Dibromo-3-Chloropropane	1 U		
1,2-Dibromoethane	1 U		
1,2-Dichlorobenzene	14	14.2	10.8 - 17.3
1,2-Dichloroethane	6.5	6.71	5.21 - 8.39
1,2-Dichloropropane	12	12.5	9.66 - 15.4
1,3,5-Trimethylbenzene	1 U		
1,3-Dichlorobenzene	1 U		
1,3-Dichloropropane	1 U		
1,4-Dichlorobenzene	12	13.6	9.79 - 16.7
1,4-Dioxane	50 U		
2,2-Dichloropropane	1 U		
2-Butanone	5 U		
2-Chloroethyl vinyl ether	1 U		
2-Chlorotoluene	1 U		
2-Hexanone	5 U		
4-Chlorotoluene	1 U		
4-Isopropyltoluene	1 U		
4-Methyl-2-pentanone	5 U		
Acetone	5 U		
Acrolein	5 U		
Acrylonitrile	1 U		
Allyl chloride	1 U		
Benzene	12	12.5	9.82 - 15.1
Bromobenzene	1 U		
Bromochloromethane	1 U		
Bromodichloromethane	1 U		
Bromoform	1 U		
Bromomethane	1 U		
Carbon disulfide	1 U		
Carbon tetrachloride	9.7	10.9	7.48 - 13.7
Chlorobenzene	15	16.4	12.8 - 20.0
Chloroethane	1 U		
Chloroform	0.37 J B		
Chloromethane	1 U		
Chloroprene	1 U		
cis-1,2-Dichloroethene	24	25.0	18.7 - 30.8

Parameter	W150-39 TA Analysis VOCs Method 8260B Routine Level	Lot No. S174-703 ID No. 0910-12-01 Certified Value	QC Performance Acceptance Limits
cis-1,3-Dichloropropene	1 U		
Dibromochloromethane	1 U		
Dibromomethane	1 U		
Dichlorodifluoromethane	1 U		
Ethyl methacrylate	1 U		
Ethylbenzene	17	19.2	14.6 - 23.8
Freon TF	1 U		
Hexachlorobutadiene	1 U		
Isobutyl alcohol	50 U		
Isopropylbenzene	1 U		
m&p-Xylene	5.3	5.75	4.35 - 7.13
Methacrylonitrile	1 U		
Methyl iodide	1 U		
Methyl methacrylate	1.4 * B		
Methyl t-butyl ether	1 U		
Methylene Chloride	16 B	18.4	12.8 - 23.6
Naphthalene	0.39 J		
n-Butylbenzene	1 U		
n-Propylbenzene	1 U		
o-Xylene	4	4.23	3.20 - 5.24
Propionitrile	4 U		
sec-Butylbenzene	1 U		
Styrene	5.5	6.01	4.51 - 7.57
tert-Butylbenzene	1 U		
Tetrachloroethene	12	14.2	9.71 - 17.2
Tetrahydrofuran	14 U		
Toluene	18	19.2	14.9 - 23.2
trans-1,2-Dichloroethene	13	14.2	10.6 - 17.8
trans-1,3-Dichloropropene	1 U		
trans-1,4-Dichloro-2-butene	1 U		
Trichloroethene	18	20.0	14.8 - 23.8
Trichlorofluoromethane	1 U		
Vinyl acetate	1 U		
Vinyl chloride	7.5	8.60	5.08 - 12.6
1,2-Dichlorobenzene-d4	23		
1,2-Dichloroethane-d4	24		
Bromofluorobenzene	25		
Toluene-d8	24		
1,2-Dichloroethene, Total	37		
Xylenes, Total	9.3	9.98	7.54 - 12.4

Notes

TA = Test America in South Burlington, VT

The Certified Values are the actual 'made to' concentrations confirmed by ERA analytical verification.

The QC Performance Acceptance Limits (QC PALs) based on actual historical dta collected in ERA's Prificiency Testing program. QC PALs reflect any inherent biases in the methods used to establish the limits and closely approximate a 95% conficence interval of the performance that experienced laboratories should achieve using accepted environmental methods.

XI. ACCURACY CHECK (Performance Evaluation Results)

SDG No.: 200-12498-1

Are more than one-half of the PES analytes within criteria for each parameter. Y N

PE Sample No./ ERA ID No,	Lot No.	Parameter	Type of PES	Matrix	Analyte	W151-PD-W1 TA Analysis (ug/l)	Non-EPA PES Scores**	Samples Affected	Action
W171-PD-W1/ ID No. 0822-12-02.1	S171703	VOCs	VOA	Aq.					

* For Region I PESs indicate the Region I PES Score Report Result: Action High; Action Low; TCL MISS; TCL CONTAMINANT; TIC HIT; TIC MISS; TIC CONTAMINANT

** For Non-EPA PESs indicate the Non-EPA PES Score: PES Compound MISS; PES Compound CONTAMINANT; PES Compound HIT (Range)

TIC Tentatively Identifiable Compound

Validator: Ann Marie Petricca

Date: 12/11/2012

XI. ACCURACY CHECK (Performance Evaluation Results)

SDG No.: 200-12498-1

Are more than one-half of the PES analytes within criteria for each parameter. Y N

PE Sample No./ ERA ID No,	Lot No.	Parameter	Type of PES	Matrix	Analyte	W151-PD-W1 TA Analysis (ug/l)	Non-EPA PES Scores**	Samples Affected	Action
W150-39/ ID No. 0910-12-01	S174703	VOCs	VOA	Aq.	Naphthalene	0.39 J	Not Present	PZ12D-PD-W1, PZ13D-PD-W1, PZ13S-PD-W1, PZ14D-PD-W1, PZ14S-PD-W1, TB156-PD-W1, PZ170-PD-W1, PZ10D-PD-W1, PZ7D-PD-W1, PZ10S-PD-W1, PZ12S-PD-W1, PZ24-PD-W1, W171-PD-W1, SW-22-39, SW-21-39, SW-20-39, SW-19-39, P-01-39, P-21-39, P-22-39, P-08-39, P-02-39, P-19-39, P-20-39, TB-150-39, and W-150-39, ML2-PD-W6(25'-28'), ML2-PD-W7(4'-6'), and TB155-PD-W1	J

* For Region I PESs indicate the Region I PES Score Report Result: Action High; Action Low; TCL MISS; TCL CONTAMINANT; TIC HIT; TIC MISS; TIC CONTAMINANT

** For Non-EPA PESs indicate the Non-EPA PES Score: PES Compound MISS; PES Compound CONTAMINANT; PES Compound HIT (Range)

TIC Tentatively Identifiable Compound

Validator: Ann Marie Petrosa

Date: 12/11/2012

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 200-12498-1

SDG Number: 200-12498

Job Description: Fall 2012 PCEM

For:
Environmental Partners Group
1900 Crown Colony Drive
Suite 402
Quincy, MA 02169

Attention: Ms. Ann Marie Petricca

Approved for release.
Sara S Goff
Project Manager I
9/28/2012 12:26 PM

Sara S Goff
Project Manager I
sara.goff@testamericainc.com
09/28/2012

The test results in this report relate only to sample(s) as received by the laboratory. These test results were derived under a quality system that adheres to the requirements of NELAC. Pursuant to NELAC, this report may not be produced in full without written approval from the laboratory

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CASE NARRATIVE

Client: Environmental Partners Group

Project: Fall 2012 PCEM

Report Number: 200-12498-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT

The samples were received on 08/30/2012, 08/31/2012, 08/31/2012, 09/01/2012, 09/06/2012, 09/14/2012 and 09/15/2012; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 1.0° C, 3.5° C, 4.2° C, 4.6° C, 5.1° C, 5.6° C, and 16.6° C.

The trip blank was not assigned a collection date or time by the samplers. A collection date of 8/29/12 was assigned, coinciding with the first day of collection.

The volume for Total Organic Carbon arrived unpreserved. Sample was transferred into a 250mL H2SO4-preserved amber glass bottle.

Date of collection for sample TB-150-39 was recorded as 1/11/12. Sample logged in per sample ID date of 9/11/12.

VOLATILE ORGANIC COMPOUNDS (GC-MS)

Samples PZ12D-PD-W1, PZ13D-PD-W1, PZ13S-PD-W1, PZ14D-PD-W1, PZ14S-PD-W1, TB156-PD-W1, PZ170-PD-W1, PZ10D-PD-W1, PZ7D-PD-W1, PZ10S-PD-W1, PZ12S-PD-W1, PZ24-PD-W1, W171-PD-W1, SW-22-39, SW-21-39, SW-20-39, SW-19-39, P-01-39, P-21-39, P-22-39, P-08-39, P-02-39, P-19-39, P-20-39, TB-150-39, and W-150-39, ML2-PD-W6(25'-28'), ML2-PD-W7(4'-6'), and TB155-PD-W1 were analyzed for volatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8260B. The samples were analyzed on 09/05/2012, 09/06/2012, 09/20/2012, 09/21/2012 and 09/24/2012.

One or more compounds were detected in method blanks MB 200-44514/5, MB 200-44517/5, MB 200-45245/5, MB 200-45329/5, and MB 200-45357/5 at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged.

Methyl methacrylate was detected in method blanks MB 200-45245/5, MB 200-45329/5, and 200-45357/5 at a level exceeding the reporting limit. If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged.

The initial calibration curve acquired on 08/27/2012 was outside acceptance criteria for Bromomethane, 2-Chloroethyl vinyl ether, Methyl iodide, and 1,2,3-Trichloropropane. The initial calibration verification (ICV) was outside acceptance criteria for Bromomethane and Acrolein. The continuing calibration verification (CCV) for analytical batch 44514 exceeded control criteria for Hexachlorobutadiene, Bromomethane, and 1,4-Dioxane. The continuing calibration verification (CCV) for analytical batch 44517 exceeded control criteria for Chloromethane, Bromomethane, Methyl iodide, and tert-Butyl alcohol. The data have been qualified and reported.

The initial calibration curve acquired on 09/18/2012 was outside acceptance criteria for Bromomethane, Methyl iodide, Propionitrile, 1,4-Dioxane, and Methyl methacrylate. The initial calibration verification (ICV) was outside acceptance criteria for Acrolein and Methyl methacrylate. The continuing calibration verification (CCV) for analytical batch 45245 exceeded control criteria for Vinyl acetate, and Methyl methacrylate. The continuing calibration verification (CCV) for analytical batch 45329 exceeded control criteria for Methyl iodide, Vinyl acetate, and Methyl methacrylate. The continuing calibration verification (CCV) for analytical batch 45357 exceeded control criteria for Methyl iodide, Vinyl acetate, and Methyl methacrylate. The data have been qualified and reported.

One or more compounds failed the recovery criteria for LCS 200-44514/3, LCS 200-44517/3, LCS 200-45245/3, LCS 200-45357/3. Refer to the QC report for details.

One or more compounds failed the recovery and relative percent difference criteria for the matirx spike and matrix spike duplicate of sample PZ7D-PD-W1 in batch 200-44517. Refer to the QC report for details.

Samples ML2-PD-W6(25'-28')[126X], PZ12D-PD-W1[4X], ML2-PD-W7(4'-6')[15X], PZ13D-PD-W1[2X], P-01-39[3X], PZ14S-PD-W1[7X],

P-19-39[2X] and PZ12S-PD-W1[9X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No other difficulties were encountered during the volatiles analyses. All other quality control parameters were within the acceptance limits.

METALS (ICP)
Samples PZ7D-PD-W1, PZ10D-PD-W1, PZ170-PD-W1, PZ10S-PD-W1, and W171-PD-W1 were analyzed for Metals (ICP) in accordance with EPA SW-846 Method 6010C. The samples were prepared on 09/06/2012 and analyzed on 09/09/2012.

Silicon was detected in method blank MB 200-44584/1-A at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

Calcium, Magnesium and Silicon failed the recovery criteria high for the matrix spike of sample PZ7D-PD-W1 in batch 200-44675. Refer to the QC report for details.

No other difficulties were encountered during the metals analyses. All other quality control parameters were within the acceptance limits.

METALS (ICPMS)
Samples PZ170-PD-W1, PZ10D-PD-W1, PZ10S-PD-W1, and W171-PD-W1 were analyzed for metals (ICPMS)in accordance with EPA SW-846 Method 6020A. The samples were prepared on 09/11/2012 and analyzed on 09/15/2012 and 09/27/2012.

Several analytes were detected in method blank MB 200-44817/1-A at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

The serial dilution performed for sample W171-PD-W1 was outside control limit for Zinc.

Sample W171-PD-W1[10X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No other difficulties were encountered during the metals analyses. All other quality control parameters were within the acceptance limits.

HEXAVALENT CHROMIUM
Sample W171-PD-W1, PZ10S-PD-W1, PZ10D-PD-W1, and PZ170-PD-W1 were analyzed for hexavalent chromium in accordance with EPA SW-846 Method 7196A. The samples were analyzed on 08/31/2012 and 09/06/2012.

Sample W171-PD-W1 was received outside of holding time.

Chromium (hexavalent) failed the recovery criteria low for the matrix spike duplicate of sample W171-PD-W1 in batch 680-248937. Refer to the QC report for details.

No other difficulties were encountered during the hexavalent chromium analysis. All other quality control parameters were within the acceptance limits.

TOTAL MERCURY
Samples PZ170-PD-W1, PZ10D-PD-W1, PZ10S-PD-W1, and W171-PD-W1 were analyzed for total mercury in accordance with EPA SW-846 Methods 7470A. The samples were prepared on 09/04/2012 and analyzed on 09/05/2012.

No difficulties were encountered during the mercury analyses. All quality control parameters were within the acceptance limits.

ALKALINITY
Samples PZ7D-PD-W1, PZ10S-PD-W1, PZ10D-PD-W1, PZ170-PD-W1, and W171-PD-W1 were analyzed for alkalinity in accordance with SM20 2320B. The samples were analyzed on 08/31/2012, 09/11/2012 and 09/13/2012.

No difficulties were encountered during the alkalinity analyses. All quality control parameters were within the acceptance limits.

TOTAL DISSOLVED SOLIDS
Samples PZ170-PD-W1, PZ10D-PD-W1, PZ7D-PD-W1, PZ10S-PD-W1, and W171-PD-W1 were analyzed for total dissolved solids in accordance with SM20 2540C. The samples were analyzed on 09/05/2012.

No difficulties were encountered during the TDS analyses. All quality control parameters were within the acceptance limits.

ORTHOPHOSPHATE
Sample W171-PD-W1, PZ10D-PD-W1, PZ170-PD-W1, PZ7D-PD-W1, and PZ10S-PD-W1 were analyzed for Orthophosphate in accordance with SM20 4500 P F. The samples were analyzed on 08/31/2012 and 09/06/2012.

Orthophosphate failed the recovery criteria low for the matrix spike and matrix spike duplicate of sample W171-PD-W1 in batch 680-248938. Refer to the QC report for details.

Sample W171-PD-W1[5X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No other difficulties were encountered during the orthophosphate analyses. All other quality control parameters were within the acceptance limits.

ANIONS (Chloride and Sulfate)
Samples PZ7D-PD-W1, PZ10S-PD-W1 PZ10D-PD-W1, PZ170-PD-W1, W171-PD-W1 were analyzed for anions, Chloride and Sulfate, in accordance with EPA SW-846 Method 9056. The samples were analyzed on 08/30/2012, 09/06/2012 and 09/11/2012.

Sulfate failed the recovery criteria low for the matrix spike duplicate of sample PZ7D-PD-W1 in batch 680-248849. Refer to the QC report for details.

No other difficulties were encountered during the anions analyses. All other quality control parameters were within the acceptance limits.

ANIONS (Nitrate and Nitrite)
Samples W171-PD-W1, PZ7D-PD-W1, PZ10S-PD-W1, PZ10D-PD-W1, and PZ170-PD-W1 were analyzed for anions, Nitrate and Nitrite, in accordance with EPA SW-846 Method 9056A. The samples were analyzed on 08/30/2012, 08/31/2012 and 09/06/2012.

No difficulties were encountered during the anions, Nitrate and Nitrite, analysis. All quality control parameters were within the acceptance limits.

TOTAL ORGANIC CARBON
Samples PZ170-PD-W1, PZ10D-PD-W1, PZ7D-PD-W1, PZ10S-PD-W1 and W171-PD-W1 were analyzed for total organic carbon in accordance with EPA SW-846 Method 9060A. The samples were analyzed on 09/05/2012.

No difficulties were encountered during the TOC analyses. All quality control parameters were within the acceptance limits.

DISSOLVED ORGANIC CARBON
Samples PZ170-PD-W1, PZ10D-PD-W1, PZ7D-PD-W1 and PZ10S-PD-W1 were analyzed for Dissolved Organic Carbon in accordance with 9060. The samples were analyzed on 09/06/2012 and 09/10/2012.

No difficulties were encountered during the DOC analyses. All quality control parameters were within the acceptance limits.

December 11, 2012

Terrence Connelly
Remedial Project Manager
US Environmental Protection Agency – Region 1
5 Post Office Square, Suite 100
Boston, MA 02109-3912

Re: SDG 200-12498
TestAmerica Laboratories, Inc.
Burgess Brothers Superfund Site
Pre-Design Investigation
Tier I Inorganics, TOC/DOC Data Validation – Groundwater Samples

Anions, TDS, Alkalinity TOC/DOC:	4 / Aqueous / PZ170-PD-W1, PZ-7D-PD-1, PZ10D-PD-W1, PZ10S-PD-W1
Cations:	4 / Aqueous / PZ170-PD-W1, PZ-7D-PD-1, PZ10D-PD-W1, PZ10S-PD-W1
PP13 Metals and Hexavalent Chromium:	3 / Aqueous / PZ170-PD-W1, PZ10D-PD-W1, PZ10S-PD-W1 1 / Aqueous PES / W171-PD-1

Dear Mr. Connelly:

A Tier I data validation, in accordance with Region I, EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses, December 1996 criteria, and criteria required under the Pre-Design Investigation (PDI) Quality Assurance Project Plan (QAPP), dated July 2012, was performed on the inorganic analytical data for 4 aqueous samples and 1 aqueous PES collected by Environmental Partners Group, Inc. from the Burgess Brothers Superfund Site. These aqueous samples and PES were analyzed for the following parameters:

- Priority Pollutant 13 Metals EPA SW-846 Methods 6020A, 7470, and 7196A
- Hexavalent Chromium Method 7196A
- Anions EPA SW-846 Method 9056A
- Orthophosphate Method 365.4
- Cations EPA SW-846 Method 6010C
- Alkalinity SM 2320B
- Total Dissolved Solids SM 2540C
- Total Organic Carbon/Dissolved Organic Carbon EPA SW-846 Method 9060A

In accordance with the PDI QAPP, Tier I Data Validation was deemed sufficient for the groundwater samples at this time, except for Priority Pollutant 13 Metals and hexavalent chromium, for which a Tier II Data Validation is also performed.

A summary of the laboratory analytical results for this SDG, including method reporting limits and dilution factors, is attached as Table 1.

A Tier I data validation is based on the following parameters:

- Complete Sample Delivery Group Files (CFS) Completeness Evidence Audit
- Evaluation of Performance Evaluation Sample (PES) Results

A CFS Completeness Evidence Audit was performed for this Sample Delivery Group (SDG) 200-12498-1 aqueous data. All criteria were met for this parameter. The attached Lab Report Table of Contents and Narrative provide the completeness information for this SDG.

The PES results were evaluated for this SDG aqueous data and are summarized in Table 2. All criteria were not met. The laboratory quantitation for selenium, hexavalent chromium, and alkalinity were outside the lower limit of the vendor's documented acceptance limits; this is less than one-half of the PES analytes. If a Tier II or Tier IIII validation were performed, the following actions would be applied to the selenium, hexavalent chromium, and alkalinity data:

- Estimate (J) the compound when detected in any compound to indicate potential low bias
- Reject (R) the quantitation limit in all samples to indicate that the data are unusable due to the possibility of false negatives

A XI Accuracy Check (PE Results) Form is also attached. Selenium and hexavalent chromium are not contaminants of concern in groundwater at the Site. The PE Sample for hexavalent chromium was received outside of holding time, due to weather delays within Fed Ex. Hexavalent chromium failed the recovery criteria low for the matrix spike duplicate of PE Sample W171-PD-W1. The PE sample for PP13 Metals required a 10 times dilution prior to analysis.

Alkalinity laboratory QC parameters were within acceptable limits. Alkalinity is one of several parameters used to evaluate potential passivation effects associated with a zero-valent iron (ZVI) remedy. Additional data validation should be performed for the alkalinity data if a ZVI remedy is selected.

Environmental Partners recommends that the inorganics aqueous data in this SDG be accepted and that no further data validation be performed. Please contact Ann Marie Petricca at (617) 657-0299 should you have any questions or comments regarding this report.

Sincerely,

Ann Marie Petricca

Ann Marie Petricca, CPG
Data Validator

Attachments:
1. Data Summary Table
2. Accuracy Check/PES Score Report
3. Completeness Evidence Audit

cc: Geoffrey Seibel, *de maximis, inc.*

Table 1: Groundwater Analytical Data
Inorganic Analyses
Burgess Brothers Superufund Site, Woodford and Bennington, VT
Test America SDG 200-12498-1

Analyte	Units	Reports To	Basis	200-12545-12 PZ7D-PD-W1 8/29-30/2012	200-12545-13 PZ10S-PD-W1 8/30/2012	200-12545-11 PZ10D-PD-W1 8/29-30/2012	200-12545-10 PZ170-PD-W1 8/29-30/2012	200-12545-16 W171-PD-W1 8/31/2012 9/4/2012
Total Dissolved Solids	mg/L	MRL	Total	**111**	**154**	**126**	**118**	**542**
Orthophosphate	mg/L	MRL	Total	0.050 U	0.050 U	0.050 U	0.050 U	**3.1**
Total Organic Carbon								
TOC Result 2	mg/L	MRL	Total	1.0 U	**1.2**	1.0 U	1.0 U	**5.1**
TOC Result 1	mg/L	MRL	Total	1.0 U	**1.2**	1.0 U	1.0 U	**5.2**
TOC Result 3	mg/L	MRL	Total	1.0 U	**1.1**	1.0 U	1.0 U	**5.1**
TOC Result 4	mg/L	MRL	Total	1.0 U	**1.2**	1.0 U	1.0 U	**5.1**
Total Organic Carbon	mg/L	MRL	Total	1.0 U	**1.2**	1.0 U	1.0 U	**5.2**
Dissolved Organic Carbon								
DOC Result 2	mg/L	MRL	Dissolved	**2.4**	**3.5**	**2.3**	1.0 U	
DOC Result 1	mg/L	MRL	Dissolved	**2.3**	**3.6**	**2.5**	1.0 U	
DOC Result 3	mg/L	MRL	Dissolved	**2.2**	**3.6**	**2.4**	1.0 U	
DOC Result 4	mg/L	MRL	Dissolved	**2.2**	**3.6**	**2.3**	1.0 U	
Dissolved Organic Carbon	mg/L	MRL	Dissolved	**2.2**	**3.6**	**2.4**	1.0 U	
Metals (ICP/MS)								
Lead	ug/L	MRL	Total		0.42 J B	0.081 J B	0.21 J B	**32.8** B
Nickel	ug/L	MRL	Total		20.0 U	20.0 U	20.0 U	**263**
Copper	ug/L	MRL	Total		0.67 J	0.73 J	2.3 J	**1450**
Antimony	ug/L	MRL	Total		20.0 U	20.0 U	0.081 J	**37.3**
Zinc	ug/L	MRL	Total		1.8 J B	1.3 J B	7.6 J B	**798**
Thallium	ug/L	MRL	Total		2.0 U	2.0 U	0.21 J B	**8.5** B
Selenium	ug/L	MRL	Total		0.41 J	2.0 U	2.0 U	**63.1**
Arsenic	ug/L	MRL	Total		0.34 J B	2.0 U	0.26 J B	**29.2** B
Silver	ug/L	MRL	Total		2.0 U	2.0 U	0.053 J	**57.9**
Beryllium	ug/L	MRL	Total		2.0 U	2.0 U	2.0 U	**15.6**
Chromium	ug/L	MRL	Total		1.0 J B	1.1 J B	1.2 J B	**184** B
Cadmium	ug/L	MRL	Total		2.0 U	2.0 U	2.0 U	**13.1**
Metals (ICP)								
Magnesium	ug/L	MRL	Total	**8720**	**6920**	**10200**	**10000**	**10100**
Iron	ug/L	MRL	Total	191 J	50.8 J	169 J	113 J	**276**
Calcium	ug/L	MRL	Total	**21900**	**29300**	**27400**	**27100**	**33200**
Manganese	ug/L	MRL	Total	**57.2**	6.6 J	**36.1**	**33.6**	**838**
Silicon	ug/L	MRL	Total	**2800** B	**2910** B	**3450** B	**3340** B	**8600** B
Potassium	ug/L	MRL	Total	1020 J	2130 J	1310 J	1240 J	**15100**
Mercury (CVAA)	ug/L	MRL	Total		0.20 U	**0.25**	0.17 J	0.20 U
Chromium (hexavalent)	mg/L	MRL	Total		0.010 U	0.010 U	0.010 U	0.010 U H
Anions, Ion Chromatography								
Nitrite as N	mg/L	MRL	Total	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Nitrate as N	mg/L	MRL	Total	0.079 J	0.25 U	0.25 U	0.25 U	**7.6**
Chloride	mg/L	MRL	Total	4.9 J	**5.2**	2.1 J	1.3 J	**72.1**
Sulfate	mg/L	MRL	Total	**17.8**	**14**	**6.6**	**5.7**	**117**
Alkalinity	mg/L	MRL	Total	**69.8**	**106**	**91.8**	**90.9**	**79.3**
Dilution Factor								
Date Analyzed								

Notes:
All values reported in micrograms per liter (ug/l)
B=Compound was found in the Blank and the Sample.
U=Not detected above the reporting limit
J=Estimated value.

Table 2: Summary of Performance Evaluation Sample (PES) Results

Pre-Design Investigation
Burgess Brothers Superfund Site, Woodford and Bennington, Vermont
Groundwater Sampling SDG: 200-12498-1

Parameter	*W-171-PD-W1 TA Analysis* *VOCs Method 8260B High Level*	*Certified Value*	*QC Performance Acceptance Limits*
Aqueous (ug/L)		**Lot No. S187-697 ID No. 0822-12-02.2**	
Antimony	37.3	38.7	35.9 - 43.0
Arsenic	29.2 B	28.0	24.9 - 32.3
Beryllium	15.6	16.0	14.7 - 17.1
Cadmium	13.1	13.6	12.4 - 14.3
Chromium	184 B	188	175 - 201
Lead	32.8 B	32.4	28.8 - 36.0
Nickel	263	264	242 - 282
Silver	57.9	58.3	52.4 - 63.8
Thallium	8.5 B	8.72	7.92 - 9.45
Selenium	63.1	75.2	67.0 - 83.4
Copper	1450	1540	1410 - 1630
Zinc	798	793	738 - 864
Mercury	0.2 U		
		Lot No. S189-658 ID No. 0822-12-02.3/4	
Chromium (hexavalent)	0.01 U H	0.019	0.0167 - 0.0208
		Lot No. 0822-12-02.5 Catalog No. 092 Custom Standard	
Calcium	33200	32100	28900 - 34900
Iron	276	264	232 - 295
Magnesium	10100	10000	8980 - 11100
Manganese	838	881	803 - 963
Potassium	15100	15300	13300 - 17300
Silicon	8600 B	9445	8182 - 10473
Aqueous (mg/L)		**Lot No. S182-667 ID No. 0822-12-02.7/8**	
Orthophosphate	3.1	3.24	2.95 - 3.59
		Lot No. S189-698 ID No. 0822-12-02.9	
Total Dissolved Solids	542	560	497 - 586
Nitrate as N	7.6	7.89	6.94 - 8.24
Nitrite as N	0.25 U		
Chloride	72.1	75.6	68.7 - 78.4
Sulfate	117	124	109 - 130
Alkalinity	79.3	91.5	84.5 - 96.9
		Lot No. S188-669 ID No. 0822-12-02.10	
TOC Result 1	5.2		
TOC Result 2	5.1		
TOC Result 3	5.1		
TOC Result 4	5.1		
Total Organic Carbon	5.2	5.41	4.90 - 5.88

Notes:

TA = Test America in South Burlington, VT

The Certified Values are the actual 'made to' concentrations confirmed by ERA analytical verification.

The QC Performance Acceptance Limits (QC PALs) based on actual historical dta collected in ERA's Prificiency Testing program. QC PALs reflect any inherent biases in the methods used to establish the limits and closely approximate a 95% conficence interval of the performance that experienced laboratories should achieve using accepted environmental methods.

XI. ACCURACY CHECK (Performance Evaluation Results)

SDG No.: 200-12498-1

Are more than one-half of the PES analytes within criteria for each parameter. Y N

PE Sample No./ ERA ID No,	Lot No.	Parameter	Type of PES	Matrix	Analyte	W-151-PD-W1 TA Analysis (mg/l)	Non-EPA PES Scores**	Samples Affected	Action
W-171-PD-W1/ ID No. 0822-12-02.2	S187697	PP13 Metals	Inoranic	Aq.	Selenium	63.1	Action Low 75.2 (67.0-83.4)	PZ170-PD-W1, PZ10D-PD-W1, PZ10S-PD-W1,	R, J
W-171-PD-W1/ ID No. 0822-12-02.3/4	S189658	Hexavalent Chromium	Inoranic	Aq.	Hexavalent Chromium	0.01 UH	Action Low 0.019 (0.0167-0.0208)	PZ10S-PD-W1, PZ10D-PD-W1, PZ170-PD-W1	R, J
W-171-PD-W1/ ID No. 0822-12-02.9	S189698	Alkalinity	Inoranic	Aq.	Alkalinity	79.3	Action Low 91.5 (84.5-96.9)	PZ10S-PD-W1, PZ10D-PD-W1, PZ170-PD-W1	R, J

* For Region I PESs indicate the Region I PES Score Report Result: Action High; Action Low; TCL MISS; TCL CONTAMINANT; TIC HIT; TIC MISS; TIC CONTAMINANT

** For Non-EPA PESs indicate the Non-EPA PES Score: PES Compound MISS; PES Compound CONTAMINANT; PES Compound HIT (Range)

TIC Tentatively Identifiable Compound

Validator: Ann Marie Petrucci

Date: 12/11/2012

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 200-12498-1

SDG Number: 200-12498

Job Description: Fall 2012 PCEM

For:
Environmental Partners Group
1900 Crown Colony Drive
Suite 402
Quincy, MA 02169

Attention: Ms. Ann Marie Petricca

Sara Goff

Approved for release.
Sara S Goff
Project Manager I
9/28/2012 12:26 PM

Sara S Goff
Project Manager I
sara.goff@testamericainc.com
09/28/2012

The test results in this report relate only to sample(s) as received by the laboratory. These test results were derived under a quality system that adheres to the requirements of NELAC. Pursuant to NELAC, this report may not be produced in full without written approval from the laboratory

TestAmerica Laboratories, Inc.
TestAmerica Burlington 30 Community Drive, Suite 11, South Burlington, VT 05403
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CASE NARRATIVE

Client: Environmental Partners Group

Project: Fall 2012 PCEM

Report Number: 200-12498-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT

The samples were received on 08/30/2012, 08/31/2012, 08/31/2012, 09/01/2012, 09/06/2012, 09/14/2012 and 09/15/2012; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 1.0° C, 3.5° C, 4.2° C, 4.6° C, 5.1° C, 5.6° C, and 16.6° C.

The trip blank was not assigned a collection date or time by the samplers. A collection date of 8/29/12 was assigned, coinciding with the first day of collection.

The volume for Total Organic Carbon arrived unpreserved. Sample was transferred into a 250mL H2SO4-preserved amber glass bottle.

Date of collection for sample TB-150-39 was recorded as 1/11/12. Sample logged in per sample ID date of 9/11/12.

VOLATILE ORGANIC COMPOUNDS (GC-MS)

Samples PZ12D-PD-W1, PZ13D-PD-W1, PZ13S-PD-W1, PZ14D-PD-W1, PZ14S-PD-W1, TB156-PD-W1, PZ170-PD-W1, PZ10D-PD-W1, PZ7D-PD-W1, PZ10S-PD-W1, PZ12S-PD-W1, PZ24-PD-W1, W171-PD-W1, SW-22-39, SW-21-39, SW-20-39, SW-19-39, P-01-39, P-21-39, P-22-39, P-08-39, P-02-39, P-19-39, P-20-39, TB-150-39, and W-150-39, ML2-PD-W6(25'-28'), ML2-PD-W7(4'-6'), and TB155-PD-W1 were analyzed for volatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8260B. The samples were analyzed on 09/05/2012, 09/06/2012, 09/20/2012, 09/21/2012 and 09/24/2012.

One or more compounds were detected in method blanks MB 200-44514/5, MB 200-44517/5, MB 200-45245/5, MB 200-45329/5, and MB 200-45357/5 at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged.

Methyl methacrylate was detected in method blanks MB 200-45245/5, MB 200-45329/5, and 200-45357/5 at a level exceeding the reporting limit. If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged.

The initial calibration curve acquired on 08/27/2012 was outside acceptance criteria for Bromomethane, 2-Chloroethyl vinyl ether, Methyl iodide, and 1,2,3-Trichloropropane. The initial calibration verification (ICV) was outside acceptance criteria for Bromomethane and Acrolein. The continuing calibration verification (CCV) for analytical batch 44514 exceeded control criteria for Hexachlorobutadiene, Bromomethane, and 1,4-Dioxane. The continuing calibration verification (CCV) for analytical batch 44517 exceeded control criteria for Chloromethane, Bromomethane, Methyl iodide, and tert-Butyl alcohol. The data have been qualified and reported.

The initial calibration curve acquired on 09/18/2012 was outside acceptance criteria for Bromomethane, Methyl iodide, Propionitrile, 1,4-Dioxane, and Methyl methacrylate. The initial calibration verification (ICV) was outside acceptance criteria for Acrolein and Methyl methacrylate. The continuing calibration verification (CCV) for analytical batch 45245 exceeded control criteria for Vinyl acetate, and Methyl methacrylate. The continuing calibration verification (CCV) for analytical batch 45329 exceeded control criteria for Methyl iodide, Vinyl acetate, and Methyl methacrylate. The continuing calibration verification (CCV) for analytical batch 45357 exceeded control criteria for Methyl iodide, Vinyl acetate, and Methyl methacrylate. The data have been qualified and reported.

One or more compounds failed the recovery criteria for LCS 200-44514/3, LCS 200-44517/3, LCS 200-45245/3, LCS 200-45357/3. Refer to the QC report for details.

One or more compounds failed the recovery and relative percent difference criteria for the matirx spike and matrix spike duplicate of sample PZ7D-PD-W1 in batch 200-44517. Refer to the QC report for details.

Samples ML2-PD-W6(25'-28')[126X], PZ12D-PD-W1[4X], ML2-PD-W7(4'-6')[15X], PZ13D-PD-W1[2X], P-01-39[3X], PZ14S-PD-W1[7X],

P-19-39[2X] and PZ12S-PD-W1[9X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No other difficulties were encountered during the volatiles analyses. All other quality control parameters were within the acceptance limits.

METALS (ICP)
Samples PZ7D-PD-W1, PZ10D-PD-W1, PZ170-PD-W1, PZ10S-PD-W1, and W171-PD-W1 were analyzed for Metals (ICP) in accordance with EPA SW-846 Method 6010C. The samples were prepared on 09/06/2012 and analyzed on 09/09/2012.

Silicon was detected in method blank MB 200-44584/1-A at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

Calcium, Magnesium and Silicon failed the recovery criteria high for the matrix spike of sample PZ7D-PD-W1 in batch 200-44675. Refer to the QC report for details.

No other difficulties were encountered during the metals analyses. All other quality control parameters were within the acceptance limits.

METALS (ICPMS)
Samples PZ170-PD-W1, PZ10D-PD-W1, PZ10S-PD-W1, and W171-PD-W1 were analyzed for metals (ICPMS)in accordance with EPA SW-846 Method 6020A. The samples were prepared on 09/11/2012 and analyzed on 09/15/2012 and 09/27/2012.

Several analytes were detected in method blank MB 200-44817/1-A at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

The serial dilution performed for sample W171-PD-W1 was outside control limit for Zinc.

Sample W171-PD-W1[10X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No other difficulties were encountered during the metals analyses. All other quality control parameters were within the acceptance limits.

HEXAVALENT CHROMIUM
Sample W171-PD-W1, PZ10S-PD-W1, PZ10D-PD-W1, and PZ170-PD-W1 were analyzed for hexavalent chromium in accordance with EPA SW-846 Method 7196A. The samples were analyzed on 08/31/2012 and 09/06/2012.

Sample W171-PD-W1 was received outside of holding time.

Chromium (hexavalent) failed the recovery criteria low for the matrix spike duplicate of sample W171-PD-W1 in batch 680-248937. Refer to the QC report for details.

No other difficulties were encountered during the hexavalent chromium analysis. All other quality control parameters were within the acceptance limits.

TOTAL MERCURY
Samples PZ170-PD-W1, PZ10D-PD-W1, PZ10S-PD-W1, and W171-PD-W1 were analyzed for total mercury in accordance with EPA SW-846 Methods 7470A. The samples were prepared on 09/04/2012 and analyzed on 09/05/2012.

No difficulties were encountered during the mercury analyses. All quality control parameters were within the acceptance limits.

ALKALINITY
Samples PZ7D-PD-W1, PZ10S-PD-W1, PZ10D-PD-W1, PZ170-PD-W1, and W171-PD-W1 were analyzed for alkalinity in accordance with SM20 2320B. The samples were analyzed on 08/31/2012, 09/11/2012 and 09/13/2012.

No difficulties were encountered during the alkalinity analyses. All quality control parameters were within the acceptance limits.

TOTAL DISSOLVED SOLIDS
Samples PZ170-PD-W1, PZ10D-PD-W1, PZ7D-PD-W1, PZ10S-PD-W1, and W171-PD-W1 were analyzed for total dissolved solids in accordance with SM20 2540C. The samples were analyzed on 09/05/2012.

No difficulties were encountered during the TDS analyses. All quality control parameters were within the acceptance limits.

ORTHOPHOSPHATE
Sample W171-PD-W1, PZ10D-PD-W1, PZ170-PD-W1, PZ7D-PD-W1, and PZ10S-PD-W1 were analyzed for Orthophosphate in accordance with SM20 4500 P F. The samples were analyzed on 08/31/2012 and 09/06/2012.

Orthophosphate failed the recovery criteria low for the matrix spike and matrix spike duplicate of sample W171-PD-W1 in batch 680-248938. Refer to the QC report for details.

Sample W171-PD-W1[5X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No other difficulties were encountered during the orthophosphate analyses. All other quality control parameters were within the acceptance limits.

ANIONS (Chloride and Sulfate)
Samples PZ7D-PD-W1, PZ10S-PD-W1 PZ10D-PD-W1, PZ170-PD-W1, W171-PD-W1 were analyzed for anions, Chloride and Sulfate, in accordance with EPA SW-846 Method 9056. The samples were analyzed on 08/30/2012, 09/06/2012 and 09/11/2012.

Sulfate failed the recovery criteria low for the matrix spike duplicate of sample PZ7D-PD-W1 in batch 680-248849. Refer to the QC report for details.

No other difficulties were encountered during the anions analyses. All other quality control parameters were within the acceptance limits.

ANIONS (Nitrate and Nitrite)
Samples W171-PD-W1, PZ7D-PD-W1, PZ10S-PD-W1, PZ10D-PD-W1, and PZ170-PD-W1 were analyzed for anions, Nitrate and Nitrite, in accordance with EPA SW-846 Method 9056A. The samples were analyzed on 08/30/2012, 08/31/2012 and 09/06/2012.

No difficulties were encountered during the anions, Nitrate and Nitrite, analysis. All quality control parameters were within the acceptance limits.

TOTAL ORGANIC CARBON
Samples PZ170-PD-W1, PZ10D-PD-W1, PZ7D-PD-W1, PZ10S-PD-W1 and W171-PD-W1 were analyzed for total organic carbon in accordance with EPA SW-846 Method 9060A. The samples were analyzed on 09/05/2012.

No difficulties were encountered during the TOC analyses. All quality control parameters were within the acceptance limits.

DISSOLVED ORGANIC CARBON
Samples PZ170-PD-W1, PZ10D-PD-W1, PZ7D-PD-W1 and PZ10S-PD-W1 were analyzed for Dissolved Organic Carbon in accordance with 9060. The samples were analyzed on 09/06/2012 and 09/10/2012.

No difficulties were encountered during the DOC analyses. All quality control parameters were within the acceptance limits.

Burgess Brothers Superufund Site, Woodford and Bennington, VT
Test America SDG 200-13092-1
Groundwater Analytical Data
Inorganic Analyses

Analyte	Units	Reports To	200-13092-1 PZ1S-PD-W1 10/4/2012 1:40 PM	200-13092-2 PZ1D-PD-W1 10/4/2012 1:30 PM
Dichlorodifluoromethane	ug/L	MRL	1.0 U	**6.7**
Chloromethane	ug/L	MRL	1.0 U	1.0 U
Vinyl chloride	ug/L	MRL	1.0 U	**5**
Bromomethane	ug/L	MRL	1.0 U	1.0 U
Chloroethane	ug/L	MRL	1.0 U	0.36 J
Trichlorofluoromethane	ug/L	MRL	1.0 U	1.0 U
Acrolein	ug/L	MRL	5.0 U	5.0 U
1,1-Dichloroethene	ug/L	MRL	1.0 U	**1.8**
Freon TF	ug/L	MRL	1.0 U	1.0 U
Acetone	ug/L	MRL	5.0 U	5.0 U
Methyl iodide	ug/L	MRL	1.0 U	1.0 U
Carbon disulfide	ug/L	MRL	1.0 U	1.0 U
Allyl chloride	ug/L	MRL	1.0 U	1.0 U
Methylene Chloride	ug/L	MRL	1.0 U	0.51 J B
Acrylonitrile	ug/L	MRL	1.0 U	1.0 U
trans-1,2-Dichloroethene	ug/L	MRL	1.0 U	1.0 U
1,2-Dichloroethene, Total	ug/L	MRL	1.0 U	**52**
Methyl t-butyl ether	ug/L	MRL	1.0 U	1.0 U
1,1-Dichloroethane	ug/L	MRL	1.0 U	1.0 U
Vinyl acetate	ug/L	MRL	1.0 U	1.0 U
Chloroprene	ug/L	MRL	1.0 U	1.0 U
2,2-Dichloropropane	ug/L	MRL	1.0 U	1.0 U
cis-1,2-Dichloroethene	ug/L	MRL	1.0 U	**52**
2-Butanone	ug/L	MRL	5.0 U	5.0 U
Propionitrile	ug/L	MRL	4.0 U	4.0 U
Bromochloromethane	ug/L	MRL	1.0 U	1.0 U
Methacrylonitrile	ug/L	MRL	1.0 U	1.0 U
Tetrahydrofuran	ug/L	MRL	14 U	14 U
Chloroform	ug/L	MRL	1.0 U	0.39 J
1,1,1-Trichloroethane	ug/L	MRL	1.0 U	1.0 U
1,1-Dichloropropene	ug/L	MRL	1.0 U	1.0 U
Carbon tetrachloride	ug/L	MRL	1.0 U	1.0 U
Isobutyl alcohol	ug/L	MRL	50 U	50 U
Benzene	ug/L	MRL	1.0 U	1.0 U
1,2-Dichloroethane	ug/L	MRL	1.0 U	1.0 U
Trichloroethene	ug/L	MRL	0.66 J	**80**
1,2-Dichloropropane	ug/L	MRL	1.0 U	1.0 U
Dibromomethane	ug/L	MRL	1.0 U	1.0 U
Methyl methacrylate	ug/L	MRL	**1.4** B	0.71 J B
1,4-Dioxane	ug/L	MRL	50 U	50 U
Bromodichloromethane	ug/L	MRL	1.0 U	1.0 U
2-Chloroethyl vinyl ether	ug/L	MRL	1.0 U	1.0 U
cis-1,3-Dichloropropene	ug/L	MRL	1.0 U	1.0 U
4-Methyl-2-pentanone	ug/L	MRL	5.0 U	5.0 U
Toluene	ug/L	MRL	1.0 U	1.0 U
trans-1,3-Dichloropropene	ug/L	MRL	1.0 U	1.0 U
Ethyl methacrylate	ug/L	MRL	1.0 U	1.0 U
1,1,2-Trichloroethane	ug/L	MRL	1.0 U	1.0 U
Tetrachloroethene	ug/L	MRL	0.91 J	**13**
1,3-Dichloropropane	ug/L	MRL	1.0 U	1.0 U
2-Hexanone	ug/L	MRL	5.0 U	5.0 U
Dibromochloromethane	ug/L	MRL	1.0 U	1.0 U
1,2-Dibromoethane	ug/L	MRL	1.0 U	1.0 U
Chlorobenzene	ug/L	MRL	1.0 U	1.0 U
1,1,1,2-Tetrachloroethane	ug/L	MRL	1.0 U	1.0 U
Ethylbenzene	ug/L	MRL	1.0 U	1.0 U
m&p-Xylene	ug/L	MRL	1.0 U	1.0 U
o-Xylene	ug/L	MRL	1.0 U	0.42 J
Xylenes, Total	ug/L	MRL	1.0 U	0.42 J
Styrene	ug/L	MRL	1.0 U	1.0 U
Bromoform	ug/L	MRL	1.0 U	1.0 U
Isopropylbenzene	ug/L	MRL	1.0 U	1.0 U
Bromobenzene	ug/L	MRL	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	ug/L	MRL	1.0 U	1.0 U
1,2,3-Trichloropropane	ug/L	MRL	1.0 U	1.0 U
trans-1,4-Dichloro-2-butene	ug/L	MRL	1.0 U	1.0 U
n-Propylbenzene	ug/L	MRL	1.0 U	1.0 U
2-Chlorotoluene	ug/L	MRL	1.0 U	1.0 U
4-Chlorotoluene	ug/L	MRL	1.0 U	1.0 U
1,3,5-Trimethylbenzene	ug/L	MRL	1.0 U	1.0 U
tert-Butylbenzene	ug/L	MRL	1.0 U	1.0 U
1,2,4-Trimethylbenzene	ug/L	MRL	1.0 U	1.0 U
sec-Butylbenzene	ug/L	MRL	1.0 U	1.0 U
1,3-Dichlorobenzene	ug/L	MRL	1.0 U	1.0 U
4-Isopropyltoluene	ug/L	MRL	1.0 U	1.0 U
1,4-Dichlorobenzene	ug/L	MRL	1.0 U	1.0 U
1,2-Dichlorobenzene	ug/L	MRL	1.0 U	1.0 U
n-Butylbenzene	ug/L	MRL	1.0 U	1.0 U
1,2-Dibromo-3-Chloropropane	ug/L	MRL	1.0 U	1.0 U
1,2,4-Trichlorobenzene	ug/L	MRL	1.0 U	1.0 U
Hexachlorobutadiene	ug/L	MRL	1.0 U	1.0 U
Naphthalene	ug/L	MRL	1.0 U	1.0 U
1,2,3-Trichlorobenzene	ug/L	MRL	1.0 U	1.0 U

Notes:

All values reported in micrograms per liter (ug/l)

B=Compound was found in the Blank and the Sample.

U=Not detected above the reporting limit

J=Estimated value.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 200-13092-1

SDG Number: 200-13092

Job Description: Burgess Brother's Sanitary Landfill

For:
Environmental Partners Group
1900 Crown Colony Drive
Suite 402
Quincy, MA 02169

Attention: Ms. Ann Marie Petricca

Approved for release.
Sara S Goff
Project Manager I
10/19/2012 12:49 PM

Sara S Goff
Project Manager I
sara.goff@testamericainc.com
10/19/2012

The test results in this report relate only to sample(s) as received by the laboratory. These test results were derived under a quality system that adheres to the requirements of NELAC. Pursuant to NELAC, this report may not be produced in full without written approval from the laboratory

TestAmerica Laboratories, Inc.
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CASE NARRATIVE

Client: Environmental Partners Group

Project: Burgess Brother's Sanitary Landfill

Report Number: 200-13092-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT

The samples were received on 10/06/2012; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 1.7 C.

VOLATILE ORGANIC COMPOUNDS (GC-MS)

Samples PZ1S-PD-W1 and PZ1D-PD-W1 were analyzed for volatile organic compounds (GC-MS)in accordance with EPA SW-846 Method 8260B. The samples were analyzed on 10/12/2012.

The initial calibration curve was outside acceptance criteria for Bromomethane, Chloroethane, Methyl iodide, and Methyl methacrylate. The continuing calibration verification (CCV) for analytical batch 46355 exceeded control criteria for Methyl iodide. The continuing calibration verification (CCV) for analytical batch 46468 exceeded control criteria for Methyl methacrylate and 1,4-Dioxane.

Methyl methacrylate, Methylene Chloride and Naphthalene were detected in method blank MB 200-46355/5 at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Methyl methacrylate, Methylene Chloride and Naphthalene were detected in method blank MB 200-46468/5 at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

No other difficulties were encountered during the volatiles analyses.

All other quality control parameters were within the acceptance limits.

Bench Test #1

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 200-12688-1

SDG Number: 200-12688

Job Description: PRB Bench Testing

For:
Environmental Partners Group
1900 Crown Colony Drive
Suite 402
Quincy, MA 02169

Attention: Ms. Ann Marie Petricca

Sara Goff

Approved for release.
Sara S Goff
Project Manager I
10/2/2012 11:50 AM

Sara S Goff
Project Manager I
sara.goff@testamericainc.com
10/02/2012

The test results in this report relate only to sample(s) as received by the laboratory. These test results were derived under a quality system that adheres to the requirements of NELAC. Pursuant to NELAC, this report may not be produced in full without written approval from the laboratory

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CASE NARRATIVE

Client: Environmental Partners Group

Project: PRB Bench Testing

Report Number: 200-12688-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT

The samples were received on 09/14/2012; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 4.5 C.

VOLATILE ORGANIC COMPOUNDS (GC-MS)

Samples S-2596-130912-1 and S-2596-130912-2 were analyzed for volatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8260B. The samples were analyzed on 09/20/2012.

Methyl methacrylate was detected in method blank MB 200-45245/5 at a level exceeding the reporting limit. If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Chloroform and Methylene Chloride were detected in method blank MB 200-45245/5 at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

The initial calibration curve was outside acceptance criteria for Bromomethane, Methyl iodide, Propionitrile, 1,4-Dioxane, and Methyl methacrylate. The initial calibration verification (ICV) was outside acceptance criteria for Acrolein and Methyl methacrylate. The continuing calibration verification (CCV) for analytical batch 45245 exceeded control criteria for Vinyl acetate and Methyl methacrylate. The data have been qualified and reported.

Methyl methacrylate failed the recovery criteria low for LCS 200-45245/3. Refer to the QC report for details.

Samples S-2596-130912-1[244X] and S-2596-130912-2[244X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No other difficulties were encountered during the volatiles analyses. All other quality control parameters were within the acceptance limits.

METALS (ICP) - Cations

Samples S-2596-130912-1 and S-2596-130912-2 were analyzed for Metals (ICP) in accordance with EPA SW-846 Method 6010C. The samples were prepared on 09/18/2012 and analyzed on 09/19/2012 and 09/24/2012.

The post digestion spike percent recovery for sample S-2596-130912-1, associated with batch 45299 was outside of control limits for Magnesium and Silicon.

No difficulties were encountered during the metals analyses. All quality control parameters were within the acceptance limits.

METALS (ICPMS) - PP-13

Samples S-2596-130912-1 and S-2596-130912-2 were analyzed for metals (ICPMS) in accordance with EPA SW-846 Method 6020A. The samples were prepared on 09/20/2012 and analyzed on 09/27/2012.

Chromium was detected in method blank MB 200-45210/1-A at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

No other difficulties were encountered during the metals analyses. All other quality control parameters were within the acceptance limits.

TOTAL MERCURY

Samples S-2596-130912-1 and S-2596-130912-2 were analyzed for total mercury in accordance with EPA SW-846 Methods 7470A. The samples were prepared and analyzed on 09/24/2012.

No other difficulties were encountered during the mercury analyses. All other quality control parameters were within the acceptance limits.

ALKALINITY

Samples S-2596-130912-1 and S-2596-130912-2 were analyzed for alkalinity in accordance with SM20 2320B. The samples were analyzed on 09/25/2012.

No difficulties were encountered during the alkalinity analyses. All quality control parameters were within the acceptance limits.

TOTAL DISSOLVED SOLIDS

Samples S-2596-130912-1 and S-2596-130912-2 were analyzed for total dissolved solids in accordance with SM20 2540C. The samples were analyzed on 09/17/2012.

No difficulties were encountered during the TDS analyses. All quality control parameters were within the acceptance limits.

ACID VOLATILE SULFIDES

Samples S-2596-130912-1 and S-2596-130912-2 were analyzed for acid volatile sulfides in accordance with EPA Method 376.2. The samples were analyzed on 09/19/2012.

No difficulties were encountered during the AVS analyses. All quality control parameters were within the acceptance limits.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 200-12803-1

SDG Number: 200-12803

Job Description: PRB Bench Testing

For:
Environmental Partners Group
1900 Crown Colony Drive
Suite 402
Quincy, MA 02169

Attention: Ms. Ann Marie Petricca

Approved for release.
Don C Dawicki
Customer Service Manager
10/7/2012 10:26 PM

Designee for
Sara S Goff
Project Manager I
sara.goff@testamericainc.com
10/07/2012

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CASE NARRATIVE

Client: Environmental Partners Group

Project: PRB Bench Testing

Report Number: 200-12803-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT
The samples were received on 09/21/2012; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 4.9 C.

The following volatile sample was received with headspace in1 of 2 sample vial(s) and was not used for analysis:
S-2596-200912-EFLUENT

VOLATILE ORGANIC COMPOUNDS (GC-MS)
Samples S-2596-200912-EFLUENT and S-2596-200912-INFLUENT were analyzed for volatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8260B. The samples were analyzed on 09/27/2012.

Methyl methacrylate was detected in method blank MB 200-45588/5 at a level exceeding the reporting limit. If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Methylene Chloride was detected in method blank MB 200-45588/5 at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

Methyl methacrylate failed the recovery criteria low for LCS 200-45588/3. Refer to the QC report for details.

The continuing calibration verification (CCV) for Vinyl acetate, and Methyl methacrylate associated with batch45588 recovered above the upper control limit. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported.

The initial calibration curve was outside acceptance criteria for Bromomethane, Iodomethane, Propionitrile, Methyl methacrylate, and 1,4-Dioxane.

The initial calibration verification (ICV) for analytical batch 45588 exceeded control criteria for Acrolein, and Methyl methacrylate. The data have been qualified and reported.

Samples S-2596-200912-EFLUENT[4X] and S-2596-200912-INFLUENT[244X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

METALS (ICP)
Samples S-2596-200912-EFLUENT and S-2596-200912-INFLUENT were analyzed for Metals (ICP) in accordance with EPA SW-846 Method 6010C. The samples were prepared on 10/01/2012 and analyzed on 10/03/2012.

No difficulties were encountered during the metals analyses.

All quality control parameters were within the acceptance limits.

METALS (ICPMS)
Samples S-2596-200912-EFLUENT and S-2596-200912-INFLUENT were analyzed for metals (ICPMS) in accordance with EPA SW-846 Method 6020A. The samples were prepared on 09/24/2012 and analyzed on 09/28/2012.

Chromium was detected in method blank MB 200-45358/2-A at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL

and/or RL, the result has been "B" flagged. Refer to the QC report for details.

TOTAL MERCURY
Samples S-2596-200912-EFLUENT and S-2596-200912-INFLUENT were analyzed for total mercury in accordance with EPA SW-846 Methods 7470A. The samples were prepared and analyzed on 09/24/2012.

Mercury failed the recovery criteria high for the MS of sample 200-12592-1 in batch 200-45387.

Mercury exceeded the rpd limit for the duplicate of sample 200-12592-1. Refer to the QC report for details.

ALKALINITY
Samples S-2596-200912-EFLUENT and S-2596-200912-INFLUENT were analyzed for alkalinity in accordance with SM20 2320B. The samples were analyzed on 10/01/2012.

No difficulties were encountered during the alkalinity analyses.

All quality control parameters were within the acceptance limits.

TOTAL DISSOLVED SOLIDS
Samples S-2596-200912-EFLUENT and S-2596-200912-INFLUENT were analyzed for total dissolved solids in accordance with SM20 2540C. The samples were analyzed on 09/24/2012

Method(s) SM 2540C: A deviation from the Standard Operating Procedure (SOP) occurred. Details are as follows: Sample volume used deviates from SOP by using less volume for this batch due to limited volume being received.

No difficulties were encountered during the TDS analyses.

All quality control parameters were within the acceptance limits.

ACID VOLATILE SULFIDES
Samples S-2596-200912-EFLUENT, S-2596-200912-INFLUENT and S-2596-200912-E were analyzed for acid volatile sulfides in accordance with EPA Method 376.2. The samples were analyzed on 09/26/2012.

No difficulties were encountered during the AVS analyses.

All quality control parameters were within the acceptance limits.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 200-13184-1

SDG Number: 200-13184

Job Description: PRB Bench Testing

For:
Environmental Partners Group
1900 Crown Colony Drive
Suite 402
Quincy, MA 02169

Attention: Ms. Ann Marie Petricca

Approved for release.
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Project Manager I
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Sara S Goff
Project Manager I
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10/31/2012

The test results in this report relate only to sample(s) as received by the laboratory. These test results were derived under a quality system that adheres to the requirements of NELAC. Pursuant to NELAC, this report may not be produced in full without written approval from the laboratory

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CASE NARRATIVE

Client: Environmental Partners Group

Project: PRB Bench Testing

Report Number: 200-13184-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT
The samples were received on 10/12/2012; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 5.3 C.

All of the samples were received at the laboratory without a sample collection time documented on the chain of custody or the container labels.

The following sample was received with headspace in the sample vial: S-2596-111012-EFFLUENT.

VOLATILE ORGANIC COMPOUNDS (GC-MS)
Samples S-2596-111012-EFFLUENT and S-2596-111012-INFLUENT were analyzed for volatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8260B. The samples were analyzed on 10/15/2012 and 10/16/2012.

Methyl methacrylate was detected in method blank MB 200-46503/5 at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Methyl methacrylate was detected in method blank MB 200-46681/5 at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

The initial calibration curve was outside acceptance criteria for Bromomethane, Chloroethane, Methyl Iodide, and Methyl methacrylate. The continuing calibration verification (CCV) for analytical batches 46681and 46503exceeded control criteria for Vinyl acetate. The data have been qualified and reported.

Vinyl acetate failed the recovery criteria low for laboratory control sample 200-46503/3. Vinyl acetate failed the recovery criteria low for LCS 200-46681/3. Refer to the QC report for details.

Sample S-2596-111012-INFLUENT[244X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No other difficulties were encountered during the volatiles analyses. All other quality control parameters were within the acceptance limits.

METALS (ICPMS)
Samples S-2596-111012-EFFLUENT and S-2596-111012-INFLUENT were analyzed for metals (ICPMS) in accordance with EPA SW-846 Method 6020A. The samples were prepared on 10/18/2012 and analyzed on 10/20/2012.

No difficulties were encountered during the metals analyses. All quality control parameters were within the acceptance limits.

TOTAL MERCURY
Samples S-2596-111012-EFFLUENT and S-2596-111012-INFLUENT were analyzed for total mercury in accordance with EPA SW-846 Methods 7470A. The samples were prepared on 10/16/2012 and analyzed on 10/17/2012.

No difficulties were encountered during the mercury analyses. All quality control parameters were within the acceptance limits.

TOTAL DISSOLVED SOLIDS
Samples S-2596-111012-EFFLUENT and S-2596-111012-INFLUENT were analyzed for total dissolved solids in accordance with SM20 2540C. The samples were analyzed on 10/16/2012.

No difficulties were encountered during the TDS analyses. All quality control parameters were within the acceptance limits.

ACID VOLATILE SULFIDES

Samples S-2596-111012-EFFLUENT, S-2596-111012-INFLUENT and S-2596-111012-E were analyzed for acid volatile sulfides in accordance with EPA Method 376.2. The samples were analyzed on 10/15/2012.

No difficulties were encountered during the AVS analyses. All quality control parameters were within the acceptance limits.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 200-13592-1

SDG Number: 200-13592

Job Description: PRB Bench Testing

For:
Environmental Partners Group
1900 Crown Colony Drive
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Quincy, MA 02169

Attention: Ms. Ann Marie Petricca

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The test results in this report relate only to sample(s) as received by the laboratory. These test results were derived under a quality system that adheres to the requirements of NELAC. Pursuant to NELAC, this report may not be produced in full without written approval from the laboratory

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Comments
No additional comments.

Receipt
The samples were received on 11/6/2012 9:45 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 16.3° C.

Except:

The following samples were received at 16.3°C and was outside the required laboratory temperature criteria of 0 to 6°C: .

GC/MS VOA

CASE NARRATIVE

Client: Environmental Partners Group

Project: PRB Bench Testing

Report Number: 200-13592-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT
The samples were received on 11/06/2012; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 16.3 C.

All samples were received outside of laboratory receipt temperature criteria of 0 to 6°C.

VOLATILE ORGANIC COMPOUNDS (GC-MS)
Samples S-2596-011112-EFL and S-2596-011112-INF were analyzed for volatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8260B. The samples were analyzed on 11/15/2012.

The initial calibration curve was outside acceptance criteria for Bromomethane, Chloroethane, and Methyl iodide. The initial calibration verification (ICV) was outside acceptance criteria for Vinyl acetate. The continuing calibration verification (CCV) for analytical batch 48117 exceeded control criteria for Acetone, 2-Butanone, and Dichlorodifluoromethane. The data have been qualified and reported.

The following analytes are being reported outside of calibration range for sample S-2596-011112-INF due to insufficient volume remaining for reanalysis: Tetrachloroethene, cis-1,2-Dichloroethene, and Trichloroethene.

Samples S-2596-011112-EFL[6X] and S-2596-011112-INF[10X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No difficulties were encountered during the volatiles analyses. All quality control parameters were within the acceptance limits.

METALS (ICP)
Samples S-2596-011112-EFL and S-2596-011112-INF were analyzed for Metals (ICP) in accordance with EPA SW-846 Method 6010C. The samples were prepared on 11/26/2012 and analyzed on 11/27/2012.

No difficulties were encountered during the metals analyses. All quality control parameters were within the acceptance limits.

METALS (ICPMS)
Samples S-2596-011112-EFL and S-2596-011112-INF were analyzed for metals (ICPMS) in accordance with EPA SW-846 Method 6020A. The samples were prepared on 11/26/2012 and analyzed on 11/27/2012 and 11/30/2012.

Chromium and Zinc were detected in method blank MB 200-48579/1-A at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

The post digestion spike percent recovery for sample S-2596-011112-EFL associated with batch 48716 was outside of control limits for Silver..

No other difficulties were encountered during the metals analyses. All other quality control parameters were within the acceptance limits.

TOTAL MERCURY
Samples S-2596-011112-EFL and S-2596-011112-INF were analyzed for total mercury in accordance with EPA SW-846 Methods 7470A. The samples were prepared on 11/08/2012 and analyzed on 11/09/2012.

No difficulties were encountered during the mercury analyses. All quality control parameters were within the acceptance limits.

ALKALINITY
Samples S-2596-011112-EFL and S-2596-011112-INF were analyzed for alkalinity in accordance with SM20 2320B. The samples were analyzed on 11/12/2012.

No difficulties were encountered during the alkalinity analyses. All quality control parameters were within the acceptance limits.

TOTAL DISSOLVED SOLIDS
Samples S-2596-011112-EFL and S-2596-011112-INF were analyzed for total dissolved solids in accordance with SM20 2540C. The samples were analyzed on 11/08/2012.

No difficulties were encountered during the TDS analyses. All quality control parameters were within the acceptance limits.

ACID VOLATILE SULFIDES
Samples S-2596-011112-EFL, S-2596-011112-E and S-2596-011112-INF were analyzed for acid volatile sulfides in accordance with EPA Method 376.2. The samples were analyzed on 11/13/2012.

Samples S-2596-011112-E, S-2596-011112-EFL, and S-2596-011112-INF were received with more than half the holding time expired. Samples were analyzed outside of holding time.

No difficulties were encountered during the AVS analyses. All quality control parameters were within the acceptance limits.

Bench Test #2

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 200-14639-1

SDG Number: 200-14639

Job Description: Burgess Brother's Sanitary Landfill

For:
Environmental Partners Group
1900 Crown Colony Drive
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02/05/2013

The test results in this report relate only to sample(s) as received by the laboratory. These test results were derived under a quality system that adheres to the requirements of NELAC. Pursuant to NELAC, this report may not be produced in full without written approval from the laboratory

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CASE NARRATIVE

Client: Environmental Partners Group

Project: Burgess Brother's Sanitary Landfill

Report Number: 200-14639-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT
The samples were received on 01/17/2013; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 5.0 C.

The container labels list sample identifiers of S-2716-160113-bag-1 for sample 1 and S-2716-160113-bag-2 for sample 2 with a collection of 1/17/13. The chain of custody (COC) lists S-2596-011112-Bag-1 and Bag-2 with a date of 01/16/13. Logged in per COC.

The original volatile organic compounds analysis produced results well over the instrument's calibrated range. Per client request the analyses were canceled.

METALS (ICP)
Samples S-2596-011112-BAG-1 and S-2596-011112-BAG-2 were analyzed for Metals (ICP) in accordance with EPA SW-846 Method 6010C. The samples were prepared on 01/18/2013 and analyzed on 01/22/2013.

No difficulties were encountered during the metals analyses.

All quality control parameters were within the acceptance limits.

METALS (ICPMS)
Samples S-2596-011112-BAG-1 and S-2596-011112-BAG-2 were analyzed for metals (ICPMS) in accordance with EPA SW-846 Method 6020A. The samples were prepared on 01/18/2013 and analyzed on 01/30/2013.

Chromium and Lead were detected in method blank MB 200-50896/1-A at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

No other difficulties were encountered during the metals analyses.

All other quality control parameters were within the acceptance limits.

TOTAL MERCURY
Samples S-2596-011112-BAG-1 and S-2596-011112-BAG-2 were analyzed for total mercury in accordance with EPA SW-846 Methods 7470A. The samples were prepared on 01/21/2013 and analyzed on 01/22/2013.

No difficulties were encountered during the mercury analyses.

All quality control parameters were within the acceptance limits.

ALKALINITY
Samples S-2596-011112-BAG-1 and S-2596-011112-BAG-2 were analyzed for alkalinity in accordance with SM20 2320B. The samples were analyzed on 01/22/2013.

No difficulties were encountered during the alkalinity analyses.

All quality control parameters were within the acceptance limits.

TOTAL DISSOLVED SOLIDS

Samples S-2596-011112-BAG-1 and S-2596-011112-BAG-2 were analyzed for total dissolved solids in accordance with SM20 2540C. The samples were analyzed on 01/21/2013.

No difficulties were encountered during the TDS analyses.

All quality control parameters were within the acceptance limits.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 200-14807-1

SDG Number: 200-14807

Job Description: Burgess Brother's Sanitary Landfill

For:
Environmental Partners Group
1900 Crown Colony Drive
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Quincy, MA 02169

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02/06/2013

The test results in this report relate only to sample(s) as received by the laboratory. These test results were derived under a quality system that adheres to the requirements of NELAC. Pursuant to NELAC, this report may not be produced in full without written approval from the laboratory

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CASE NARRATIVE

Client: Environmental Partners Group

Project: Burgess Brother's Sanitary Landfill

Report Number: 200-14807-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT

The samples were received on 01/28/2013; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 5.8 C.

Samples were received at the laboratory without a sample collection time documented on the chain of custody . As a result, a sample collection time of 00:00 on the date of collection was used.

The screen vial for volatile sample S-2716-240113-BAG-2 was received with headspace. This container was not used for analysis.

VOLATILE ORGANIC COMPOUNDS (GC-MS)

Samples S-2716-240113-BAG-1 and S-2716-240113-BAG-2 were analyzed for volatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8260B. The samples were analyzed on 01/31/2013.

The initial calibration curve was outside acceptance criteria for Bromomethane, Chloroethane, and Methyl iodide. The initial calibration verification (ICV) was outside acceptance criteria for Allyl chloride. The continuing calibration verification (CCV) for analytical batch 51359 exceeded control criteria for Bromomethane, 1,4-Dioxane, and Allyl chloride. The data have been qualified and reported.

Samples S-2716-240113-BAG-1[339X] and S-2716-240113-BAG-2[339X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No difficulties were encountered during the volatiles analyses.

All quality control parameters were within the acceptance limits.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 200-15094-1

SDG Number: 200-15094

Job Description: Burgess Brother's Sanitary Landfill

For:
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03/14/2013

The test results in this report relate only to sample(s) as received by the laboratory. These test results were derived under a quality system that adheres to the requirements of NELAC. Pursuant to NELAC, this report may not be produced in full without written approval from the laboratory

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CASE NARRATIVE

Client: Environmental Partners Group

Project: Burgess Brother's Sanitary Landfill

Report Number: 200-15094-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT
The samples were received on 02/14/2013; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 2.4 C.

The samples were received at the laboratory without a sample collection time documented on the chain of custody.

The analysis of sample S-2716-120213-PEFF was cancelled by the client.

VOLATILE ORGANIC COMPOUNDS (GC-MS)
Samples S-2716-120213-CEFF and S-2716-120213-BAG were analyzed for volatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8260B. The samples were analyzed on 02/22/2013.

Hexachlorobutadiene was detected in method blank MB 200-52261/5 at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

The initial calibration curve was outside acceptance criteria for Chloroethane and Methyl iodide. The initial calibration verification (ICV) was outside acceptance criteria for Vinyl Acetate. The continuing calibration verification (CCV) for analytical batch 52261exceeded control criteria for Bromomethane, Chloroethane, and Methyl iodide. The data have been qualified and reported.

Carbon disulfide failed the recovery criteria low for LCS 200-52261/3. Refer to the QC report for details.

Sample S-2716-120213-BAG[339X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No other difficulties were encountered during the volatiles analyses.

All other quality control parameters were within the acceptance limits.

METALS (ICPMS)
Samples S-2716-120213-CEFF and S-2716-120213-BAG were analyzed for metals (ICPMS) in accordance with EPA SW-846 Method 6020A. The samples were prepared on 02/18/2013 and analyzed on 02/20/2013.

Several analytes were detected in method blank MB 200-52020/2-A at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

The post digestion spike percent recovery for Selenium and Zinc associated with batch 29835 was outside of control limits.

The low level continuing calibration verification (CCVL) for analytical batch 52137 exceeded control criteria for Zinc. The data have been qualified and reported.

No other difficulties were encountered during the metals analyses.

All other quality control parameters were within the acceptance limits.

TOTAL MERCURY
Samples S-2716-120213-CEFF and S-2716-120213-BAG were analyzed for total mercury in accordance with EPA SW-846 Methods

7470A. The samples were prepared and analyzed on 02/20/2013.

No difficulties were encountered during the mercury analyses.

All quality control parameters were within the acceptance limits.

TOTAL DISSOLVED SOLIDS

Samples S-2716-120213-CEFF and S-2716-120213-BAG were analyzed for total dissolved solids in accordance with SM20 2540C. The samples were analyzed on 02/18/2013.

No difficulties were encountered during the TDS analyses.

All quality control parameters were within the acceptance limits.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 200-15508-1

SDG Number: 200-15508

Job Description: Burgess Brother's Sanitary Landfill

For:
Environmental Partners Group
1900 Crown Colony Drive
Suite 402
Quincy, MA 02169

Attention: Ms. Ann Marie Petricca

Approved for release.
Sara S Goff
Project Manager I
3/29/2013 4:28 PM

Sara S Goff
Project Manager I
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03/29/2013

The test results in this report relate only to sample(s) as received by the laboratory. These test results were derived under a quality system that adheres to the requirements of NELAC. Pursuant to NELAC, this report may not be produced in full without written approval from the laboratory

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CASE NARRATIVE

Client: Environmental Partners Group

Project: Burgess Brother's Sanitary Landfill

Report Number: 200-15508-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT

The samples were received on 03/14/2013; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 3.0 C.

VOLATILE ORGANIC COMPOUNDS (GC-MS)

Samples S-2716-130313-BAG, S-2716-130313-P-EFL and S-2716-130313-C-EFL were analyzed for volatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8260B. The samples were analyzed on 03/25/2013.

The initial calibration curve was outside acceptance criteria for Methyl iodide, 2-Chloroethyl vinyl ether, and trans-1,4-Dichloro-2-butene. The initial calibration verification (ICV) for analytical batch exceeded control criteria for Vinyl acetate, 2-Butanone, Acetone, 2-Chloroethyl vinyl ether, 2-Hexanone, and trans-1,4-Dichloro-2-butene. The continuing calibration verification (CCV) for analytical batch 53415 exceeded control criteria for Bromomethane, tran-1,4-Dichloro-2-butene, and 2-Chloroethyl vinyl ether. The data have been qualified and reported.

Sample S-2716-130313-P-EFL was over diluted based on provided analyte concentrations. Sufficientt volume was not available to perform more concentrated analysis.

Hexachlorobutadiene and Naphthalene were detected in method blank MB 200-53415/6 at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

Carbon disulfide failed the recovery criteria low for LCS 200-53415/4. 2-Chloroethyl vinyl ether, 2-Hexanone, Acetone and trans-1,4-Dichloro-2-butene failed the recovery criteria high. Refer to the QC report for details.

Samples S-2716-130313-BAG[383X], S-2716-130313-P-EFL[26X] and S-2716-130313-C-EFL[4X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No other difficulties were encountered during the volatiles analyses. All other quality control parameters were within the acceptance limits.

METALS (ICP)

Samples S-2716-130313-BAG, S-2716-130313-P-EFL and S-2716-130313-C-EFL were analyzed for Metals (ICP) in accordance with EPA SW-846 Method 6010C. The samples were prepared on 03/18/2013 and analyzed on 03/19/2013 and 03/20/2013.

No difficulties were encountered during the metals analyses. All quality control parameters were within the acceptance limits.

METALS (ICPMS)

Samples S-2716-130313-BAG, S-2716-130313-P-EFL and S-2716-130313-C-EFL were analyzed for metals (ICPMS) in accordance with EPA SW-846 Method 6020A. The samples were prepared on 03/18/2013 and analyzed on 03/20/2013 and 03/22/2013.

Chromium and Lead were detected in method blank MB 200-53106/1-A at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

No other difficulties were encountered during the metals analyses. All other quality control parameters were within the acceptance limits.

TOTAL MERCURY

Samples S-2716-130313-BAG, S-2716-130313-P-EFL and S-2716-130313-C-EFL were analyzed for total mercury in accordance with EPA SW-846 Methods 7470A. The samples were prepared on 03/19/2013 and analyzed on 03/20/2013.

Mercury was detected in method blank MB 200-53160/21-A at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". If the associated sample reported a result above the MDL and/or RL, the result has been "B" flagged. Refer to the QC report for details.

No other difficulties were encountered during the mercury analyses. All other quality control parameters were within the acceptance limits.

ALKALINITY

Samples S-2716-130313-BAG, S-2716-130313-P-EFL and S-2716-130313-C-EFL were analyzed for alkalinity in accordance with SM20 2320B. The samples were analyzed on 03/25/2013.

No difficulties were encountered during the alkalinity analyses. All quality control parameters were within the acceptance limits.

TOTAL DISSOLVED SOLIDS

Samples S-2716-130313-BAG, S-2716-130313-P-EFL and S-2716-130313-C-EFL were analyzed for total dissolved solids in accordance with SM20 2540C. The samples were analyzed on 03/20/2013.

No difficulties were encountered during the TDS analyses. All quality control parameters were within the acceptance limits.

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