ENI, LLC

FOCUSED FEASABILITY STUDY

FOR THE

**THE ALCAS SOURCE AREA, INCLUDING
THE ALCAS FACILITY
AND PARCEL B PROPERTIES
OLEAN, NEW YORK**

Prepared for

**ALCOA, Inc.
Alcoa, Tennessee**

**Original: January 31, 2013
Revised: July 14, 2014**

Prepared by

ENI Engineering, LLC

707892

TABLE OF CONTENTS

List of Figures

List of Tables

List of Appendices

1.0 Introduction

On behalf of Alcoa Remediation, ENI, LLC. in conjunction with CDM Smith, Inc., has prepared this Focused Feasibility Study ("*FFS*") Report for the Alcas property ("*Alcas Source Area*") located in Olean, Cattaraugus County, New York. The Alcas Source Area is located within the Olean Well Field Superfund Site ("*Site*").

The development of the FFS study was conducted in three parts that included:

- The development and screening of remedial technologies, submitted to the USEPA on February 27, 2009 as *Part 1: Development and Screening of Remedial Technologies*
- Evaluation of data needs and implementation of treatability investigation, and
- The detailed analysis of alternatives.

This FFS Report utilizes the results from the treatability investigation to analyze treatment alternatives against evaluation criteria outlined in the detailed analysis of alternatives.

1.1 *Purpose*

The purpose of the FFS report was to gather sufficient information to support an informed risk management decision regarding remedial alternatives at the Alcas Source Area that sufficiently accomplish the defined remedial action objectives.

1.2 *Report Organization*

This FFS Report follows the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (EPA/540/G-89/004, Office of Emergency and Remedial Response, October 1988).

This FFS Report is organized as follows:

- Section 1 – Introduction: This section describes the purpose and objectives of the report and outlines the organization of the report.
- Section 2 – Alcas Source Area Conditions: This section provides a historical perspective of the Olean Well Field Superfund Site along with Alcas Source Area-specific geological and hydrogeological conditions. This section also provides a Soil/DNAPL and groundwater assessment at the Alcas Source Area and a summary of the treatability investigation results.
- Section 3 – Basis for Remediation: Remedial Action Objectives are established, as well as applicable or relevant and appropriate requirements
- Section 4 – Identification and Screening of Remedial Technologies: This section describes the screening criteria and preliminary screening evaluation.
- Section 5 – Development of Remedial Action Alternatives: This section provides a summary of the development and screening of remedial technologies.
- Section 6 – Detailed Analysis of Alternatives: This section describes the detailed evaluation of remedial alternatives that passed the initial screening process. The detailed analysis evaluates alternatives against seven evaluation criteria.

- Section 7 – Comparative Analysis of Alternatives: This section compares each alternative against the other alternatives.
- Section 8 – References.

2.0 Alcas Source Area Conditions

This section describes the conditions at the Alcas Source Area, including: history; geology; hydrogeology; soil, DNAPL, and groundwater assessment; and a summary of pre-remedial design characterization.

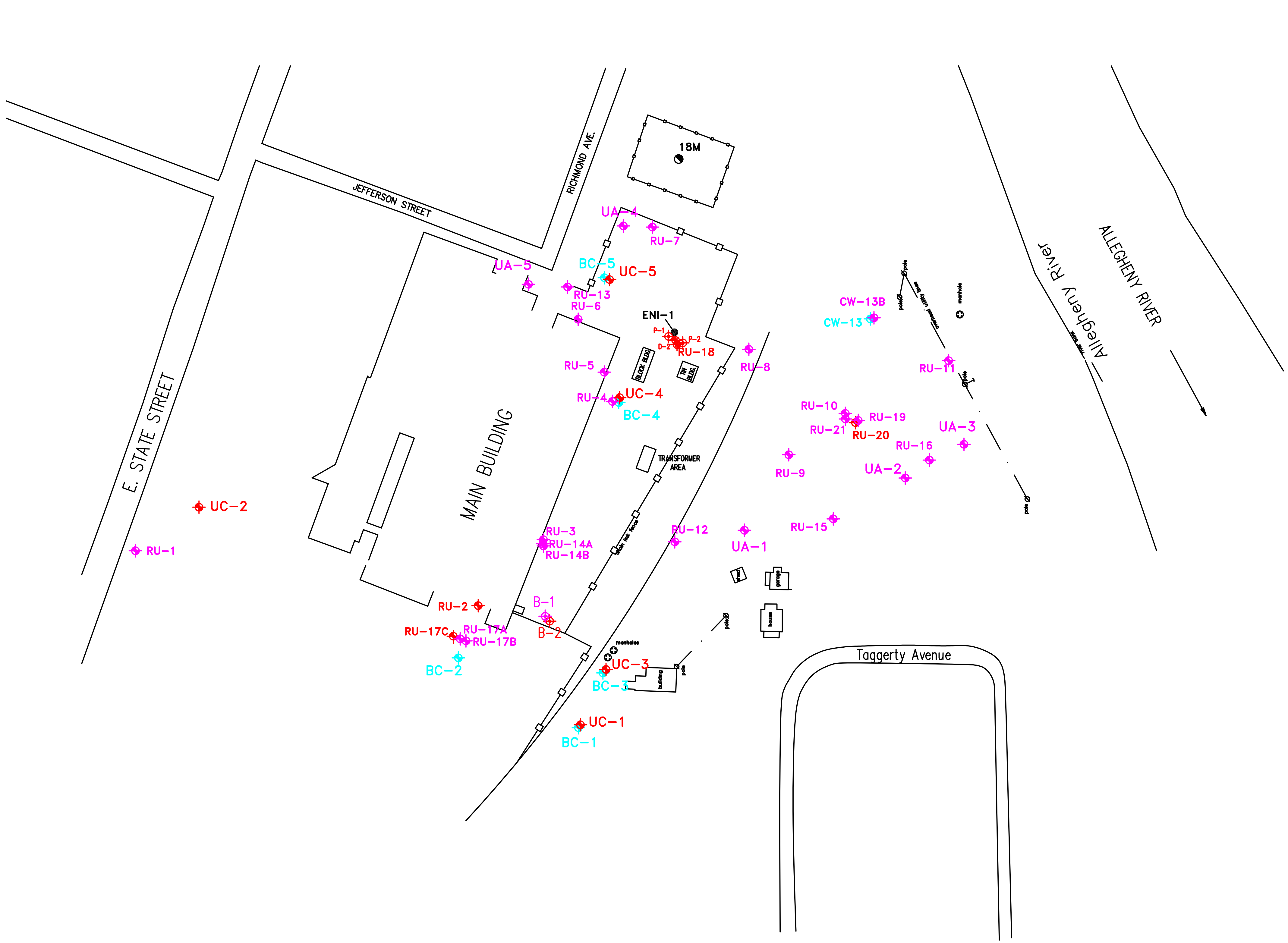
For ease of understanding, the Alcas Source Area consists of two parts, the Alcas Facility and Parcel B properties. The Alcas Facility consists of the Main Building and associated land and structures located at 1116 East State Street, Olean, New York. The Alcas Facility is currently owned and occupied by Cutco Corporation. Parcel B is located south of the Alcas Facility at the following legal description:

> ALL THAT TRACT OR PARCEL OF LAND, situate in the City of Olean, Cattaraugus County, State of New York, bounded and described as follows:
>
> BEGINNING at a point on the north Right of Way line of Billington Avenue where it intersects with the centerline of Taggerty Avenue extended thence N 88-45-18 W along the north Right of Way line of Billington Avenue, a distance of 125.42' to a point; thence N 01-14-42 W through lands now or formerly of Murphy Properties, Inc., a distance of 311.96' to a point; thence south easterly on a curve to the left, along the southerly bounds of Cutco Cutlery Corp., with a radius of 1981 .29' and an arc length of 611.56' to an iron pin; thence S 68-53-05 E along the southerly bounds of Cutco Cutlery Corp., a distance of 8.72' to an iron pin; thence S 05-24-27 W along the easterly bounds of Louise Butler, a distance of 420.17' to a point on the river bank of the Allegheny River; thence S 61-05-11 W along the river bank of the Allegheny River, a distance of 27.22' to a point; thence N 29-32-29 W along the westerly bounds of Randolph V. Price and David Muir, a distance of 461.74' to a point; thence the following courses through lands now or formerly of Murphy Properties Inc.:
>
> N 29-04-08 W, a distance of 97.63' to an iron pin set;
> N 89-11-12 W, a distance of 77.36' to an iron pin set;
> S 00-40-08 W, a distance of 62.81 ' to the point of beginning.

2.1 *Site History*

The Olean Well Field Superfund Site (the *"Site"*) is located in the eastern portion of the City of Olean ("*City*") and west and northwest of the Towns of Olean and Portville in Cattaraugus County, New York as shown in Figure 2-1. The Site incorporates three municipal wells (*"City Production Wells"*), and spans approximately 800 acres of property principally occupied by industrial facilities. The Allegheny River flows through the southwest and southern portions of the Site. State Routes 16 and 417 provide access to the area. A portion of the Alcas Source Area was formerly occupied by the Alcas Cutlery Corporation, and is currently occupied by the Cutco Corporation. Cutlery and sporting knives have been manufactured at the facility since 1949. As part of the manufacturing process, the facility formerly used trichloroethene ("*TCE*") in on site vapor degreasers.

Following initial investigation activities, the U.S. Environmental Protection Agency ("*EPA*") added the Site to the National Priorities List in September 1983. Between 1983 and 1985, the



LEGEND

BC-1	LOWER (BOTTOM) CITY AQUIFER WELLS
UC-1	UPPER CITY AQUIFER WELLS
UA-1	UPPER AQUITARD WELLS
SW-14	EXISTING MONITORING WELLS
RU-12	NEW MONITORING WELLS
18M	PUBLIC WATER WELL
ENI-1	BORING
	PROPERTY BOUNDARY
	FENCE

0 75 150 300

SCALE IN FEET

Notes:

This plat was completed on Oct 12, 2000
from an instrument survey on Oct. 6, 1999 & Oct2 & 4, 2000.
2000 Robert C. Ackerman, P.L.S No. 49845

All elevations were taken on the top of the 2" PVC
pipe casing around the 1" PVC well pipe and were
marked thereon with a black marker pen.

Elevation datum from the City of Olean,
Engineering Office, Olean, NY. Base being USGS.

ENVIRONEERING, INC.

FIGURE 2-1
ALCAS SOURCE AREA
LOCATION MAP

ALCAS PROPERTY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	05/21/2014	137-192

EPA conducted additional investigations at the Site and initiated early remedial actions including the supply of carbon adsorption filters to owners of impacted private wells. It was determined that soils and groundwater were impacted by several chemicals of concern ("*COCs*") including TCE and its degradation products, with established pathways of migration to the Site's Upper Aquifer (*"Upper Aquitard" or "UA"*) and Lower Aquifer (*"City Aquifer*"). Targeted daughter, or degradation, products for TCE include cis-1,2-dichloroethene ("*cDCE*") and vinyl chloride ("*VC*"). Tetrachloroethene ("*PCE*"), a parent product for TCE, has also been detected at the Site and is most likely derived from a commercial grade fraction of the TCE solvent.

On September 30, 1996, EPA issued a Record of Decision for operable unit 2 at the Site which addressed the sources of volatile organic compound (VOC) contamination to groundwater, including the Alcas Source Area. The major components of the selected remedy for OU2 for the Alcas source area included the vacuum enhanced recovery (VER) of VOCs from contaminated soil, upgradient and downgradient groundwater monitoring and implementation of groundwater use restrictions.

As part of the 1998 Operable Unit 2 Consent Decree, Institutional Controls were implemented at the Site. They include:

- Refrain from installing or using any groundwater wells at or downgradient of the Source Area, except for any production wells or monitoring wells currently being used at the Property, monitoring wells required for implementation of the Work, or as approved by EPA. This restriction will terminate upon the recording in the County Clerk's Office of EPA's Certification of Completion of the Work pursuant to Paragraph 50b [of the Consent Decree];
- Refrain from installing or using any groundwater wells upgradient of the Source Area, except for any production wells or monitoring wells currently being used at the Property, monitoring wells required for implementation of the Work, or as approved by EPA. This restriction will terminate upon the recording in the County Clerk's Office of EPA's Certification of Completion of the Work pursuant to Paragraph 50b [of the Consent Decree];
- Refrain from increasing the rate of withdrawal from production wells currently being used at the Property unless for routine business operations or as approved by EPA. This restriction will terminate upon the recording in the County Clerk's Office of EPA's Certification of Completion of the Work pursuant to Paragraph 50b [of the Consent Decree];
- Refrain from excavating the Affected Property, other than any and all excavation required for the Remedial Action, for the maintenance, repair or removal of utility facilities or as otherwise approved by EPA. This restriction will terminate upon the completion of the Remedial Action; and
- Refrain from constructing or erecting any temporary or permanent structure over the Affected Property, other than that required for the Remedial Action or as approved by EPA. This restriction will terminate upon the completion of the Remedial Action.

2.2 *Alcas Source Area Geology*

The geology at the Alcas Source Area is characteristic of glacial deposit. Alcas Source Area soils transition downward from primarily a finer sediment unit typical of glacial till near land surface to a coarse glacial outwash unit of high permeability, to a glacio-lacustrine clay encountered in boreholes at 82 to 97 feet below land surface ("*bls*"). To illustrate the Alcas Source Area geology, three geological cross sections were constructed. The location of the cross sections is shown in Figure 2-2. The symbols representing the different stratigraphies used in the cross sections are shown in Figure 2-3. The lithologic units logged during this investigation are shown in Cross-Section A-A', B-B', and C-C' in Figures 2-4, 2-5, and 2-6, respectively.

The overlying glacial till unit was encountered at approximately 0 to 12 feet bls, and varies in thickness across a majority of the Alcas Source Area between 16 and 29 feet. The till unit was identified by its olive gray color and/or the gravel content and is commonly referred to as the Upper Aquitard based on its generally low permeability. This unit contained 50 to 97 percent clay in the historical sieve analyses. The thickness of the till is highly variable across the Alcas Source Area. Within this unit, a discontinuous thicker and somewhat coarser sequence of sediments may provide preferential pathways for water and constituent migration, and this discontinuous lens (or lenses) is referred to in this document as the Upper Water Bearing Zone.

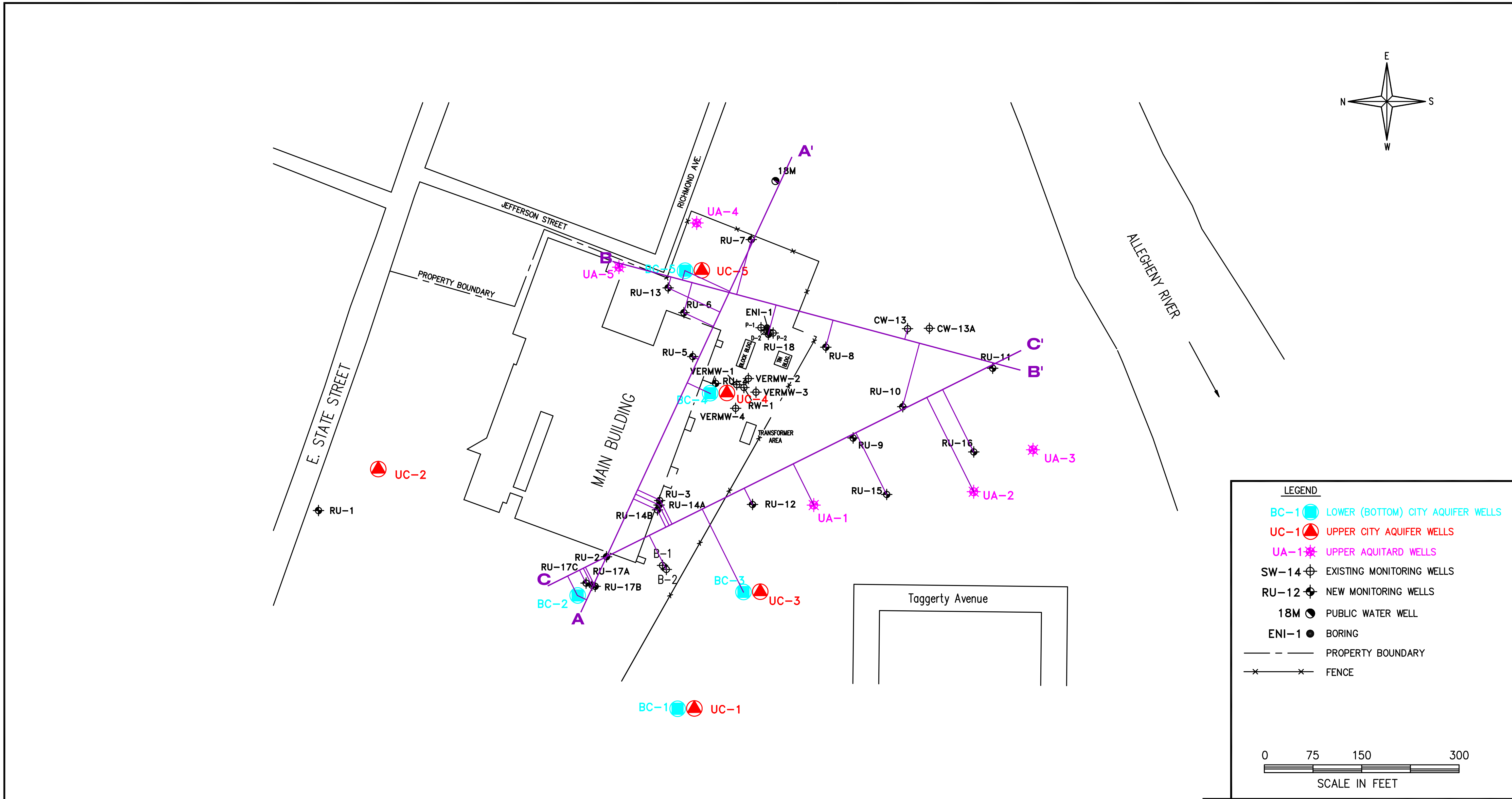
The glacial outwash has been encountered below the Upper Aquitard from approximately 25 to 35 feet bls, and varies in thickness between 54 and 72 feet across the Alcas Source Area. This unit is very permeable, and yields significant quantities of water. The City Aquifer hydrogeologic unit is primarily contained within the glacial outwash geologic unit at the Alcas Source Area. As noted above, glacio-lacustrine clays provide an effective bottom boundary to the City Aquifer between roughly 80 and 100 feet bls.

2.3 *Alcas Source Area Hydrogeology*

The groundwater elevations for the upper and lower portions of the City Aquifer wells were contoured. Figure 2-7 shows the upper City Aquifer contours. The contours for the upper and lower portions of the City Aquifer show groundwater generally flowing to the east toward City Production Well 18M. These maps show that City Production Well 18M's controlling influence potentially extends beyond the westward boundary of the Main Building, thus capturing affected groundwater in the City Aquifer.

Based on these groundwater elevations, groundwater flow in the City Aquifer appears consistent and uniform. This was expected since City Production Well 18M has been in continuous service since 1990. Given City Production Well 18M has been pumping for the last 15 years and the consistent and uniform surrounding groundwater flow, the flow system in the City Aquifer can be assumed to be at steady state. This means that the shape of the contours and complete capture of affected groundwater in the City Aquifer will not change unless the pumping in City Production Well 18M is reduced or stopped.

Most of the wells used for measuring groundwater elevations in the UWBZ are located around the perimeter of the Alcas Facility and to the south on Parcel B. Groundwater elevations in these wells are all much shallower than those in City Aquifer wells, indicating a significant downward



ENVIRONEERING, INC.

FIGURE 2-2

LINES OF GEOLOGIC CROSS SECTION

ALCAS PROPERTY
OLEAN, NEW YORK

DRAWN BY: AF	DATE: 09/05/2013	PROJ. NO. 137 – 192

1. PAVEMENT, CONCRETE, &/OR FILL
2. SILTY CLAY
3. SILTY CLAY W/GRAVEL
4. SILTY, SANDY CLAY
5. SANDY CLAY
6. CLAYEY SAND
7. SILTY SAND
8. CLAY W/GRAVEL
9. CLAYEY SILT
10. GRAVEL
11. GRAVEL W/SAND & SILT
12. SHALE
13. SANDY CLAY W/ GRAVEL
14. CLAYEY SILT W/ GRAVEL
15. SAND W/GRAVEL & SILT
16. CLAY W/GRAVEL & SAND
17. SILT W/GRAVEL
18. CLAY
19. GRAVEL W/CLAY
20. SAND
21. SILT
22. SILTY CLAYEY SAND W/GRAVEL
23. SAND W/GRAVEL
24. GRAVEL W/SAND
25. SILTY CLAYEY GRAVEL
26. GRAVELLY SAND
27. SILTY SANDY GRAVELLY CLAY
28. SILTY CLAYEY SANDY GRAVEL
29. CLAYEY SANDY GRAVEL
30. SANDY SILT

NOT TO SCALE

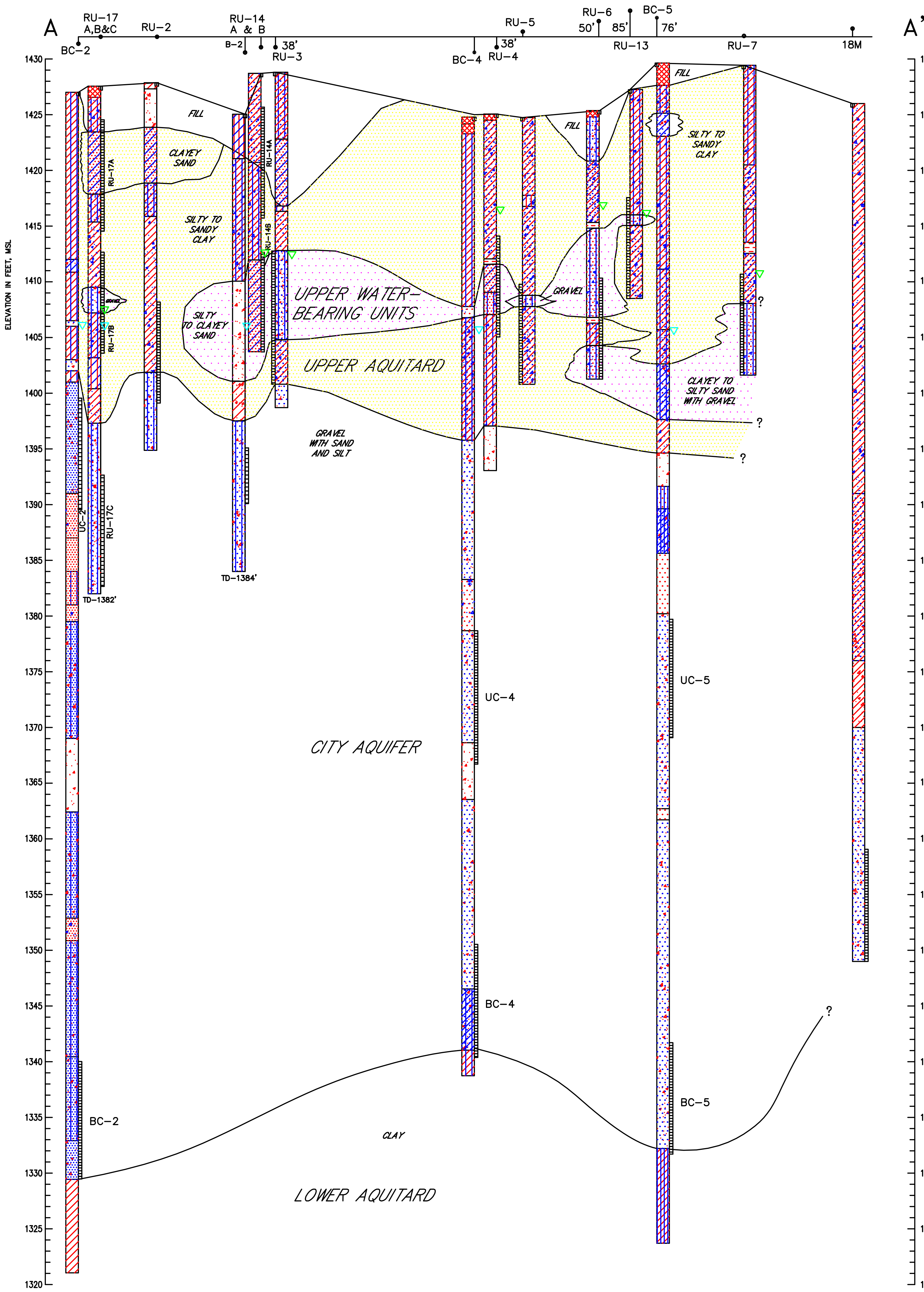
NOTE:
RED INDICATES PREDOMINANT LITHOLOGY.
BLUE INDICATES SECONDARY LITHOLOGY.

ENVIRONEERING, INC.

FIGURE 2–3
STRATIGRAPHIC COLUMN DESCRIPTIONS

ALCAS PROPERTY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	09/05/2013	137 – 192



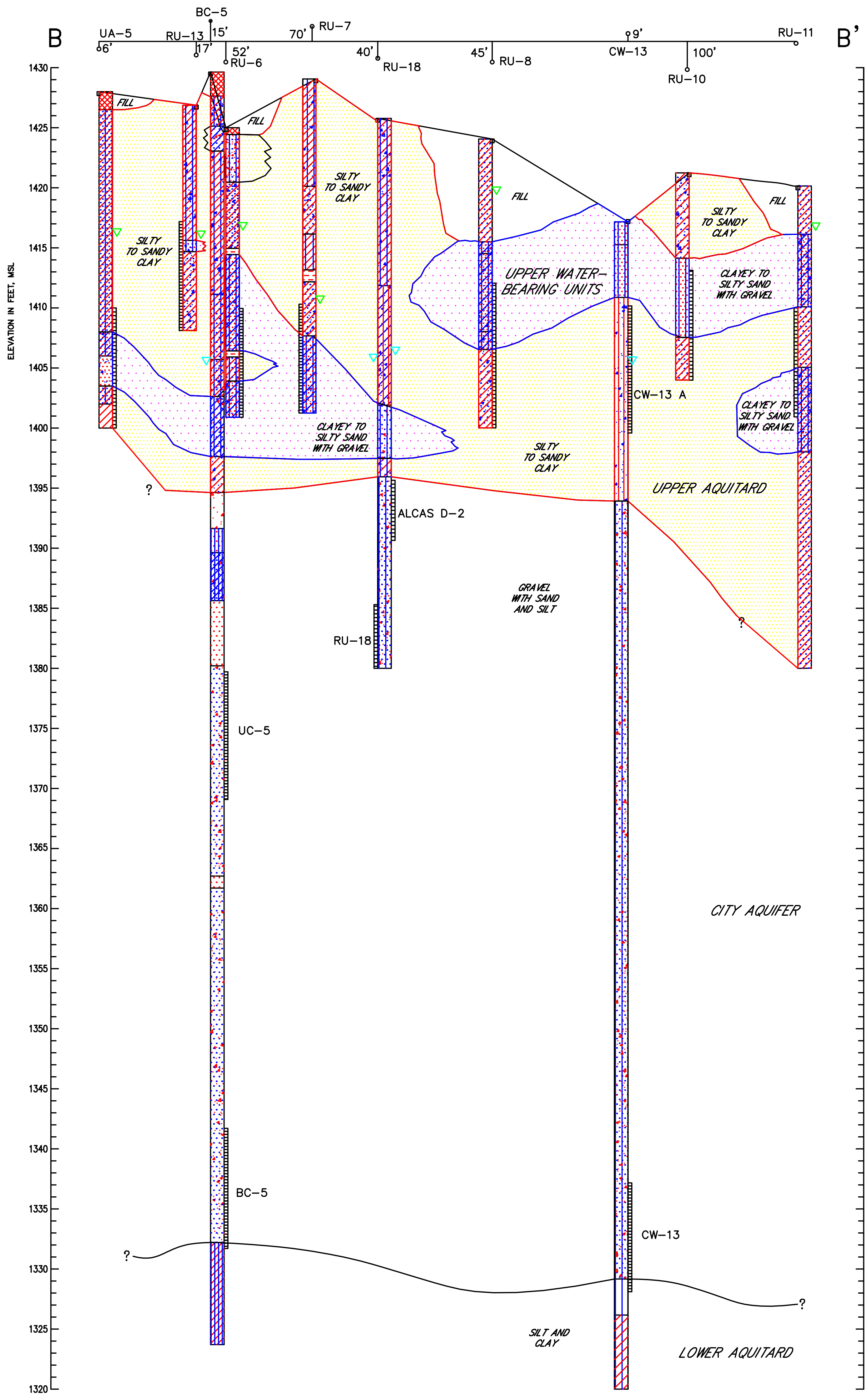
0 25 50 100
HORIZONTAL SCALE IN FEET

NOTE:
RED INDICATES PREDOMINANT LITHOLOGY.
BLUE INDICATES SECONDARY LITHOLOGY.
GROUNDWATER ELEVATION FOR UPPER WATER BEARING ZONE WELLS (11/29/2011).
GROUNDWATER ELEVATION FOR UPPER CITY WELLS (11/29/2011).

ENVIRONEERING, INC.

FIGURE 2-4
GENERALIZED GEOLOGIC CROSS-SECTION A – A'
ALCAS PROPERTY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	09/05/2013	137 – 192

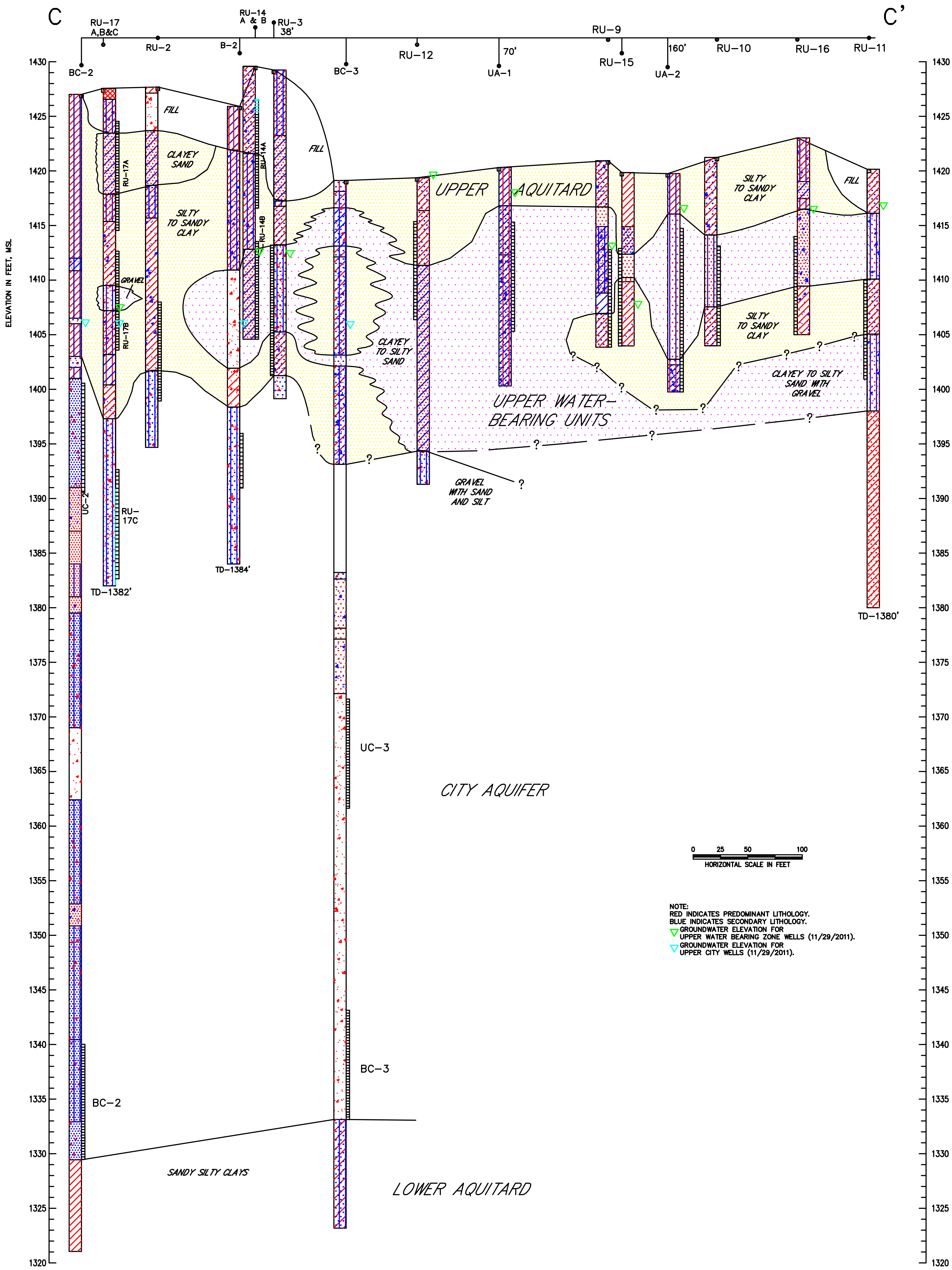


NOTE:
RED INDICATES PREDOMINANT LITHOLOGY.
BLUE INDICATES SECONDARY LITHOLOGY.
GROUNDWATER ELEVATION FOR UPPER WATER BEARING ZONE WELLS (11/29/2011).
GROUNDWATER ELEVATION FOR UPPER CITY WELLS (11/29/2011).

ENVIRONEERING, INC.

FIGURE 2–5
GENERALIZED GEOLOGIC CROSS–SECTION B – B'
ALCAS PROPERTY
OLEAN, NEW YORK

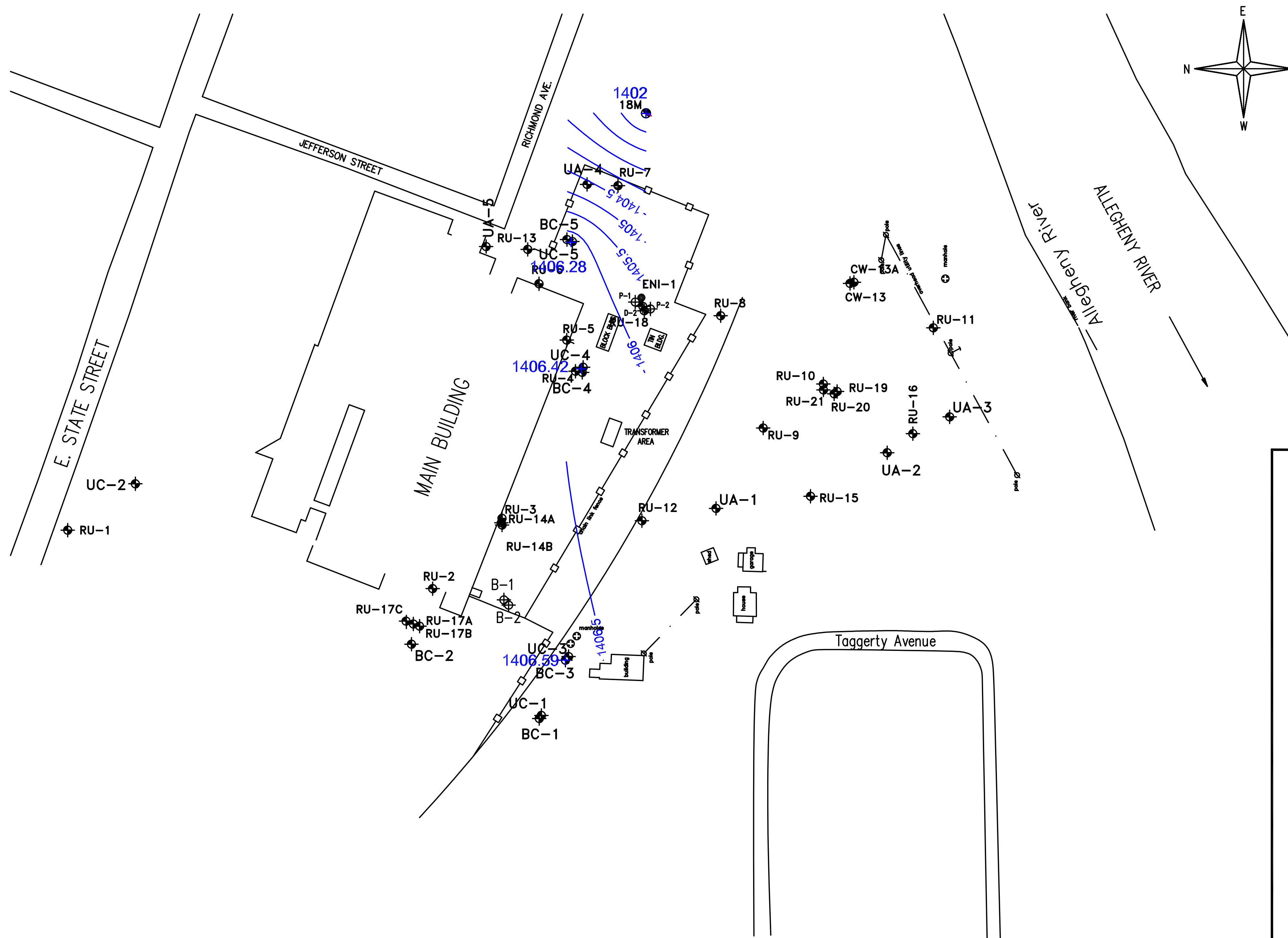
DRAWN BY:	DATE:	PROJ. NO.
AF	09/05/2013	137 – 192



ENVIRONEERING, INC.

FIGURE 2-6
GENERALIZED GEOLOGIC CROSS-SECTION C – C'
ALCAS PROPERTY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	09/05/2013	137 – 192



LEGEND

UA-1	ALCAS MONITORING WELLS
SW-14	EXISTING MONITORING WELLS
18M	PUBLIC WATER WELL
ENI-1	BORING
	PROPERTY BOUNDARY
	FENCE
	FEBRUARY 2012 CONTOURS

Notes:
This plat was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245

Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

0 75 150 300
SCALE IN FEET

ENVIRONEERING, INC.

FIGURE 2-7
Upper City Groundwater Contours
(2-14-2012)

ALCAS PROPERTY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	1/21/2013	137-192

gradient between the UWBZ and the City Aquifer. Two potential exceptions to this are wells UA-4 and RU-7 located east of the Alcas Facility, just over halfway to 18M.

Groundwater elevations in these wells are almost 10 feet deeper than UWBZ wells, consistent with those in the City Aquifer; however, the screens were intended to target the UWBZ based on field observations during drilling. Figure 2-8 shows groundwater elevations contours for the UWBZ, but with solid lines stopping just east of the Alcas Facility to indicate how they would be drawn without including UA-4 and RU-7. This results in a hydraulic gradient that is primarily to the south and southeast, potentially reflecting the influences of both the regional topography sloping toward the river and the pumping at 18M. The dashed lines on the figure indicate how the contour lines would be drawn if UA-4 and RU-7 are included in the UWBZ data set. This results in a very strong easterly gradient in the UWBZ on the east side of the Alcas Facility. As it is not clear whether the groundwater elevations in these two wells represent the UWBZ or the upper City Aquifer, both possibilities will be considered in the Alcas Source Area conceptual model discussion in Section 2.6.

2.4 *Soil/DNAPL Assessment Summary*

Early investigations at the Alcas Source Area involved the collection of soil samples from the southern/southeast portion of the Alcas Facility. However, the concentrations in the soil samples do not indicate residual DNAPL in this portion of the Alcas Facility. It is possible that some of the affected soils may be associated with small, nearby releases (*i.e.*, weed killing activities).

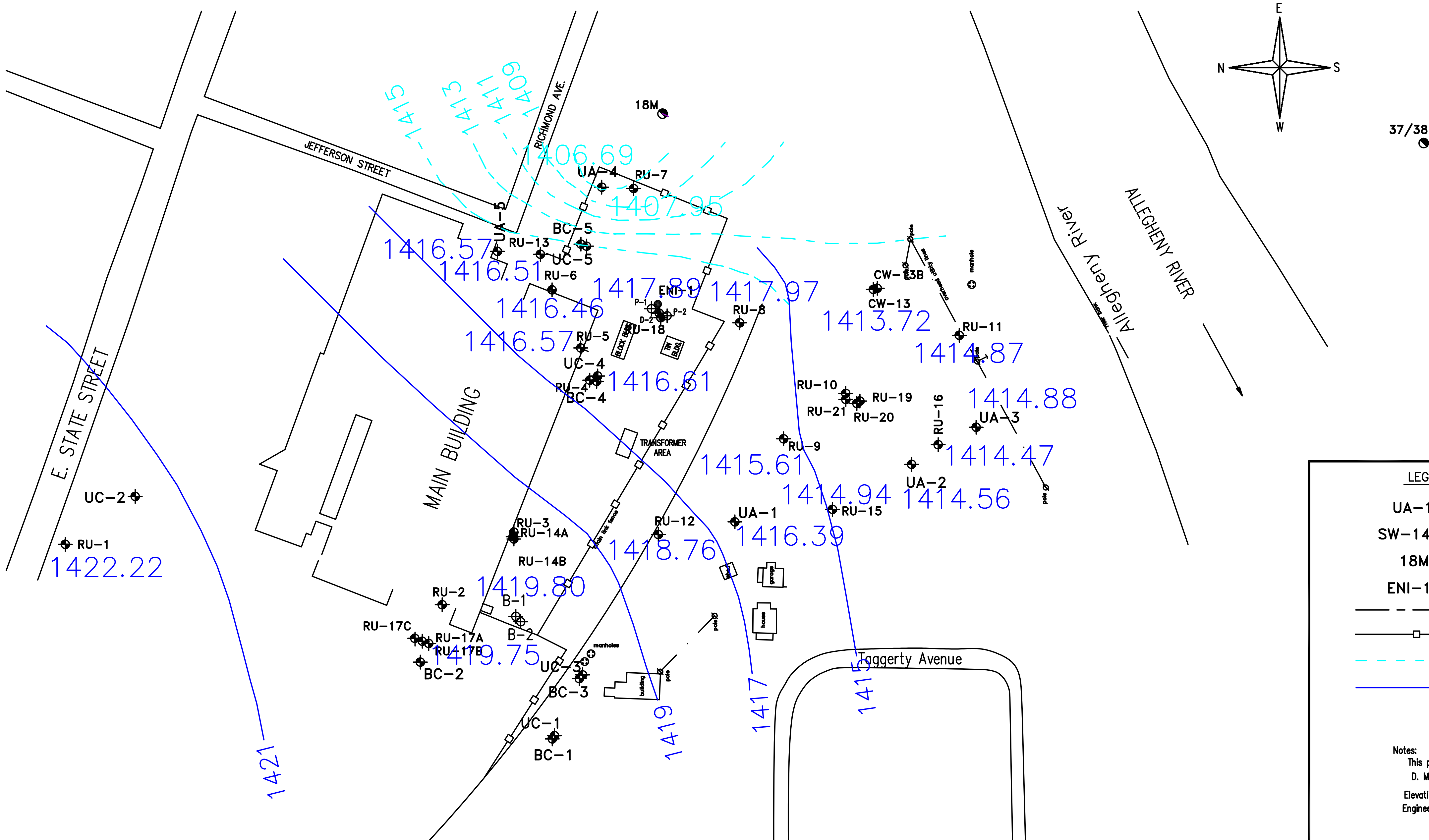
The majority of impacted soils at the Alcas Source Area are beneath the Main Building. Varying concentrations of COCs were detected in the soil samples collected from the borings installed within the Main Building. Figure 2-9 shows the location of the soil borings advanced within the Main Building. Concentrations of TCE as high as 280 milligrams per kilogram (mg/kg) were detected in boring B-3 at 9-10 feet depth.

This concentration represents the highest soil sample concentration of TCE detected at the Alcas Source Area to date. The presence of this concentration of TCE beneath the Main Building further substantiates the hypothesis that the source area is under the Main Building.

2.5 *Groundwater Assessment Summary*

In 2004, vertical profiling of the groundwater at the Alcas Source Area was conducted. Groundwater samples were collected at 10 foot intervals from two borings at depths ranging from approximately 30 feet to approximately 100 feet below grade.

Of the COCs at the Alcas Source Area, TCE and PCE were the most prevalent. The profile data show that TCE had migrated vertically from beneath the Main Building through the Upper Aquitard then traveled horizontally. Profiling samples from the bottom of the City Aquifer provide a characterization of water quality and determine that no free DNAPL existed at the bottom of this unit. Results suggest that the source of the material impacting 18M exists as a residual DNAPL in the Upper Aquitard not as a “pooled DNAPL” in the City Aquifer. The profiling further demonstrates that concentrations are decreasing from the UWBZ into the Upper City Aquifer and then further decease from the Upper City into the Lower City Aquifer.



LEGEND

UA-1	ALCAS MONITORING WELLS
SW-14	EXISTING MONITORING WELLS
18M	PUBLIC WATER WELL
ENI-1	BORING
	PROPERTY BOUNDARY
	FENCE
	Contours With Effect from 18M
	Contours With No Effect from 18M

Notes:
This plat was completed on Jan. 2012
D. Michael Canoda P.L.S. No. 49245
Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

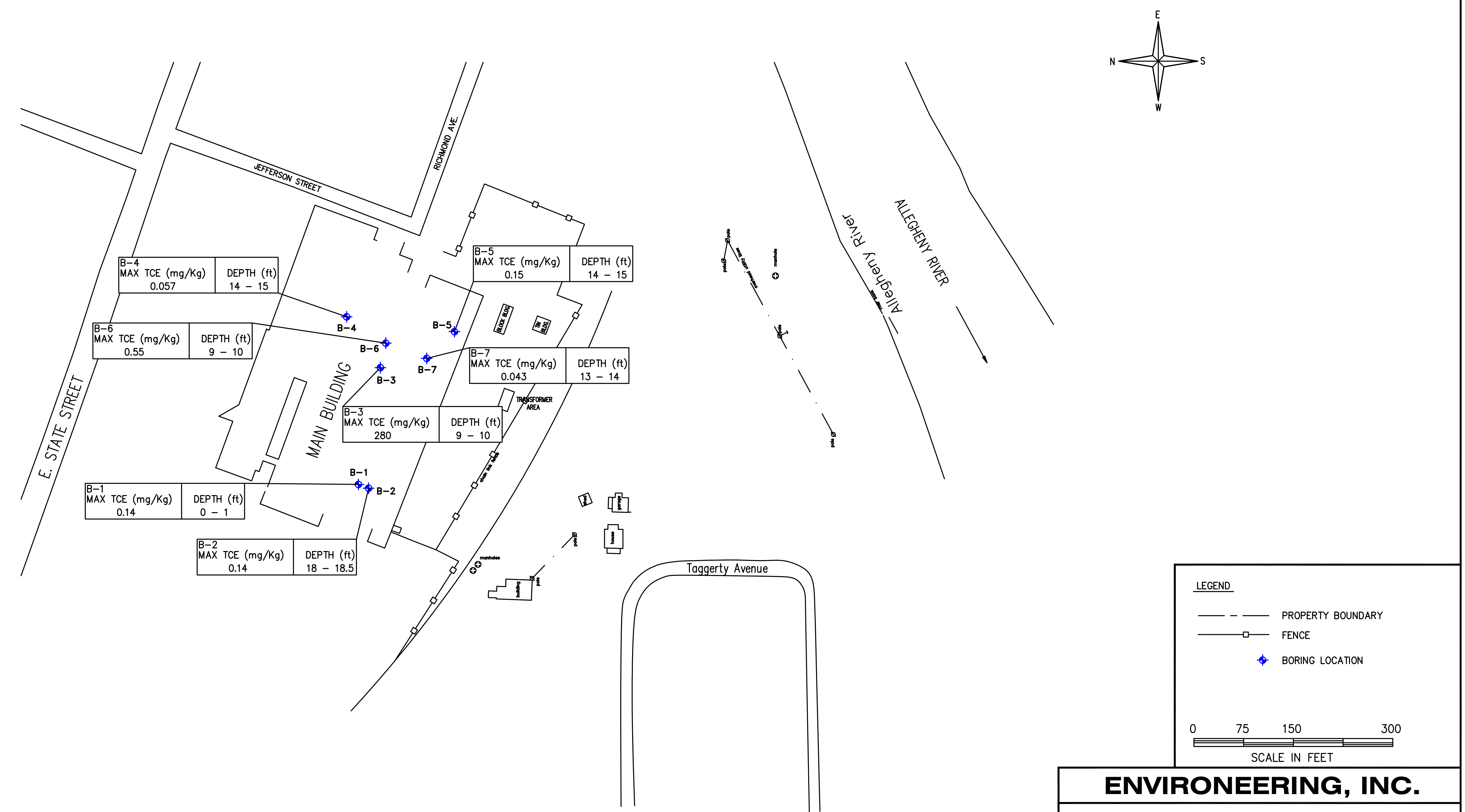
0 75 150 300
SCALE IN FEET

NOTE:
Blue contours are used to indicate the groundwater flow direction that results from not including the UA-4 and RU-7 wells as part of the UWBZ group of wells.
Cyan contours are used to indicate the groundwater flow direction that results from including the UA-4 and RU-7 wells as part of the UWBZ group of wells.

ENVIRONEERING, INC.

FIGURE 2-8
Upper Water Bearing Zone
Groundwater Contours (2-14-2012)
ALCAS PROPERTY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	1/21/2013	137-192



Notes:
This plat was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245
Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

ENVIRONEERING, INC.

FIGURE 2–9
SOIL BORING LOCATION MAP
IN MAIN BUILDING

ALCAS PROPERTY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	05/09/2014	137 – 192

2.5.1 Upper Water Bearing Zone

The sampling results show several key components of the plume distribution at the Alcas Source Area. The wells around the southeast corner of the Main Building (RU-4, RU-5, and RU-6) have TCE concentrations that exceed 1 percent of the solubility of TCE in water (solubility limit). This suggests the presence of a current or historical DNAPL source at this location, or a short distance up gradient. This places the likely source of DNAPL under the Main Building. Figure 2-10 illustrates the TCE in the Upper Water Bearing Zone.

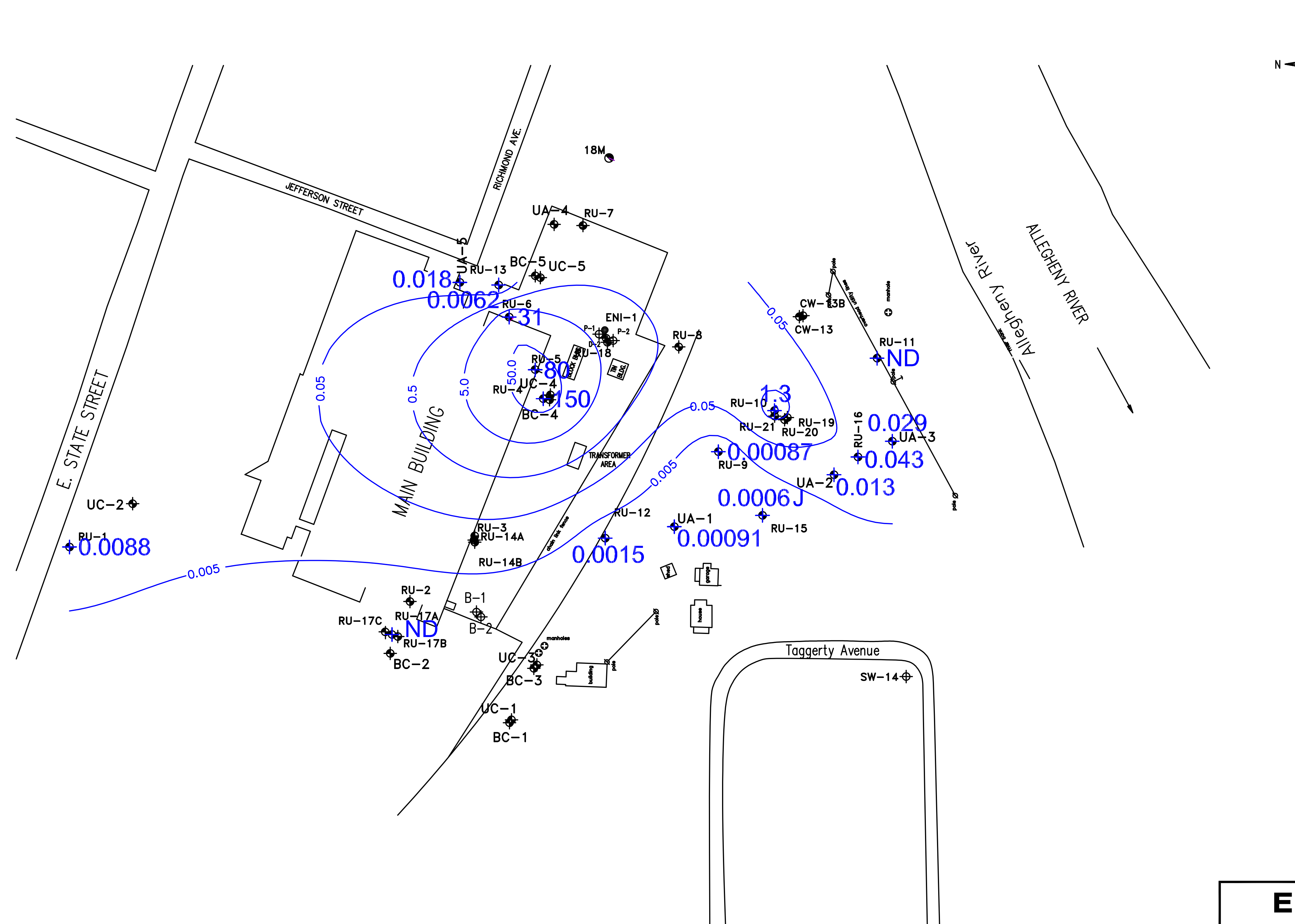
The dissolved-phase plume extends from the southeast corner toward the river generally to the south. This direction of contaminant migration would have predominated during the periods before Well 18M was installed and during the shutdown of 18M during the 1970s. During the 1960s and post 1980, a portion of the groundwater flow is likely toward 18M. The portion of the Alcas Source Area that has flow toward 18M in the Upper Water Bearing Zone is from under the eastern half of the Main Building. As shown in Figure 2-8, it is unclear how far the influence of 18M extends to the south of the Alcas Source Area. The groundwater concentrations are decreasing from the Main Building toward the south with TCE concentrations in RU-8 and RU-9 at 0.120 mg/L and 0.00087 mg/L, respectively. Closer to the river, the TCE concentration increases to 1.3 mg/L (results from the September 2007 sampling event) in RU-10. This higher concentration in RU-10 might represent the migration of TCE that predominated prior to the installation of 18M and during the shutdown of 18M during the 1970s. Given the vicinity of RU-10 is clearly outside the capture zone of 18M (Figure 2-8), concentrations in this area seem to have remained relatively unchanged for several years. The hydraulic gradient south of RU-10 flattens out considerably suggesting that any flow in the UWBZ in that area would be extremely slow.

2.5.2 City Aquifer

The top of the City Aquifer is generally located 25 to 35 feet below grade in the western portion of the Alcas Source Area, dipping to the east and south. To assist in the assessment of groundwater quality in the upper portion of the City Aquifer, five monitor wells (UC-1 through UC-5) were installed at the Alcas Source Area. To assess groundwater quality in the lower portion of the City Aquifer, five monitor wells (BC-1 through BC-5) were installed at the Alcas Source Area. In addition, monitor wells D-2, CW-13, B-2, RU-17C, RU-18 and UC-1 through UC-5 have been used to assess the impact to the upper portion of the City Aquifer.

City well 18M is located east of the Alcas Facility. Currently, TCE concentrations in 18M are approximately 0.020 mg/L. The highest concentration of TCE (10-16 mg/L) has been found in D2. Monitor wells UC-1 – UC4 contain TCE concentrations ranging from <0.001 mg/L to 0.055 mg/L. Figure 2-11 illustrates the TCE concentrations of the upper city aquifer. In the lower portion of the City Aquifer no detectable concentrations of TCE above the drinking water standard have been observed.

In 1991, the EPA issued unilateral administrative order OU1 to the PRPs. As part of the OU1 order, EPA required groundwater samples be collected from selected wells around the Olean Well Field on a quarterly and semi-annual basis. Alcas D-2 and CW-13 are the two closest wells to the Alcas Facility. D-2 has a concentration of approximately 16 mg/L, and CW-13 has a concentration of approximately 0.00015 mg/L. The concentration of TCE in these wells has



LEGEND

UA-1	ALCAS MONITORING WELLS
SW-14	EXISTING MONITORING WELLS
18M	PUBLIC WATER WELL
ENI-1	BORING
	PROPERTY BOUNDARY
	FENCE
0.0011	TCE CONCENTRATION IN THE UPPER WATER BEARING ZONE (mg/L)
	TCE CONTOUR INTERVAL (mg/L) For contouring purposes, the minimum detection limit (MDL) was used for non-detects (ND)

SAMPLES COLLECTED IN NOVEMBER AND DECEMBER 2011

0 75 150 300

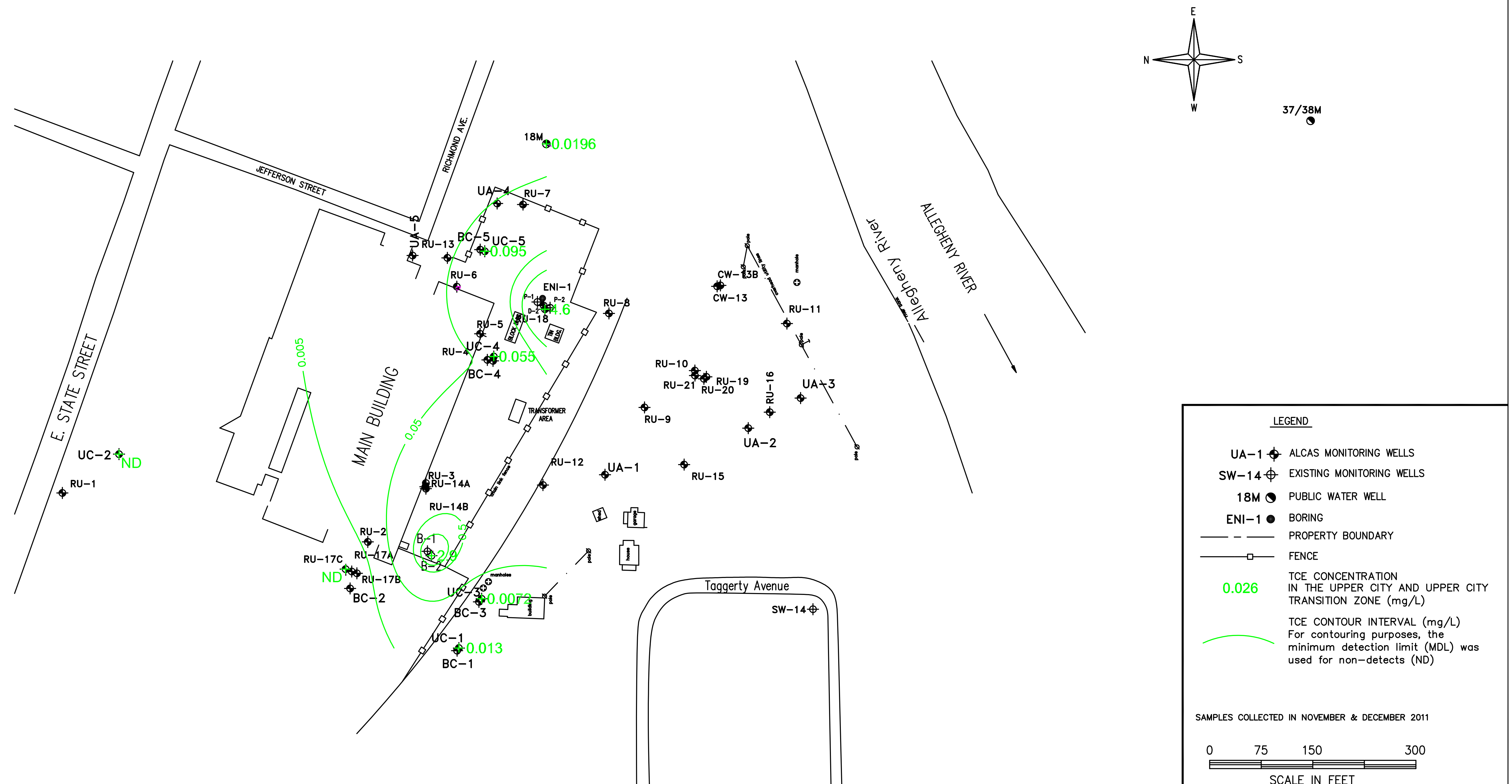
SCALE IN FEET

Notes:
This plat was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245
Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

ENVIRONEERING, INC.

FIGURE 2-10
TCE
Concentration Isopleth Map
Upper Water Bearing Zone
ALCAS PROPERTY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	09/05/2013	137-192



Notes:
This plat was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245

Elevation datum from the City of Olean,
Engineering Office, Olean, NY. Base being USGS.

ENVIRONEERING, INC.

FIGURE 2–11
TCE
Concentration Isopleth Map
Upper City and Upper City Transition Zone
ALCAS PROPERTY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	09/05/2013	137–192

remained relatively unchanged for the past 15 years, indicating that while 18M is in operation, a stable plume exists in the City Aquifer.

2.6 *Alcas Source Area Conceptual Model*

Decisions regarding the effectiveness of remedial actions must be based on a thorough understanding of the physical and chemical conditions of a site. The conceptual model serves as a method of evaluating the restoration potential of a site, relating governing parameters to site-specific data. The conceptual model can be summarized as follows:

- The source material is composed of chlorinated solvents originally released as DNAPL, but now present as immobilized, residual DNAPL, high concentrations sorbed to soil, and/or high concentrations dissolved in groundwater in the Upper Aquitard/UWBZ.
- At the Alcas Source Area, The UWBZ is a discontinuous unit comprising predominantly sand, primarily appearing as localized stream deposits and fill material within the Upper Aquitard;
- The Upper Aquitard is a very heterogeneous unit comprising predominantly silty/clayey units with intermixed sandy units, characterized by low permeabilities, thereby acting as an aquitard overlying the City Aquifer;
- A strong vertical hydraulic gradient exists between the UWBZ and the City Aquifer, indicating they are generally not in strong hydraulic communication;
- Horizontal groundwater flow is the primary component of groundwater flow, and vertical groundwater flow is a secondary component, as indicated by the rapidly decreasing COC concentrations with depth in the City Aquifer;
- At the Alcas Source Area, horizontal flow of groundwater in the Upper Aquifer is generally directed to the south toward the Allegheny River, though the pumping of 18M might exert a southeasterly influence at least under the eastern half of the Alcas Facility;
- The primary source area consisting of one or more entry zones and associated residual DNAPL zones is located below the Main Building; and
- Dissolved phase concentrations in the UWBZ/Upper Aquitard south of the Main Building are stable due to the flat hydraulic gradient in this area and the lack of influence of 18M.

This information suggests a probable residual material is under the Main Building that will persist and continue to generate dissolved phase derivatives for unknown lengths of time as long as the material persists. Overall, the residual material under the Main Building identified by the updated conceptual model includes a significantly larger area than originally specified in the OU2 ROD.

It is important to note that this conceptual model identifies both the residual DNAPL source and the dissolved phase concentrations outside the influence of 18M to the south as separate areas that need to be addressed by remedial alternatives. Mass removal in the residual source area will decrease any COC flux both to the City Aquifer and through the Upper Aquitard to the south and southeast, while mass removal in the southern dissolved concentration area will accelerate restoration of groundwater there. These two areas will both be considered in the detailed evaluation of alternatives in Section 6.

2.7 *Summary of Treatability Investigation*

Investigation activities were conducted to collect characterization data and assess applicability, removal efficiency, and implementability of in-situ remediation technologies. The activities outlined in the *Part II Phase 2 Data Collection Work Plan (revised June 2011)* consisted of:

- The collection of groundwater elevation data and aquifer testing to simulate remedial alternative and hydrogeologic conditions with a groundwater flow model,
- The collection of groundwater samples to update Alcas Source Area characterization data and evaluate natural attenuation as a remedial alternative,
- Administered a bench-scale study on ISCO treatment technologies,
- Conducted field pilot test of ISCO using activated sodium persulfate, and
- Conducted field pilot test of enhanced anaerobic bioremediation.

The results of the treatability investigation are included as:

- Appendix B: Modeling Report for Evaluation of Groundwater Extraction as a Remedial Alternative and Olean Groundwater Model Calibration and Capture Simulation Memorandum;
- Appendix C: Data Evaluation for ISCO Pilot Study;
- Appendix D: Bench-scale Test Summary Report;
- Appendix E: Groundwater Characterization for Evaluation of Natural Attenuation; and
- Appendix F: Enhanced Anaerobic Bioremediation Pilot Study.

3.0 Basis for Remediation

The identification and screening of appropriate remedial alternatives requires that remedial goals and requirements be established as the basis for remediation. In this section, Remedial Action Objectives are established, as well as applicable or relevant and appropriate requirements (ARARs). With these identified, alternatives with the potential to meet them can be developed.

3.1 *Remedial Action Objectives*

The Record of Decision ("ROD") for the second operable unit ("OU2") for the Site considered risks on both a human health and ecological basis. The human health assessment addressed potential risk by identifying several potential exposure pathways by which the public may be exposed to under current and future land-use conditions. The baseline risk assessment evaluated the health effects that would result from exposure to groundwater containing constituents of concern through three pathways; namely, ingestion, dermal contact and inhalation of volatilized constituents during showering. Risk as a result of constituents in surface and subsurface soils was calculated for an exposure scenario of ingestion or inhalation by construction workers. A residential exposure scenario was not calculated because the property is zoned and operated as industrial/commercial, and was expected to continue as such in the future.

The baseline risk assessment results indicated that ingestion of and dermal contact with untreated groundwater at the Site poses the only unacceptable risks to human health. Risks due to the inhalation of constituents from untreated groundwater during showering were within EPA's acceptable risk range. Risks calculated for ingestion and inhalation of surface and subsurface soils by construction workers were found to be acceptable at the Alcas Source Area.

The ecological risk assessment concluded that there are no significant habitats present at the Alcas Source Area which could potentially support indigenous wildlife receptor species.

The groundwater RAOs for the Alcas Source Area (Alcas Facility and Parcel B) include:

- Restore the City Aquifer beneath the Alcas Source Area to its beneficial use as a source of drinking water by reducing contaminant levels to the more stringent of federal MCLs or New York State standards;
- Minimize, contain and/or eliminate sources of VOC contaminants already in the shallow groundwater at the Alcas Source Area; and
- Minimize and/or eliminate the potential for future human exposure to Alcas Source Area contaminants via contact with contaminated groundwater.

The groundwater preliminary remediation goals are identified in Table 3-1.

Table 3-1: Remediation Goals for Groundwater

Chemicals of Potential Concern (COPCs)	NYS Groundwater Quality Standards (ppb)	NYS Drinking Water Quality Standards (ppb)	National Primary Drinking Water Standards (ppb)
cis- 1,2-DCE	5	5	70
trans-1,2-DCE	5	5	100
TCE	5	5	5
PCE	5	5	5
Vinyl Chloride	2	2	2
Xylene	5	5	10,000

The soil RAOs for the Alcas Facility include:

- Minimize, contain and/or eliminate VOC contaminants from soils at the Alcas Source Area that are leaching into the groundwater; and
- Minimize and/or eliminate the potential for human exposure to Alcas Source Area contaminants via contact with contaminated soil.

To satisfy these RAOs, soil remediation goals for addressing the Alcas soil contamination are identified in Table 3-2.

Table 3-2: Remediation Goals for Soil

Chemicals of Potential Concern (COPCs)	Soil Remediation Goals (ppm)
cis- 1,2-DCE	0.25
trans-1,2-DCE	0.19
Vinyl Chloride	0.02
TCE	0.47
PCE	1.3
Xylene	1.6

Soil remediation goals were developed as a function of the State Remedial Program Soil Cleanup Objectives (6 NYCRR Subpart 375-6) as discussed below.

3.2 *Applicable or Relevant and Appropriate Requirements (ARARs), To-Be Considered, or Other Guidance*

ARARs are classified into three categories: (1) chemical-specific, (2) location-specific, and (3) action-specific, depending on whether the requirement is triggered by the presence or emission of a chemical, by a vulnerable or protected location, or by a particular action.

Chemical-specific ARARs are typically health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, are expressed as numerical values that represent cleanup standards (i.e., the acceptable concentration of a chemical at the site). Location-specific ARARs are restrictions on the concentration of constituents or the conduct of activities in environmentally sensitive areas. Action-specific ARARs are usually technology- or activity-based requirements or limitations on actions or conditions taken with respect to specific constituents. Action-specific ARARs do not determine the remedial alternative; rather, they indicate how a selected alternative must be achieved.

According to published EPA guidance (EPA540-R-98-020), ARARs may be waived under certain circumstances during on-site response actions. In other cases, the response may incorporate environmental policies or proposals that are not ARARs, but do address site- specific concerns. Such to-be-considered ("*TBCs*") standards may be used in determining the cleanup levels necessary for protection of human health and the environment. These TBCs include nonpromulgated criteria, advisories, guidance, and proposed standards.

Tables 3-3 through 3-5 identify action, chemical, and location-specific ARARs, TBCs, or other guidance considered for this Alcas Source Area.

3.3 *Remediation Implementation and Optimization Strategy*

The selected remedy for the Alcas Source Area must account for the details of the Alcas Source Area conceptual model outlined in Section 2.6, as well as the RAOs and site-specific constraints discussed in Section 3.1. Doing this will require some flexibility in remedy implementation that incorporates new data as they are collected, evaluates them in the context of progress toward cleanup objectives and cost, and facilitates optimization of the remedy through modifying operations, capitalizing on new opportunities for cost-effective mass removal, transitioning from aggressive to passive technologies, and/or reevaluating cleanup targets.

Some of the key Alcas Source Area conditions and constraints that will affect the remediation implementation include:

- The source material present at the Alcas Source Area comprises immobilized, residual DNAPL, high concentrations sorbed to soil, and/or high concentrations dissolved in groundwater in a large area located under the southeast corner of the Main Building;
- The soils of the UWBZ, where the constituent mass is contained, are highly heterogeneous; and
- Preventing detrimental impacts to municipal well 18M will be of primary importance to remedy implementation.

In Sections 5 and 6, remedial alternatives with the potential to meet the RAOs are developed and evaluated as a conceptual design. A major objective, per the RAOs, is to remove or control source material remaining at the Alcas Source Area. As such, some technologies are considered that are focused primarily on containment (or control) of the source material, while others are considered that have the potential to remove some or all of the source. In general EPA guidance expresses a preference for removal of source material over containment when possible; i.e., a reduction in toxicity, mobility, or volume. Therefore, special attention is given to alternatives employing these technologies in the development of a remediation strategy for the Alcas Source Area.

Table 3-3
Chemical-specific ARARs, TBCs, and other Guidance
Alcas Property
Olean, Cattaraugus County, New York

Regulatory Level	Regulatory Authority and Citation	Requirement Synopsis
Federal	National Primary Drinking Water Standards-Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) (42 U.S.C. § 300f et seq and 40 CFR Part 141, Subpart F)	Establishes health-based standards for public drinking water systems. Also establishes drinking water quality goals set at levels at which no adverse health effects are anticipated, with an adequate margin of safety.
State	New York State Department of Health Drinking Water Standards (10 NYCRR Part 5)	Sets MCLs for public drinking water supplies.
State	New York Remedial Program Soil Cleanup Objectives (6 NYCRR Part 375.6)	Establish standards for soil cleanups.
State	New York DEC Commissioner Policy 51 (CP-51 /Soil Cleanup Guidance)	Provides the framework and procedures for the selection of soil cleanup levels appropriate for each of the remedial programs
State	New York Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations (6 NYCRR Part 703)	Establish numerical standards for groundwater and surface water cleanups.

Table 3-4
Action-specific ARARs, TBCs and other Guidance
Alcas Property
Olean, Cattaraugus County, New York

Regulatory Level	Regulatory Authority and Citation	Requirement Synopsis
General Requirement for Site Remediation		
Federal	OSHA—Record keeping, Reporting, and Related Regulations (29 CFR 1904)	This regulation outlines the record keeping and reporting requirements for an employer under OSHA.
Federal	OSHA—General Industry Standards (29 CFR 1910)	These regulations specify an 8-hour time-weighted average concentration for worker exposure to various organic compounds. Training requirements for workers at hazardous waste operations are specified in 29 CFR 1910.120.
Federal	OSHA—Construction Industry Standards (29 CFR 1926)	This regulation specifies the type of safety equipment and procedures to be followed during site remediation.
Federal	RCRA Identification and Listing of Hazardous Wastes (40 CFR 261)	Describes methods for identifying hazardous wastes and lists known hazardous wastes.
Federal	RCRA Standards Applicable to Generators of Hazardous Wastes (40 CFR 262)	Describes standards applicable to generators of hazardous wastes.
Federal	RCRA—Preparedness and Prevention (40 CFR 264.30–264.31)	This regulation outlines the requirements for safety equipment and spill control.
Federal	RCRA—Contingency Plan and Emergency Procedures (40 CFR 264.50–264.56)	This regulation outlines the requirements for emergency procedures to be used following explosions, fires, etc.
State	New York Hazardous Waste Management System – General (6 NYCRR Part 370)	This regulation provides definition of terms and general standards applicable to hazardous wastes management system.
State	New York Identification and Listing of Hazardous Waste (6 NYCRR Part 371)	Describes methods for identifying hazardous wastes and lists known hazardous wastes.
State	New York Hazardous Waste Management Facilities (6 NYCRR Part 373)	Regulates treatment, storage, and disposal of hazardous waste.
State	New York Management of Specific Hazardous Waste (6 NYCRR Part 374)	Establishes standards for the management of specific hazardous wastes.
State	New York Environmental Remediation Programs (6 NYCRR Part 375)	Identifies process for investigation and remedial action at state funded Registry site; provides exception from NYSDEC permits
State	New York DEC Commissioner Policy 51 (CP-51 /Soil Cleanup Guidance)	Provides the framework and procedures for the selection of soil cleanup levels appropriate for each of the remedial programs
State	New York Solid Waste Management Regulations (6 NYCRR 360)	Sets standards and criteria for all solid waste management facilities, including design, construction, operation, and closure requirements for the municipal solid waste landfills.
Waste Transportation		
Federal	Department of Transportation (DOT) Rules for Transportation of Hazardous Materials (49 CFR Parts 107, 171, 172, 177 to 179)	This regulation outlines procedures for the packaging, labeling, manifesting, and transporting hazardous materials.
Federal	RCRA Standards Applicable to Transporters of Hazardous Waste (40 CFR 263)	Establishes standards for hazardous waste transporters.
State	New York Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities (6 NYCRR Part 372)	Establishes record keeping requirements and standards related to the manifest system for hazardous wastes.
State	New York Waste Transporter Permit Program (6 NYCRR Part 364)	Establishes permit requirements for transportations of regulated waste.
Disposal		
Federal	RCRA Land Disposal Restrictions (40 CFR 268)	Identifies hazardous wastes restricted from land disposal and provides treatment standards under which an otherwise prohibited waste may be land disposed.
State	New York Standards for Universal Waste (6 NYCRR Part 374-3) and Land Disposal Restrictions (6 NYCRR Part 376)	These regulations establish standards for treatment and disposal of hazardous wastes.
Groundwater Discharge		
Federal	Clean Water Act (CWA [40 CFR 122, 125)	National Pollutant Discharge Elimination System (NPDES) permit requirements for point source discharges must be met, including the NPDES Best Management Practice (BMP) Program. These regulations include, but are not limited to, requirements for compliance with water quality standards, a discharge monitoring system, and records maintenance.
Federal	Clean Water Act (Federal Ambient Water Quality Criteria [FAWQC] and Guidance Values [40 CFR 131.36])	Establishes criteria for surface water quality based on toxicity to aquatic organisms and human health.
Federal	Safe Drinking Water Act – Underground Injection Control Program (40 CFR 144, 146)	Establish performance standards, well requirements, and permitting requirements for groundwater re-injection wells.
State	New York Regulations on State Pollution Discharge Elimination System (SPDES) (6 NYCRR parts 750-757)	This permit governs the discharge of any wastes into or adjacent to State waters that may alter the physical, chemical, or biological properties of State waters, except as authorized pursuant to a NPDES or State permit.
State	New York Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations (6 NYCRR Part 703)	Establish numerical criteria for groundwater treatment before discharge.
State	New York State Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (TOGS 1.1.1)	Provides groundwater effluent limitations for use where there are no standards.
Off-Gas Management		
Federal	Clean Air Act (CAA)—National Ambient Air Quality Standards (NAAQs) (40 CFR 50)	These provide air quality standards for particulate matter, lead, NO_2, SO_2, CO, and volatile organic matter.
Federal	Federal Directive – Control of Air Emissions from Superfund Air Strippers (OSWER Directive 9355.0-28)	These provide guidance on the use of controls for superfund site air strippers as well as other vapor extraction techniques in attainment and non-attainment areas for ozone.
State	New York Air Quality Standards/ DER-10 (6 NYCRR Part 257)	This regulation requires that maximum 24-hour concentrations for particulate matter not be exceeded more than once per year. Fugitive dust emissions from site excavation activities must be maintained below 250 micrograms per cubic meter ($\mu g/m^3$).
State	New York State Department of Environmental Conservation (DAR-1) Air Guide 1, Guidelines for the Control of Toxic Ambient Contaminants	This policy provides guidance for the control of toxic ambient air contaminants and outlines the procedures for evaluating sources.
State	New York Permits and Certificates (6 NYCRR Part 201)	Permits may be exempted for listed trivial activities.
State	New York Emissions Verification (6 NYCRR Part 202)	Specifies the sampling and documentation requirements for off-gas emissions.
State	New York General Prohibitions (6 NYCRR Part 211)	Prohibition applies to any particulate, fume, gas, mist, odor, smoke, vapor, pollen, toxic or deleterious emissions.
State	New York General Process Emission Sources (6 NYCRR Part 212)	Sets the treatment requirements for certain emission rates.

Table 3-5
Location-specific ARARs, TBCs and other Guidance
Alcas Property
Olean, Cattaraugus County, New York

Regulatory Level	Citation	Requirement Synopsis
Federal	National Historic Preservation Act (16 U.S.C. §470 et seq. and 36 CFR Part 800)	Establishes procedures to provide for preservation of historical and archeological data that might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program.
Federal	Endangered Species Act (16 U.S.C.§ 1531 et seq., 50 CFR Part 200)	Requires that the continued existence of any endangered or threatened species and/or its habitat not be impacted by a federal activity
Federal	Clean Water Act Section 404; 40 CFR Parts 230; 33 CFR Parts 320-330	Prohibits discharge into wetlands.
Federal	Clean Water Act ; 40 CFR Part 6 Appendix A, section 4	Avoids adverse effects, minimize potential harm, preserve, and enhance wetlands.
Federal	Floodplain Management; 40 CFR 6.302 (b) (2005)	Regulates activities in a floodplain.
State	Endangered and Threatened Species of Fish and Wildlife (6 NYCRR Part 182)	Standards for the protection of threatened and endangered species
State	Freshwater Wetlands; 6 NYCRR 663-665	Establishes permit requirement regulations, wetland maps, and classifications.
State	Floodplain Management; 6 NYCRR 500	Describes development permitting requirements for areas in floodplains
State	Use and Protection of Waters; 6 NYCRR 608	Regulates the modification or disturbance of streams
State	Wild, Scenic, and Recreational Rivers; 6 NYCRR 666	Regulations for administration and management.
State	Floodplains; 6 NYCRR 502	Contains floodplain management criteria for state projects.

As will be discussed in subsequent sections, several technologies hold promise for removing source and dissolved constituent mass at the Alcas Source Area. However, the Alcas Source Area conditions and constraints listed above provide an important context for implementation of those technologies. First, the proximity of well 18M is a limiting factor for in situ treatment technologies employing injection of treatment reagents. Such injections must be implemented such that no detrimental impact to well 18M water quality is realized. This means that injections cannot employ overly large volumes and cannot be extended over too long a time period.

Second, the locations of the source material under the Main Building provide a formidable challenge for delivery of any technology. The fact that the Main Building houses an active, large manufacturing operation congested with large pieces of equipment which cannot be moved further limits accessibility.

Third, the nature of the source material, the heterogeneity of the soils is a constraining factor. Based on the collective experience of practitioners over the last two decades, it is highly unlikely that complete removal of the source material can be achieved cost-effectively under these conditions in a short time period by any of the technologies available (e.g., NRC 2012).

These constraints do not prevent cost-effective use of source removal technologies for significant benefit, but they do mean that a combination of aggressive, short-term mass removal technologies and passive, long-term attenuation processes should be employed in the context of achieving “faster, cleaner, greener, and cheaper” cleanups.

Following remedy selection (to be specified in a Record of Decision Amendment), the Remedial Design phase will proceed. Following the design, the remedy will be constructed. During construction, additional subsurface information will be obtained that might suggest conditions are somewhat different than expected during the conceptual design phase, and some optimization of the remedial design is required before completing construction or beginning operations. Once any required modifications to the construction design or operations strategy are implemented, remedial operations will begin.

Performance monitoring data will be collected routinely to determine whether the system is operating as designed, and whether progress is being made toward cleanup objectives. These data will be used to update the Alcas Source Area conceptual model as appropriate. Armed with the performance monitoring data and updated Alcas Source Area conceptual model, the effectiveness of the remedy can be evaluated. The appropriate frequency of these evaluations will depend on the remedy selected, and the evaluations will be conducted in accordance with EPA guidance (Groundwater Completion Strategy, U.S. EPA OSWER directive 9200.2-144, May 2014).

In the case of aggressive source removal technologies, the transition will be to long-term, ongoing attenuation processes resulting from the active remedy. A performance monitoring strategy will be developed for the attenuation processes that include performance benchmarks based on numerical modeling using the updated Alcas Source Area conceptual model. The performance timeframe for attenuation processes is expected to be significantly longer than that of the source removal technology(ies), so the frequency of evaluation will likely be lower. In any case, performance monitoring data will be collected in order to update the Alcas Source Area conceptual model, and the effectiveness of attenuation processes will be evaluated following the same process as for the source removal portion of the remedy.

4.0 Identification & Screening of Remedial Technologies

Screening of remedial technologies and technology process options was conducted in two stages. The first stage evaluated technologies based on technical implementability and compliance with site-specific constraints. The second stage evaluated technologies based on effectiveness, implementability, and cost.

Based on the Alcas Source Area conceptual model outlined in Section 2 and the RAOs developed in Section 3, the Alcas Source Area has been divided into two primary areas to be targeted for remedial action. The first area is the residual source area underneath and immediately adjacent to the Alcas Facility. The second primary area is the dissolved phase concentrations on Parcel B.

Remedial alternatives based on available remedial technologies were developed for each target area. Those technologies are described and evaluated in the ENI report Focused Feasibility Study *Part 1: Development and Screening of Remedial Technologies* submitted to the US EPA on February 27, 2009. The technologies held for further evaluation are discussed in Section 5.0.

5.0 Development of Remedial Action Alternatives

The following technologies are held for further evaluation to address soil and groundwater contamination at the Alcas Facility.

- Alternative A.1 - No Action;
- Alternative A.2 - Excavation of Shallow Impacted Soils;
- Alternative A.3 - Vacuum Enhanced Recovery of Contaminated Soil;
- Alternative A.4 - Groundwater Extraction and Treatment of Intercepted Groundwater Flow from the Source Area Using a Collection Trench;
- Alternative A.5 - Groundwater Extraction and Treatment of Intercepted Groundwater Flow from the Source Area Using Vertical or Horizontal Extraction Wells;
- Alternative A.6 - ZVI Permeable Reactive Barrier using Fracing Method to Treat Intercepted Groundwater Flow from the Source Area;
- Alternative A.7 - Barrier Wall Containment to Prevent Impacted Groundwater from the Upper Aquitard from Migration to the City Aquifer;
- Alternative A.8 - Multiple ZVI Treatment Zones using Fracing Method to Treat the Source Areas Beneath the Main Building; and
- Alternative A.9a - ISCO using Activated Persulfate to Treat the Source Areas Beneath the Main Building; and
- Alternative A.9b - ISCO using Activated Persulfate with Excavation to Treat the Source Areas Beneath the Main Building.

The following technologies are held for further evaluation to address groundwater contamination at Parcel B.

- Alternative B.1 - No Action;
- Alternative B.2 - ISCO using Persulfate;
- Alternative B.3 - ISCO using Ozone;
- Alternative B.4 - Enhanced Anaerobic Bioremediation; and
- Alternative B.5 - Monitored Natural Attenuation.

6.0 Detailed Analysis of Alternatives

This section presents a detailed analysis of each remedial alternative identified in Section 5.0. The detailed analysis will present relevant information that will aid in the selection of an alternative that satisfies the RAOs, complies with ARARs, is cost effective, provides a permanent solution, and reduces toxicity, mobility, or volume.

In accordance with 40 CFR §300.430 RI/FS Selection of Remedy and US EPA *Guidance for Conduction Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA 1988), each alternative will be assessed against nine evaluation criteria that include:

1. Overall Protection of Human Health and the Environment: Alternatives are assessed to determine whether they can adequately protect human health and the environment, in both the short and long term.
2. Compliance with ARARs: Alternatives are assessed to determine whether they attain ARARs.
3. Long-term effectiveness and permanence: Alternatives are assessed for long-term effectiveness and permanence, along with the degree of certainty that they provide for success. The magnitude of risk remaining from untreated or treated residual waste is also examined along with the adequacy and reliability of controls that may be necessary to manage untreated or treated residual waste.
4. Reduction of toxicity, mobility or volume: Alternatives are assessed to the degree to which they can reduce toxicity, mobility, or volume. The evaluation will analyze the treatment process and the materials treated, the amount of material treated, the degree to which the treatment is irreversible, the type and quantity of residual waste following treatment, and whether the alternative utilizes treatment as a principal element.
5. Short-term effectiveness: Alternatives are assessed based on the risk imposed to the community, workers, and environment during implementation and the time required until protection is achieved.
6. Implementability: The technical and administrative feasibility of implementing the alternative is assessed along with the availability of services and materials required for implementation. Aspects of technical feasibility includes difficulties with construction and operation, ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of the remedy. Aspects of administrative feasibility include activities needed to coordinate with other offices and agencies.
7. Cost: Alternatives are assessed on capital costs, annual operation and maintenance (O&M) costs, and analysis of net present value of all costs. Capital costs consist of direct and indirect costs. Direct costs include expenditure for equipment, labor, and materials necessary to install the remedy. Indirect costs include expenditure for engineering, financial, and any other service that is not part of the actual installation activities but is required to complete the installation.

   Annual O&M costs are post-construction costs necessary to ensure the continued effectiveness of a remedy. They include, operating labor costs, maintenance material costs, auxiliary materials and energy costs, disposal, sampling and laboratory costs, administrative costs, insurance and taxes costs, contingency, rehabilitation costs, and costs to conduct periodic reviews.

A present worth analysis was used to evaluate expenditures that occur at different time periods to allow for a comparison on the basis of a single sum representing the amount that, if invested in the base year and disbursed as needed, would be sufficient to cover all costs associated with the remedy.

Estimated costs were developed using EPA guidance, and are based on the best available data at the time of the conceptual design. Estimated costs may be modified during the remedial design and/or the long-term monitoring results.

The information in the cost estimate summary tables is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the administrative record file, an explanation of significant differences, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within –30 to +50 percent of the actual project cost.

8. State acceptance: This assessment evaluates the technical and administrative issues and concerns the State may have regarding each of the alternatives. This criterion will be addressed following the submittal of the FFS Report.
9. Community acceptance: This assessment evaluates the issues and concerns that the public may have regarding each of the alternatives. This criterion will be addressed following the submittal of the FFS Report.

The detailed analysis consists of a description of each alternative followed by an evaluation of each alternative against evaluation criteria 1 through 7.

Finally, for each of the alternative, the following time frames has been estimated:

- Construction Phase;
- Implementation Phase; and
- Remedial Action Objectives Phase.

Phase time estimates are based on the conceptual design, current conditions, and available technologies, and are subject to change.

6.1 *Detailed Analysis of Alternatives to Address Soil and Groundwater Contamination at the Alcas Facility*

Nine remedial alternatives were retained for detailed analysis to address soil and groundwater contamination at the Alcas Facility. The detailed analysis of the remedial alternatives is presented in the following sections.

6.1.1 Alternative A.1 - No Action

The following sections present a detailed analysis of conducting no action to shallow impacted soils or impacted groundwater. This alternative was retained to provide a baseline for comparison to all other alternatives

6.1.1.1 Overall Protection of Human Health and the Environment

The No Action alternative does not reduce existing concentrations in soil or groundwater or minimize migration of COCs to the City Aquifer. However, it would not incorporate implementing activities that would present exposure risks to the community, workers, or the environment. This alternative does not include monitoring or institutional controls. The No Action Alternative does not achieve RAOs.

6.1.1.2 Compliance with ARARs

This alternative would not comply with chemical-, location-, or action-specific ARARs.

6.1.1.3 Long-Term Effectiveness and Permanence

No remedial action is associated with this alternative; therefore, no long-term effectiveness or permanence will be achieved.

6.1.1.4 Reduction of Mobility, Toxicity, or Volume

This action offers no reduction of toxicity, mobility, or volume through treatment.

6.1.1.5 Short-Term Effectiveness

The No Action alternative does not include any implementation activities and thus poses no risks to the community, workers or the environment.

6.1.1.6 Implementability

Since no remedial actions are associated with this alternative, this alternative would be technically and administratively feasible and not cause a disruption to operations at the existing Cutco Corporation facility.

6.1.1.7 Cost

The capital and O&M costs associated with this alternative are $0 since there are no remedial actions associated with this alternative. The total present value costs for this alternative are likewise estimated to be $0 in 2012 dollars.

6.1.1.8 Phase Time Estimation

Phase time estimates are based on the conceptual design, current conditions, and available technologies, and are subject to change.

Phase	Time
Construction	0 years
Implementation	0 years
Remedial Action Objectives	Does Not Reach

6.1.2 Alternative A.2 - Excavation of Shallow Impacted Soils

Under the conceptual design for excavation, soil in the vadose zone with COC concentrations exceeding risk-based levels will be excavated and transported off-site for proper disposal. Excavation areas will be located outside the footprint of the Main Building and outside major access roads at the Alcas Source Area. The excavation area will extend to a maximum depth of

8 feet below ground surface. The estimated volume of soil to be removed is 2,245 cubic yards. Excavation areas will be backfilled with clean fill from an off-site location. The location of excavation areas is shown on Figure 6-1.

6.1.2.1 **Overall Protection of Human Health and the Environment**

Excavation of shallow impacted soils would effectively remove some contaminant mass from the excavated areas. However, excavation of impacted soils beneath the Main Building, where most of the mass is suspected to reside, cannot be accomplished without significant impact and disturbance to the ongoing manufacturing operations at the existing Cutco Corporation facility. The contaminants in soils located under and adjacent to the Main Building would continue to impact the groundwater and therefore, the reduction of COC flux to the City Aquifer will likely be minor and RAOs would not be achieved.

6.1.2.2 **Compliance with ARARs**

The alternative would not comply with chemical-specific ARARs for soil or groundwater as the alternative would have minimal or no effectiveness in remediating, controlling or abating the contamination source situated underneath the Main Building.

6.1.2.3 **Long-Term Effectiveness and Permanence**

The migration of COCs from the Alcas Source Area to the City Aquifer is unlikely to be impacted by the removal of shallow impacted soils. The excavation of impacted shallow soils would remove source material that contributes to the contamination of the UWBZ through groundwater recharge. However, source material located underneath the Main Building will remain unabated, and continue to contribute COCs to the UWBZ. The magnitude of source material underneath the Main Building is unknown, but is believed to be the primary source of COCs to the UWBZ.

6.1.2.4 **Reduction of Mobility, Toxicity, or Volume**

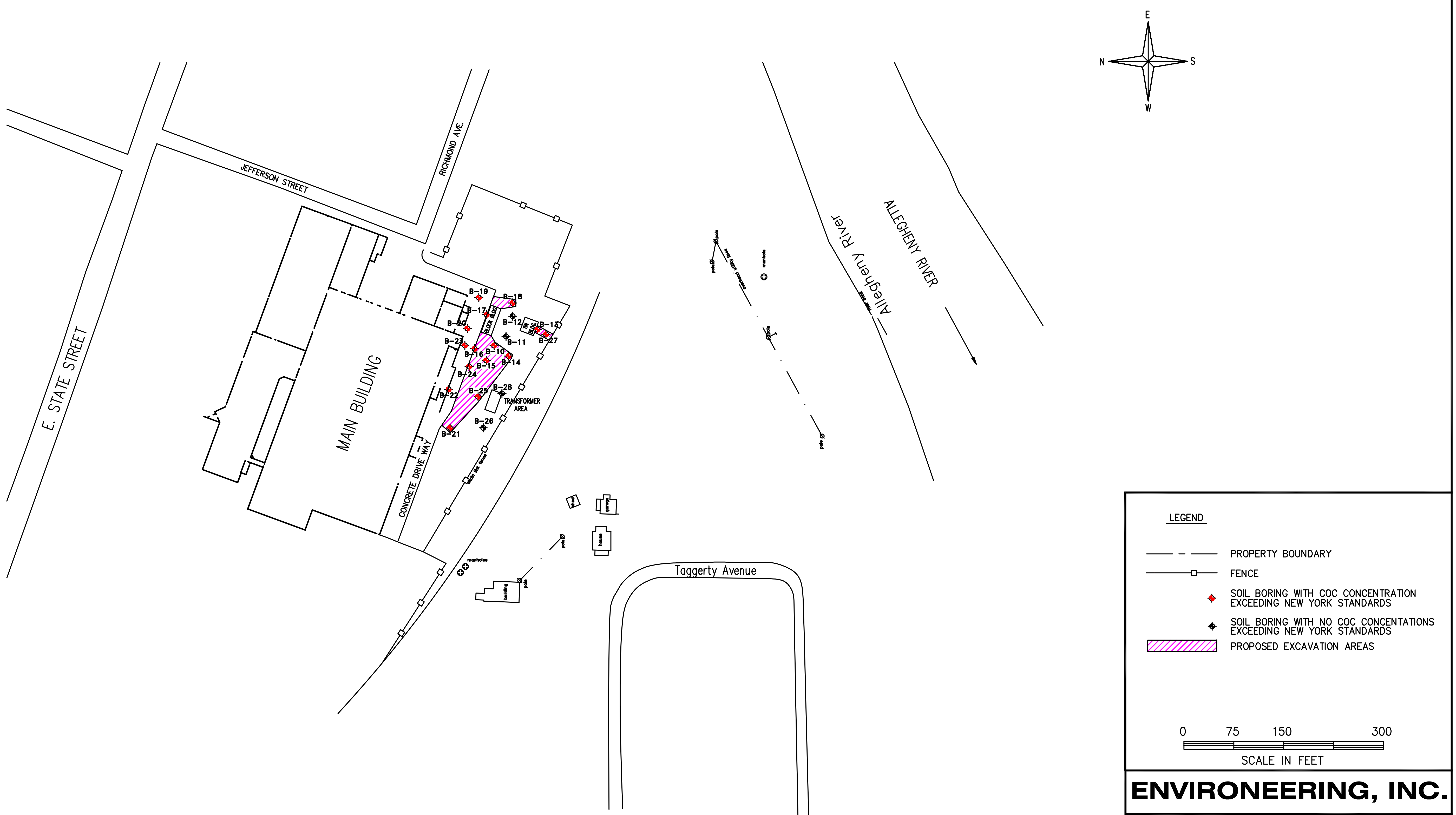
Excavation of shallow impacted soils would effectively remove some COC mass from the excavated areas. However, migration of COCs to the City Aquifer cannot be minimized without the removal of impacted soils beneath the Main Building.

6.1.2.5 **Short-Term Effectiveness**

Excavation of shallow soils would result in minimal exposure risks to the community, workers, and the environment, which would be managed by worker training. Waste generated during the activity would be managed using approved methods.

6.1.2.1 **Implementability**

Excavation of shallow soils is technically feasible, as the technology is conventional. Storm and sanitary sewer lines are known to be buried along the perimeter of the Main Building and excavation could be adequately conducted around buried utilities. Shallow excavation depths of 8 feet will have minimal impacts to the current manufacturing operations. No administrative difficulties are foreseen.



Notes:
This plat was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245
Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

ENVIRONEERING, INC.

FIGURE 6–1
EXCAVATION OF SHALLOW IMPACTED SOILS

ALCAS PROPERTY
OLEAN, NEW YORK

DRAWN BY: AF	DATE: 09/05/2013	PROJ. NO. 137 – 192

6.1.2.2 **Cost**

Capital costs include the excavation and management of shallow impacted soils. The capital costs for this alternative are $309,317. There are no further actions to be implemented and therefore no O&M costs associated with this alternative. The total present value costs for this alternative are estimated to be approximately $309,317 in 2012 dollars. A detailed cost analysis is included in Appendix A.

6.1.2.3 **Phase Time Estimation**

Phase time estimates are based on the conceptual design, current conditions, and available technologies, and are subject to change.

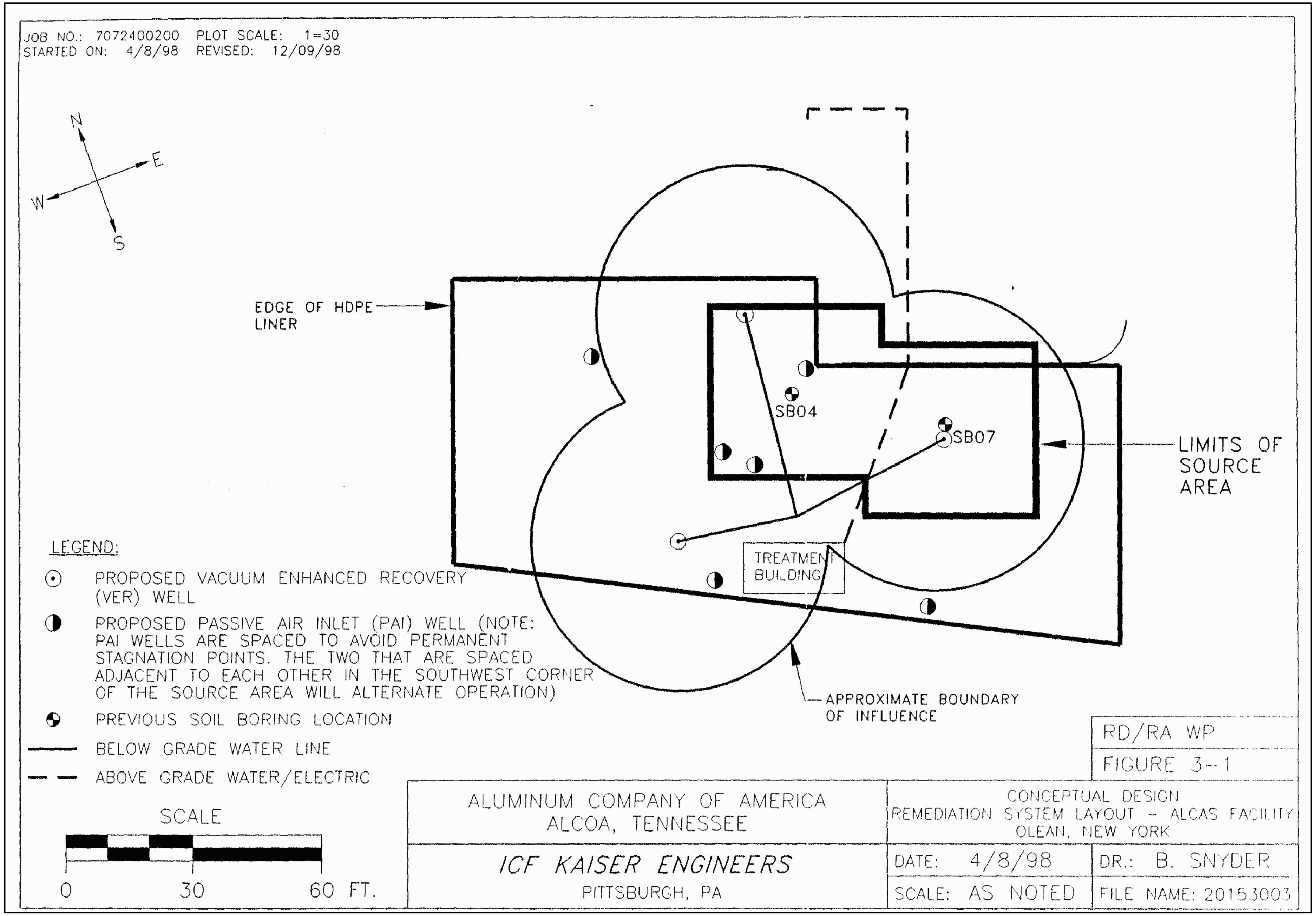
Phase	Time
Construction	1 year
Implementation	1 year
Remedial Action Objectives	Greater than 30 years

6.1.3 Alternative A.3 - Vacuum Enhanced Recovery of Contaminated Soil

Vacuum enhanced recovery (VER) was the original remedy selected in the October 1996 OU2 ROD for the Alcas Source Area. The conceptual model understood at that time did not include site-specific characterization of the Alcas Source Area in terms of underlying Alcas Source Area geology, hydrogeology, or source constituents and associated phase-derivatives. A Site Evaluation and Conceptual Model Report was submitted to the USEPA on January 17, 2000, for purposes of updating the Alcas Source Area conceptual model of the Alcas Source Area. This submittal was followed by a formal letter on January 25, 2000, to present significant new information and provide an update of the Alcas remedy decision in order to enable remedial progress in accordance with statutory requirements. The Alternatives and Analysis Report and Formal Request for a Remedy Decision Update was submitted on July 14, 2000, to provide analysis of remedy update alternatives in order to substantiate the request for a remedy decision update. A Remedy Update was granted by the USEPA in February 2003.

As documented in these reports, significant new information has become available through additional investigations that substantiates that the original Alcas Source Area conceptual model was incomplete and inaccurate. The original remedy decision was based on the concept that affected soils in the UWBZ represented the source of affected groundwater whereas, the updated Alcas Source Area conceptual model suggests a probable long-term DNAPL zone under the Main Building that will persist and continue to generate dissolved phase constituents to the UWBZ if left uncontrolled. The updated Alcas Source Area conceptual model rendered VER ineffective at achieving RAOs.

The original remedy proposed that the affected soils in the UWBZ would be remediated through a one-step application of VER which would lead to the permanent restoration of the lower aquifer. A schematic of the original VER alternative as proposed in the March 1999 Remedial Design and Remedial Action Workplan is provided as Figure 6-2. In an effort to incorporate the updated Alcas Source Area conceptual model, the VER alternative being evaluated in this report has been modified from the original alternative outlined in the 1996 ROD. Specifically, the VER technology would be utilized to function as an UWBZ interceptor system within the UWBZ



CONCEPTUAL DESIGN AS PROVIDED IN THE MARCH 1999 REMEDIAL DESIGN AND REMEDIAL ACTION WORKPLAN FOR THE ALCAS FACILITY BY ICF KAISER ENGINEERS, INC.

ENVIRONEERING, INC.		
FIGURE 6-2 VER LAYOUT FROM 1999 CONCEPTUAL DESIGN ALCAS PROPERTY OLEAN, NEW YORK		
DRAWN BY: MW	DATE: 05/30/2014	PROJ. NO. 137 - 192

plume zone, immediately down gradient of the governing source DNAPL zone under the Main Building. The system would operate full time as opposed to a one-step operation, for as long as the source DNAPL persists. However, because of the heterogeneous soil conditions and the presence of DNAPL under the building.VER is not expected to achieve the RAOs for the Alcas Source Area.

This alternative consists of VER of contaminated soil to treat the residual source area. An estimated 2,245 cubic yards of contaminated soil will be treated using the proposed alternative. A VER system uses negative air pressure which is applied to a series of recovery wells. The negative pressure, which is generated by a high vacuum pump, causes the movement of soil vapor and some groundwater towards the wells for recovery. The vapor recovery causes desorption (removal of contaminants which are adsorbed onto soil particles) and volatilization of VOCs by continuously removing contaminated vapors and forcing clean air into the contaminated areas. An off-gas treatment system will use granular activated carbon (GAC) to remove contaminants which are above federal and New York State air emissions levels. Any groundwater recovered with the soil vapor, would also be treated with GAC prior to discharge.

This alternative also includes the following components:

- long-term monitoring to ensure that groundwater quality improves following implementation of the selected remedy until cleanup levels are achieved.
- institutional controls in the form of proprietary controls, such as deed restrictions for groundwater and soil use**,** existing governmental controls, such as well permit requirements, and informational devices, such as publishing advisories in local newspapers and issuing advisory letters to local governmental agencies regarding groundwater use in the impacted area.
- a Site Management Plan ("SMP") would be developed to provide for the proper management of the Alcas Source Area remedy post-construction, such as through the use of institutional controls until RAOs are met, and will also include long-term groundwater monitoring, periodic reviews and certifications. Until the RAOs are achieved, the SMP would also provide for the proper management of any contaminated unsaturated soils remaining beneath the concrete slab of the building.

6.1.3.1 **Overall Protection of Human Health and the Environment**

VER would not be effective in the treatment of VOC contamination beneath the Main Building where most of the mass is suspected to reside and, therefore would not be protective of human health and the environment. Based on Alcas Source Area geological conditions and the presence of DNAPL under the building, a VER system would not be effective in removing contaminant mass and reducing COC flux to the City Aquifer.

6.1.3.2 **Compliance with ARARs**

Regardless of configuration, this alternative would not comply with chemical-specific ARARs, since VER would not be effective in reducing VOC contamination in inaccessible areas beneath the main building. Only limited quantities of contaminants in both the soil and groundwater would be removed, and reductions of contaminants to the City Aquifer would be minimal.

6.1.3.3 Long-Term Effectiveness and Permanence

In general, a VER system can remove COCs from the contaminated source area, including source area below the water table. However, Alcas Source Area geology indicates that the dominant permeability of the upper aquitard is in the range of approximately 10^{-8} cm/sec. It is also expected that these low permeability clays are saturated to within 5 to 7 feet of the till surface. A VER system would be required to dewater the tight clays, provide uniform airflow fields void of preferential pathways and gradients, and maintain a pressure gradient sufficient to remove contaminant mass across the treatment zone. Based on the geological conditions at the Alcas Source Area, VER application would be very difficult if not impracticable to operate effectively in this low permeability environment regardless of configuration.

Due to the Alcas Source Area geological conditions, it can be expected that most residual source areas will be contacted by the VER operation, and the media that is treated will continue to be impacted by remaining source areas left under the Main Building. Vapor and dissolved phase plumes will redevelop from untreated source areas to similar extents and magnitudes that existed prior to system start-up. This rebounding condition of mass transport will continue as long as unaltered, residual source persists.

6.1.3.4 Reduction of Mobility, Toxicity, or Volume

The Alcas Source Area geology in the upper aquitard is not conducive to in-situ treatment involving advection, airflow technology. The airflow fields will not be uniform and will be dominated by preferential pathways and gradients that will limit system performance and comprehensive treatment. Where functional, the system will also be inefficient in terms of effectively dewatering the low permeability clay units and pulling a vacuum through the subsurface. In this geoenvironment, it is unreasonable to expect advective treatment effects throughout all source area media. It is also unreasonable to expect efficient advective recovery over time. To the extent source area media is not contacted by VER airflow, diffusion rates of the Alcas Source Area source will not be altered and the source will persist unabated. Therefore, COC flux into City Aquifer will not be impacted by the application of VER.

A VER system extending to the base of the upper aquitard would encounter significant upwelling of water from the lower City Aquifer. As upwelling occurs, dewatering potential above is deceased and the VER technology would be limited further. The increased penetration depths would also increase risk of further contaminants spreading into the City Aquifer.

6.1.3.5 Short-Term Effectiveness

VER may have potential short-term impacts to the community, workers, and the environment which would be managed by engineering controls and worker training. Measures would be implemented to mitigate potential impacts to workers and the community through the use of personnel protective equipment and standard health and safety practices. Waste generated during the installation of extraction wells would be managed using approved methods.

6.1.3.6 Implementability

The presence of DNAPL beneath the main building at the Alcas facility poses significant access challenges because of the existing manufacturing operations at the facility. The DNAPL source under the building cannot be addressed by VER and therefore cannot be implemented to address this source. The materials and services necessary for the installation of VER wells are readily available. The remedial technology is conventional and proven to treat Alcas Source Area COCs.

6.1.3.7 **Cost**

The cost estimate provided includes costs for operating the VER system for an estimated 30 years. Capital costs include installation of VER wells and associated treatment system. Total capital costs are estimated to be approximately $338,000 for the remediation system. O&M costs include the O&M of the system and groundwater monitoring. Annual O&M costs are estimated to average $100,000 per year over 30 years. The total present value life cycle costs of this alternative using a discount rate of 7 percent is $1,400,000. A detailed cost analysis is included in Appendix A.

6.1.3.8 **Phase Time Estimation**

For cost-estimating and planning purposes, phase time estimates are based on the conceptual design, current conditions, and available technologies, and are subject to change.

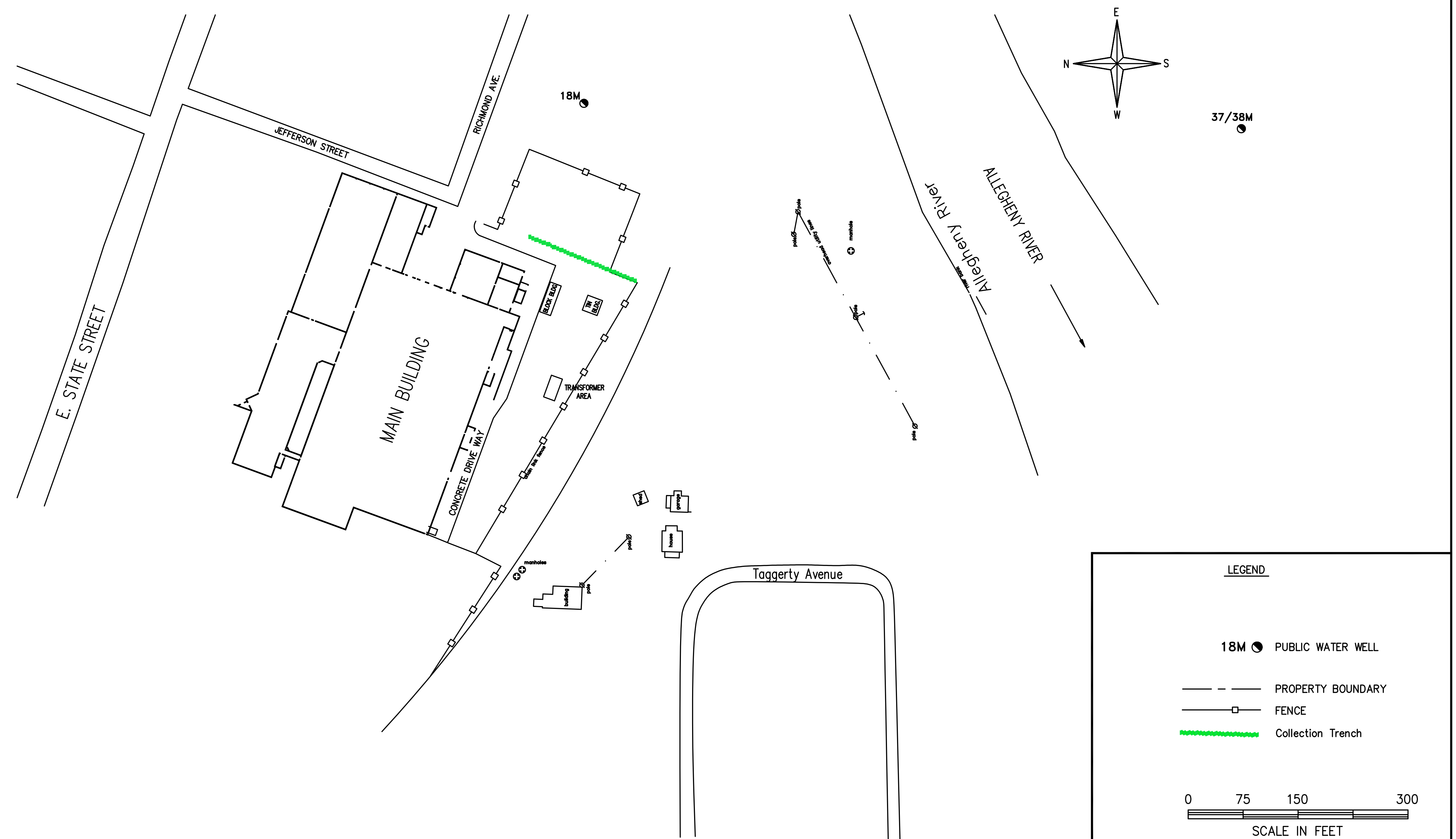
Phase	Time
Construction	1 year
Implementation	30 years
Remedial Action Objectives	Greater than 30 years

6.1.4 Alternative A.4 - Groundwater Extraction and Treatment of Intercepted Groundwater Flow from the Source Area Using a Collection Trench

For the purposes of this report, a conceptual system design was developed. A Remedial Design document would be developed and approved should this alternative be selected. The conceptual system developed for this report consists of a collection trench excavated along the southeast portion of the Alcas Facility. The system would operate at an extraction rate of approximately 10 gpm. The construction of a collection trench that is 160 feet long, 32 feet deep, and 2 feet wide would create a more permeable zone where groundwater would be extracted and provide a large area of hydraulic capture. The location of the collection trench is illustrated on Figure 6-3 and a cross section depicting the basic details of the alternative relative to the geology is shown on Figure 6-4. A description of the groundwater model used to develop the conceptual design of this alternative is included in Appendix B.

Extracted groundwater will be treated with an air stripper and discharged to an NPDES outfall. System installation would require 3-4 weeks of significant disruption and over the long-term the treatment system would require regular operational maintenance and monitoring. The treatment system is expected to operate for 30 years.

Soils will be disposed of in accordance with RCRA Hazardous Waste generator, transporter, treatment and disposal requirements. Air emissions will comply with State and Federal air emissions standards. Treated groundwater requiring discharge will comply with National and State pollution discharge elimination system requirements.



Notes:
This plat was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245

Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

ENVIRONEERING, INC.

FIGURE 6–3

GROUNDWATER EXTRACTION AND TREATMENT – COLLECTION TRENCH

ALCAS PROPERTY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	1/21/2013	137–192

ENVIRONEERING, INC.

FIGURE 6–4

CONCEPTUAL CROSS SECTION OF THE GROUNDWATER COLLECTION TRENCH

ALCAS PROPERTY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	1/21/2013	137-192

Components of this technology include the following:

- Identify and isolate subsurface utilities that are present at the proposed trench location.
- Install a groundwater collection trench made up of biodegradable biopolymer slurry in the transition zone along the southeast portion of the Alcas Source Area to intercept COCs from the upper source area.
- An air stripper will treat extracted groundwater and discharge to a NPDES outfall.
- Excavated materials from the top 35 feet will be used to refill the trench without any need of treatment or off-site disposal, and the excavated materials below the top 35 feet will be handled and treated as hazardous waste until tested and determined to be non-hazardous.
- Installation would be conducted in a phased approach; supplemental investigation would be performed during the initial phase, followed by full system installation during the final phase.

6.1.4.1 **Overall Protection of Human Health and the Environment**

Groundwater extraction and treatment would result in minimal exposure risks to the community, workers, and the environment which would be managed by engineering controls and worker training. Operation of a collection trench and groundwater treatment system would significantly reduce the flux of Alcas Source Area COCs to the City Aquifer. This alternative would be protective of human health and the environment by reducing the flux of COC mass to the City Aquifer, which will decrease both the concentration at well 18M and the operational timeframe of the treatment system at 18M.

6.1.4.2 **Compliance with ARARs**

The alternative would not comply with chemical-specific ARARs for soil or groundwater as the alternative would have minimal or no effectiveness in remediating, controlling or abating the contamination source situated underneath the Main Building.

6.1.4.3 **Long-Term Effectiveness and Permanence**

Groundwater extraction and treatment of intercepted groundwater flow from the source area would control the hydraulic gradient at the Alcas Source Area and prevent additional flux of COCs to the City Aquifer, reducing influent concentrations at 18M. Long-term O&M of the groundwater pump and treat system would be required. Given the very high concentrations of residual DNAPL under the Main Building, it will take in excess of 50 years for the groundwater collection trench to remediate the soil contamination underneath the Main Building and reduce the flux of COCs from the residual source to be reduced to the point that natural attenuation processes are sufficient to prevent unacceptable concentrations of COCs from reaching 18M. The actual remediation duration for this alternative is unknown.

6.1.4.4 **Reduction of Mobility, Toxicity, or Volume**

The alternative will reduce the mobility, toxicity, and volume of COC in the upper water bearing zone at the Alcas Source Area. Migration of COCs will be controlled through hydraulic gradients, and COCs would be treated with an air stripper, which would not destroy the COCs, but would transfer them to the atmosphere at concentrations well below unacceptable levels.

6.1.4.5 **Short-Term Effectiveness**

Groundwater extraction and treatment would result in minimal exposure risks to the community, workers, and the environment which would be managed by engineering controls and worker training. Waste generated during the installation of extraction wells would be managed using approved methods.

6.1.4.6 **Implementability**

Implementation of this alternative is both technically and administratively feasible. The collection trench would be installed using common trenching installation methods. The materials and services necessary for the installation are readily available. The remedial technology is conventional and proven to treat Alcas Source Area COCs.

6.1.4.7 **Cost**

Capital costs include installation of extraction trench and associated treatment system. Total capital costs are estimated to be approximately $1,005,010 for the remediation system. O&M costs include the O&M of the system and groundwater monitoring. Annual O&M costs are estimated to average between $136,900 per year over 30 years. The total present value life cycle costs of this alternative using a discount rate of 7 percent is $2,700,000. A detailed cost analysis is included in Appendix A.

6.1.4.8 **Phase Time Estimation**

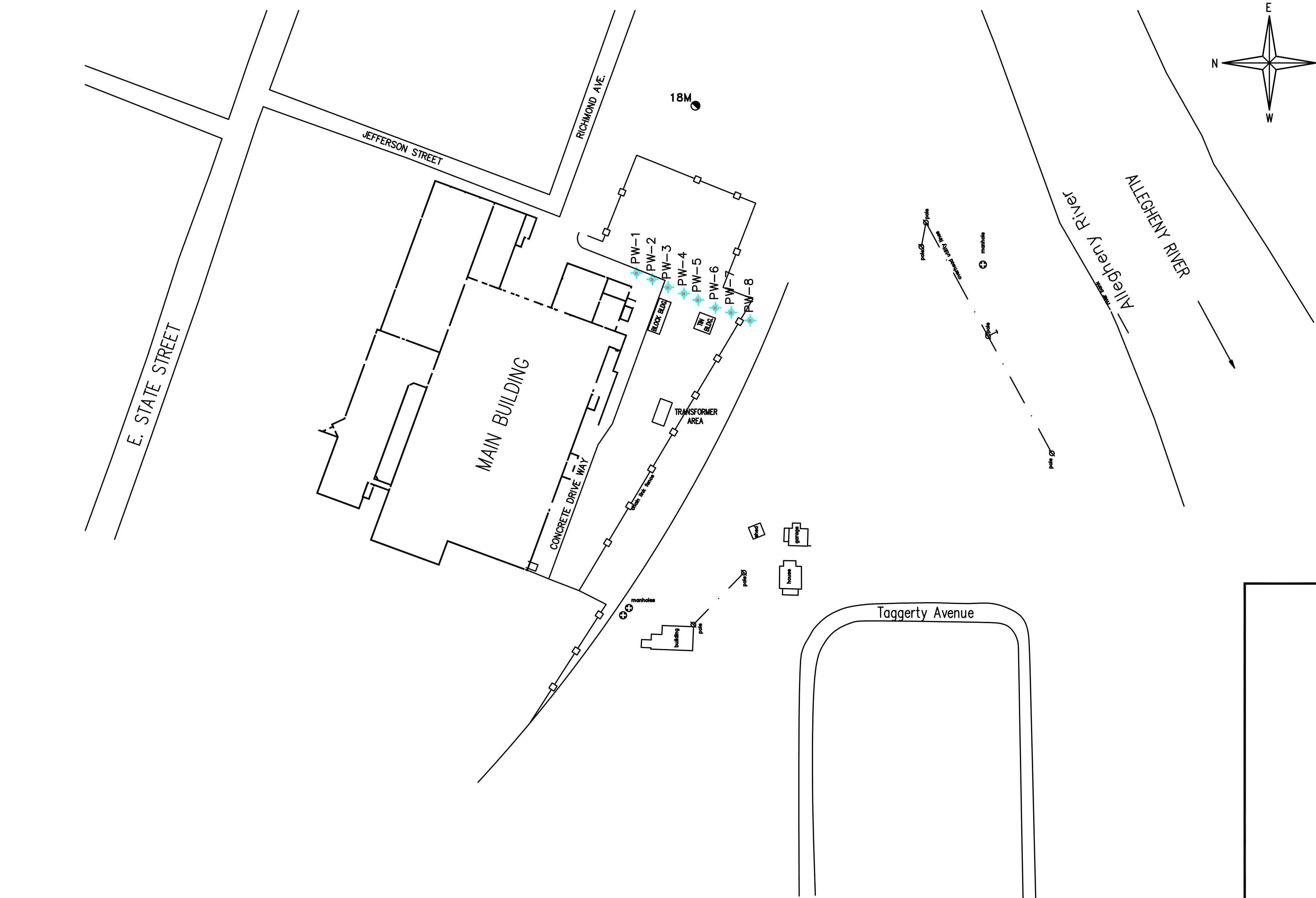
Phase time estimates are based on the conceptual design, current conditions, and available technologies, and are subject to change.

Phase	Time
Construction	2-3 years
Implementation	30 years
Remedial Action Objectives	Greater than 30 years

6.1.5 Alternative A.5 - Groundwater Extraction and Treatment of Intercepted Groundwater Flow from the Source Area Using Vertical or Horizontal Extraction Wells

For the purposes of this report, a conceptual system design was developed to intercept groundwater from the source area using vertical or horizontal extraction wells. The final orientation and configuration of the extraction well network would be determined during the Remedial Design phase should this alternative be selected.

The conceptual vertical well system developed for this report consists of 8 vertical extraction wells installed along the southeast portion of the Alcas Facility. The system would operate at an extraction rate of approximately 8 gallons per minute (gpm). The extraction wells would extend to 40 feet deep and provide a large area of hydraulic capture. The locations of the extraction wells are illustrated on Figure 6-5. A description of the groundwater model used to develop the conceptual design of this alternative is included in Appendix B.



LEGEND

18M PUBLIC WATER WELL

PROPERTY BOUNDARY

FENCE

Vertical Extraction Well

0 75 150 300

SCALE IN FEET

Notes:
This plat was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245
Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

ENVIRONEERING, INC.

FIGURE 6–5

GROUNDWATER EXTRACTION AND TREATMENT – VERTICAL EXTRACTION WELLS

ALCAS PROPERTY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	11/14/2012	137–154

The conceptual horizontal well system developed for this report consists of a horizontal extraction well installed along the southeast portion of the Alcas Facility that would extend beneath the Main Building. The system would operate at an extraction rate of approximately 10 gpm. The extraction well would extend 160 feet at a depth of 40 feet, providing a large area of hydraulic capture. The location of the extraction well is illustrated on Figure 6-6. A description of the groundwater model used to develop the conceptual design of this alternative is included in Appendix B.

Extracted groundwater will be treated with an air stripper and discharged to an NPDES outfall. System installation would require 3-4 weeks of significant disruption, and over the long-term the treatment system would require regular operational maintenance and monitoring.

Soils will be disposed of in accordance with RCRA Hazardous Waste generator, transporter, treatment and disposal requirements. Air emissions will comply with State and Federal air emissions standards. Treated groundwater requiring discharge will comply with National and State pollution discharge elimination system requirements.

Components of this technology include the following:

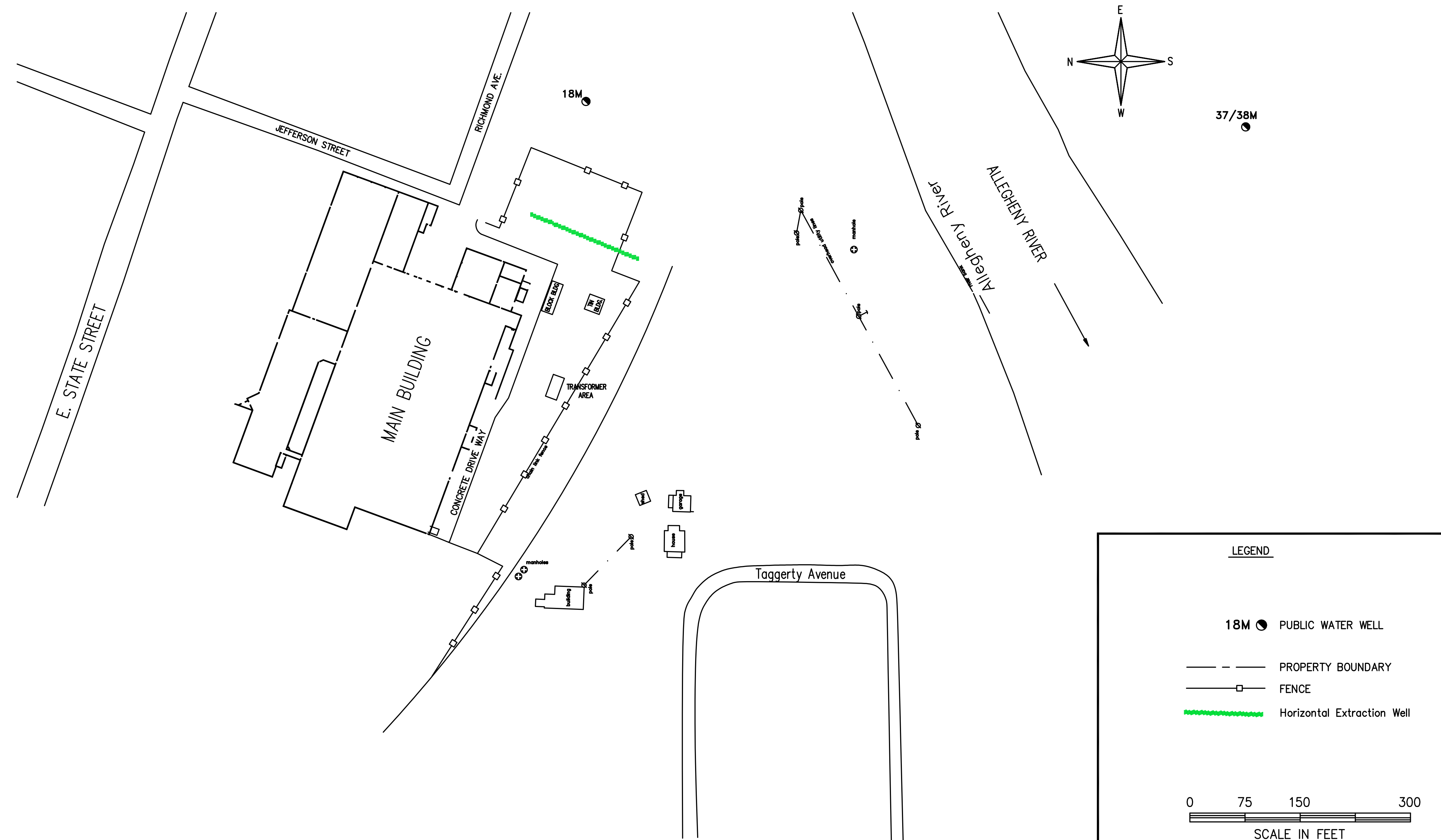
- Conduct Geotechnical Study of feasibility of this technology.
- Identify and isolate subsurface utilities that are present at the proposed well locations.
- Install a groundwater extraction and treatment system in the transition zone along the southeast portion of the Alcas Facility to intercept COCs from the upper source area.
- Excavated materials below the top 35 feet will be handled and treated as hazardous waste until tested and determined to be non-hazardous.
- An air stripper will treat extracted groundwater and discharge to an NPDES outfall.
- Installation would be conducted in a phased approach; supplemental investigation would be performed during the initial phase, followed by full system installation during the final phase.

6.1.5.1 **Overall Protection of Human Health and the Environment**

Groundwater extraction and treatment would result in minimal exposure risks to the community, workers, and the environment which would be managed by engineering controls and worker training. Operation of the extraction wells and groundwater treatment system would significantly reduce the flux of Alcas Source Area COCs to the City Aquifer. This alternative would be protective of human health and the environment by reducing the flux of COC mass to the City Aquifer, which will decrease both the concentration at well 18M and the operational timeframe of the treatment system at 18M.

6.1.5.2 **Compliance with ARARs**

This alternative will remove Alcas Source Area COCs in the Upper Aquitard groundwater before they can spread to the City Aquifer but is not expected to reduce groundwater concentrations to below regulatory standards. Therefore, this alternative will not comply with chemical-specific ARARs for COCs in the groundwater in the Upper Aquitard.



Notes:
This plat was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245
Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

ENVIRONEERING, INC.

FIGURE 6–6
GROUNDWATER EXTRACTION AND TREATMENT – HORIZONTAL EXTRACTION WELL
ALCAS PROPERTY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	11/14/2012	137–192

6.1.5.3 **Long-Term Effectiveness and Permanence**

Groundwater extraction and treatment of intercepted groundwater flow from the source area would control the hydraulic gradient at the Alcas Source Area and prevent additional flux of COCs to the City Aquifer, reducing influent concentrations at 18M. Long-term O&M of the groundwater pump and treat system would be required. For the purpose of this report it is assumed that it will take a minimum of 30 years for the flux of COCs from the residual source to be reduced to the point that natural attenuation processes are sufficient to prevent unacceptable concentrations of COCs from reaching 18M. The actual remediation duration for this alternative might be longer.

6.1.5.4 **Reduction of Mobility, Toxicity, or Volume**

The alternative will reduce the mobility, toxicity, and volume of COC in the upper water bearing zone at the Alcas Source Area. Migration of COCs will be controlled through hydraulic gradients, and COCs would be treated with an air stripper, which would not destroy the COCs, but would transfer them to the atmosphere at concentrations well below unacceptable levels.

6.1.5.5 **Short-Term Effectiveness**

Groundwater extraction and treatment would result in minimal exposure risks to the community, workers, and the environment which would be managed by engineering controls and worker training. Waste generated during the installation of extraction wells would be managed using approved methods.

6.1.5.6 **Implementability**

Implementation of this alternative is both technically and administratively feasible. The extraction wells would be installed using common installation techniques. The materials and services necessary for the installation are readily available. The remedial technology is conventional and proven to treat Alcas Source Area COCs.

6.1.5.7 **Cost**

Capital costs include system design, installation of extraction wells, and associated treatment system. Total capital costs are estimated to be between $764,757 and $963,600 for the remediation system. O&M costs include the O&M of the system and groundwater monitoring. Annual O&M costs are estimated to average $165,000 per year over 30 years. The total present value life cycle costs of this alternative using a discount rate of 7 percent is between $2,810,000 and $3,010,000. A detailed cost analysis is included in Appendix A.

6.1.5.8 **Phase Time Estimation**

Phase time estimates are based on the conceptual design, current conditions, and available technologies, and are subject to change.

Phase	Time
Construction	2-3 years
Implementation	30 years
Remedial Action Objectives	Greater than 30 years

6.1.6 Alternative A.6 - ZVI Permeable Reactive Barrier using Fracing Method to Treat Intercepted Groundwater Flow from the Source Area

Under the conceptual design for a ZVI PRB, approximately thirty-six frac boreholes will be installed in two rows in the southeast portion of the Alcas Facility. Within each borehole, an estimated 7 fractures will be created and filled with ZVI. The fracing process generates a minimal amount of aquifer material requiring disposal, but some residual water/guar used in the injection mixing tanks may require off-site disposal. The effective ZVI thickness is estimated to be only 3 inches for this alternative. Soils will be disposed of in accordance with RCRA Hazardous Waste generator, transporter, treatment and disposal requirements. Figure 6-7 is provided to show the configuration of this alternative.

Components of this technology include the following:

- Install approximately of 36 frac boreholes (in two rows with borehole spacing of approximately 15 feet within each row) to a depth of 50 feet bgs.
- Within each borehole a total of 7 fractures will be created for ZVI emplacement, one fracture to be initiated every 2.5 feet from 50 feet bgs to 35 feet bgs.
- Installation of up to six new monitoring wells for performance monitoring
- To limit potential hazards associated with fracing and potential spreading of contaminants to the City Aquifer, the depth of the fracing borehole will be limited to no closer than 3 feet from the City Aquifer transition zone.

6.1.6.1 <u>**Overall Protection of Human Health and the Environment**</u>

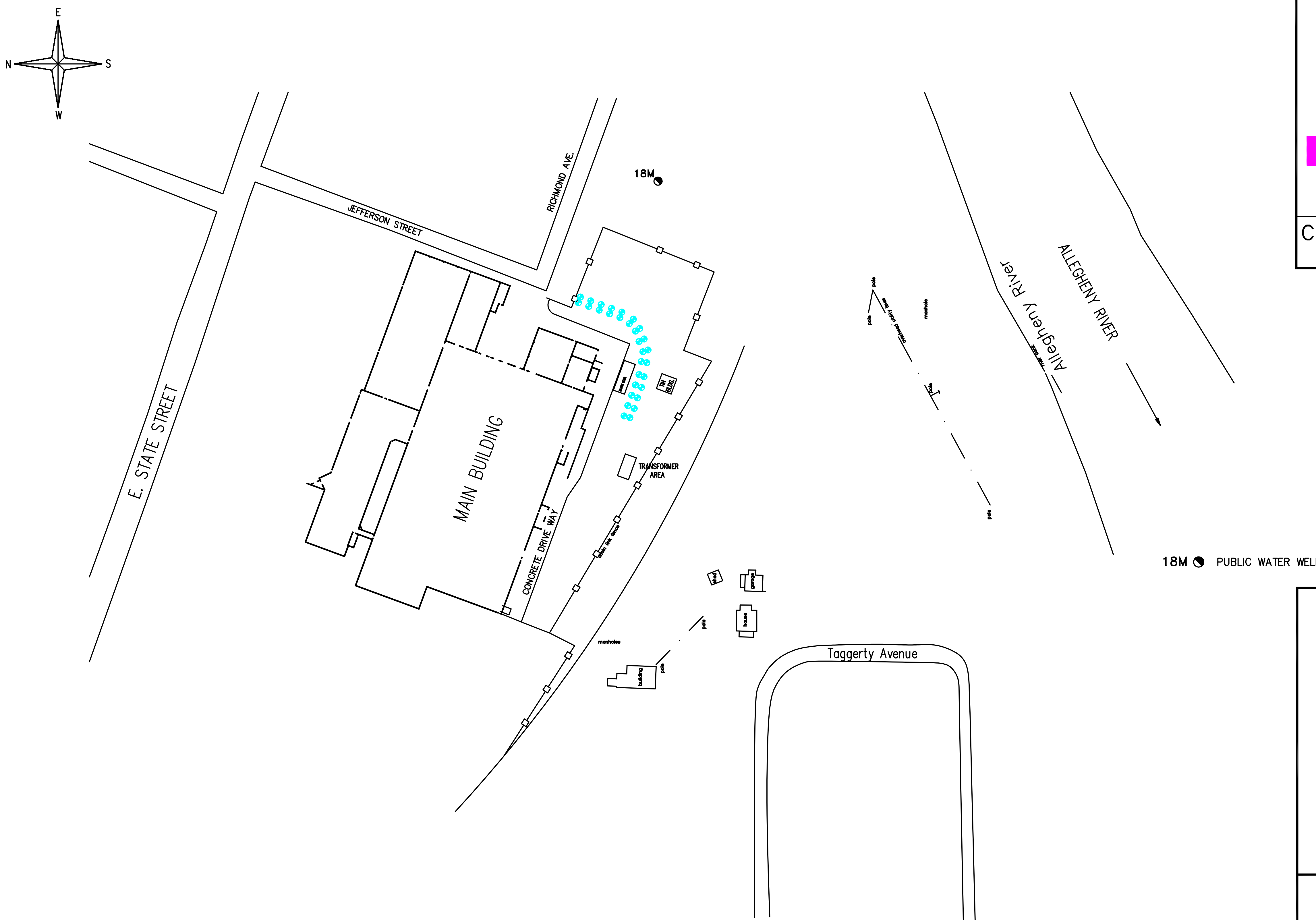
Implementation of this alternative would result in minimal exposure risk to the community, workers, and the environment. This alternative will comply with chemical-specific ARARs for COCs in the groundwater in the Upper Aquitard by providing actual in-situ treatment. The treatment will result in irreversible dechlorination of Alcas Source Area COCs that would reduce the contaminant volume in the Upper Aquitard and prevent mobility to the Upper City Aquifer. Groundwater monitoring would be used to assess achievement of RAOs. This alternative would be protective of human health and the environment by reducing the flux of COC mass to the City Aquifer, which will decrease both the concentration at well 18M and the operational timeframe of the treatment system at 18M.

6.1.6.2 <u>**Compliance with ARARs**</u>

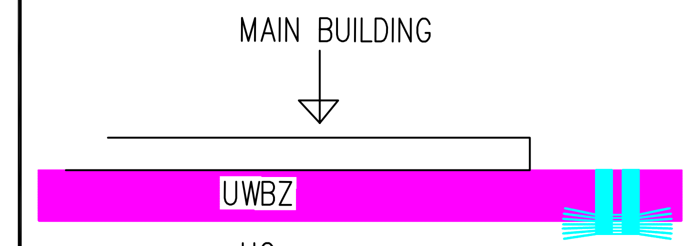
The alternative would not comply with chemical-specific ARARs for soil or groundwater as the alternative would have minimal or no effectiveness in remediating, controlling or abating the contamination source situated underneath the Main Building. As long as the source area persists underneath the Main Building, RAOs would likely never be achieved. As soon as this alternative is removed or the ZVI was exhausted, groundwater concentrations would rebound to pre-remedial action levels given the remaining source area. This alternative will not lead to achievement of MCLs in groundwater.

6.1.6.3 <u>**Long-Term Effectiveness and Permanence**</u>

TCE has been shown to be reduced by ZVI, provided that sufficient contaminant residence time is allowed through the iron barrier (EPA/600/F-97/008 July 1997). In recent studies conducted by Naval Facilities Engineering Service Center (NFESC), the longevity of ZVI PRBs were found to be performing as designed with a predicted performance duration of at least 30 years. The



Notes:
This plat was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245
Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.



CROSS SECTIONAL VIEW LOOKING NORTH EAST

LEGEND

- PROPERTY BOUNDARY
- FENCE
- BOREHOLES LOCATION
- VERTICAL BOREHOLE PAIRS WITH FRACTURES

0 75 150 300
SCALE IN FEET

ENVIRONEERING, INC.

FIGURE 6-7
ZVI PBR TO TREAT INTERCEPTED GROUNDWATER FLOW FROM THE SOURCE AREA
ALCAS PROPERTY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	09/05/2013	137 – 192

NFESC study found that the longevity of the reactivity of the iron deteriorates progressively with exposure to groundwater and there is a potential of decreasing permeability through the wall due to precipitation over time (Battelle, 2002).

The release of soluble iron into the groundwater would not impact wellhead treatment at 18M and/or 37/38M, as increased iron concentrations typically do not extend more than a few feet down gradient of the PRB except in low pH conditions.

6.1.6.4 **Reduction of Mobility, Toxicity, or Volume**

This alternative would provide actual in-situ COC treatment resulting in irreversible dechlorination of Alcas Source Area COCs that would result in reducing the contaminant volume in the Upper Aquitard and reduce mobility to the City Aquifer. This alternative does not transfer COCs to other media

6.1.6.5 **Short-Term Effectiveness**

Implementation of this alternative would result in minimal exposure risk to the community, workers, and the environment which would be managed by worker training. There is minimal potential for cross-media contamination as contaminants are treated in-situ and not brought to the surface. Waste generated during the installation of frac boreholes and additional monitoring wells would be managed using approved methods.

6.1.6.6 **Implementability**

Installing ZVI filled frac boreholes would be technically feasible. No administrative implementation obstacles are expected. The materials and services necessary for the installation of frac boreholes and for the injection of the ZVI slurry are readily available. It is estimated that this alternative can be implemented within 5 years at which time groundwater monitoring can begin. The duration of groundwater monitoring will be determined during the Remedial Design phase.

6.1.6.7 **Cost**

The periodic monitoring of performance-monitoring wells, initial disposal of excavated borehole soil, and comparably low O&M costs compared to other technologies has contributed to a relative low cost for this technology. Total capital costs are estimated to be approximately $1,018,373. Annual O&M costs are estimated to average $14,730 per year over years 1 through 8. The total periodic cost is estimated to be $22,035 for monitoring well abandonment when RAOs are achieved. The total present value life cycle costs of this alternative using a discount rate of 7 percent is $1,200,000. A detailed cost analysis is included in Appendix A.

6.1.6.8 **Phase Time Estimation**

Phase time estimates are based on the conceptual design, current conditions, and available technologies, and are subject to change.

Phase	Time
Construction	1-2 years
Implementation	3-5 years
Remedial Action Objectives	Greater than 30 years

6.1.7 Alternative A.7 - Barrier Wall Containment to Prevent Impacted Groundwater from the Upper Aquitard from Migration to the City Aquifer

For the purposes of this report, a conceptual system design was developed. A Remedial Design document would be developed and approved should this alternative be selected. Horizontal boreholes will be installed beneath the Main Building and filled with bentonite slurry. The horizontal boreholes would be installed with zero to minimal spacing between wells. An L-shaped containment trench is installed downgradient of horizontal groundwater flow and filled with bentonite slurry. The trench is positioned around the source area beneath the Main Building. System installation would require 3-4 weeks of significant disruption. Soils will be disposed of in accordance with RCRA Hazardous Waste generator, transporter, treatment and disposal requirements. Figure 6-8 is provided to show the location of this alternative.

Components of this technology include the following:

- Identify and isolate subsurface utilities that are present at the proposed trench location.
- An L-shaped containment trench is installed down to the Upper Aquitard, positioned downgradient of groundwater flow around the Main Building.
- Horizontal boreholes filled with bentonite will be installed beneath the Main Building to prevent vertical groundwater flow.
- The trench and horizontal wells will be filled with bentonite slurry to contain the source area beneath the Main Building.
- Installation would be conducted in a phased approach; supplemental investigation would be performed during the initial phase, followed by full system installation during the final phase.

6.1.7.1 **Overall Protection of Human Health and the Environment**

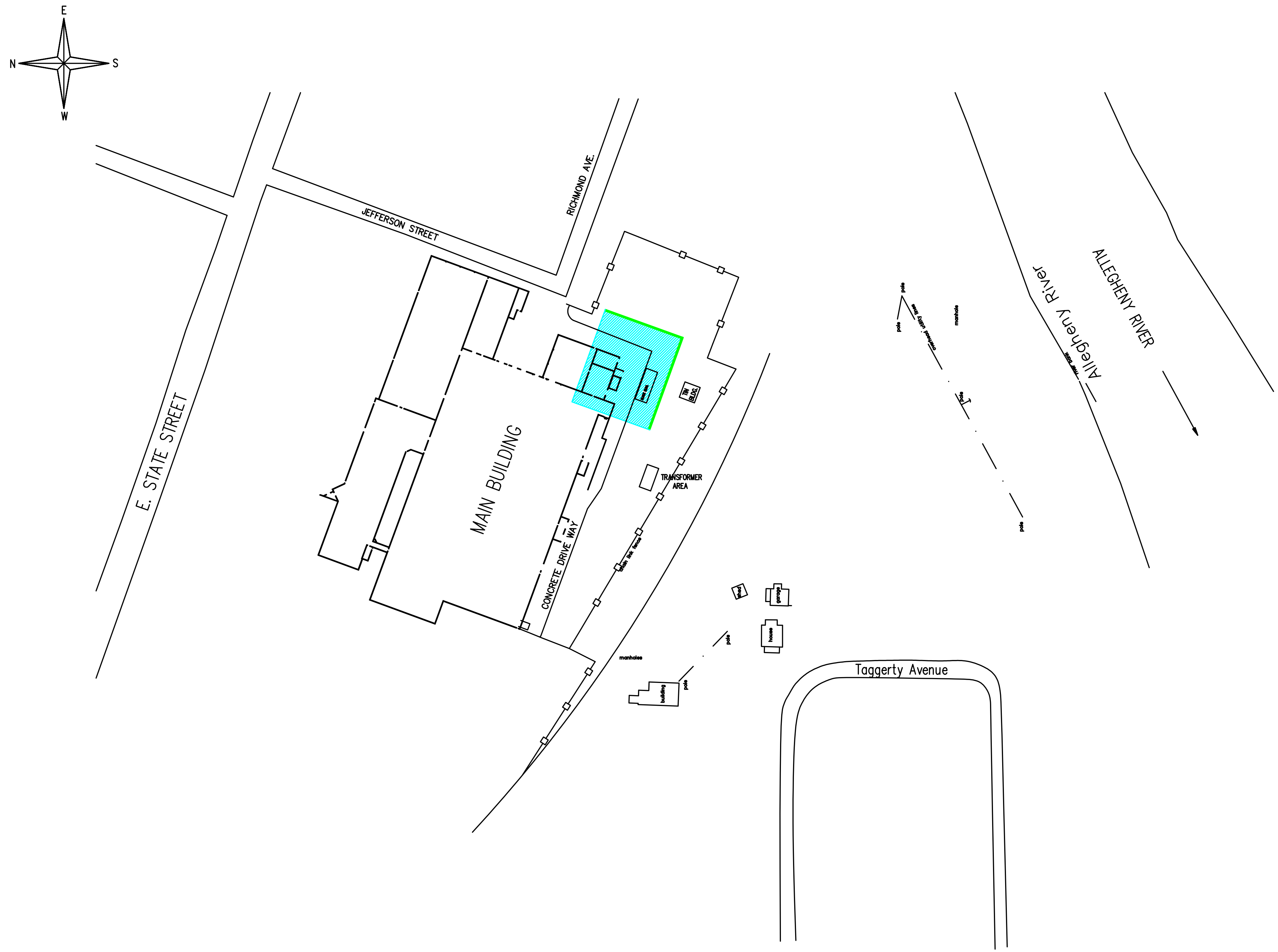
Implementation of this alternative would result in minimal exposure risks to the community, workers, and the environment which would be managed by engineering controls and worker training. If constructed successfully, this alternative would be protective of human health and the environment by preventing groundwater migration from the source area, thereby decreasing both the concentration of COCs, and the operational timeframe at 18M.

6.1.7.2 **Compliance with ARARs**

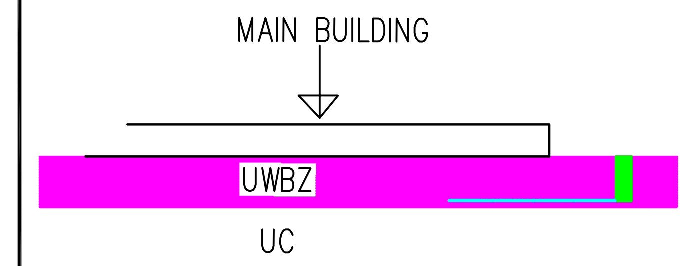
The alternative would not comply with chemical-specific ARARs for soil or groundwater as the alternative would have minimal or no effectiveness in remediating, controlling or abating the contamination source situated underneath the Main Building.

6.1.7.3 **Long-Term Effectiveness and Permanence**

If constructed successfully, this alternative would prevent the migration of Alcas Source Area COCs from the residual source area to the City Aquifer. However, no guarantee can be given to the precision of constructing horizontal wells with minimal spacing. Thus, due to difficulty with installation, the degree of certainty in constructing a successful bottom barrier is low. Impact to municipal wellhead treatment at 18M or 37/38M is not expected.



Notes:
This plat was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245
Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.



CROSS SECTIONAL VIEW LOOKING NORTH EAST

LEGEND

- PROPERTY BOUNDARY
- FENCE
- VERTICAL BENTONITE SLURRY WALL
- HORIZONTAL BORINGS FILLED WITH BENTONITE
- AREA COVERED BY HORIZONTAL BORINGS FILLED WITH BENTONITE

0 75 150 300
SCALE IN FEET

ENVIRONEERING, INC.

FIGURE 6–8

BARRIER WALL CONTAINMENT

ALCAS PROPERTY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	09/05/2013	137 – 192

6.1.7.4 **Reduction of Mobility, Toxicity, or Volume**

Provided that the bottom barrier is constructed successfully, the bentonite filled trench and horizontal wells will create a barrier around the source area beneath the Main Building, preventing the migration of dissolved phase COCs to the upper water bearing zone and the underlying City Aquifer. No reduction in toxicity or volume is expected.

6.1.7.5 **Short-Term Effectiveness**

Implementation of this alternative would result in minimal exposure risks to the community, workers, and the environment which would be managed by engineering controls and worker training. Waste generated during the installation of barrier wall would be managed using approved methods.

6.1.7.6 **Implementability**

The alternative is administratively feasible. The technical implementability of this alternative relies solely on the installation of horizontal wells beneath the Main Building with minimal spacing between boreholes to effectively construct bottom containment. The services and material necessary to construct horizontal wells are readily available but the required precision to reduce spacing between boreholes to properly construct the bottom barrier is not easily accomplished. Thus, no guarantee can be given to the successful construction of a bottom barrier. The installation of the trench and horizontal wells would require at a minimum, 6-8 weeks of construction, causing significant disruption to the operations at the existing Cutco Corporation facility.

6.1.7.7 **Cost**

Capital costs include system design, installation of horizontal boreholes, and installation of bentonite slurry trench. Total capital costs are estimated to be approximately $7,352,067 for the remediation system. O&M costs include the groundwater monitoring. Annual O&M costs are estimated to average $30,565 per year over 30 years. The total present value life cycle costs of this alternative using a discount rate of 7 percent is $7,730,000. A detailed cost analysis is included in Appendix A.

6.1.7.8 **Phase Time Estimation**

Phase time estimates are based on the conceptual design, current conditions, and available technologies, and are subject to change.

Phase	Time
Construction	1-2 years
Implementation	30 years
Remedial Action Objectives	Does not meet

6.1.8 Alternative A.8 - Multiple ZVI Treatment Zones using Fracing Method to Treat the Source Areas beneath the Main Building

Under the conceptual design for ZVI treatment zones, approximately thirty-seven frac boreholes will be installed in multiple rows in the source area under the Main Building. Within each borehole, 8 fractures will be created and filled with ZVI. The effective ZVI thickness is estimated to be only 3 inches for this alternative. The fracing process generates a minimal amount of aquifer material requiring disposal, but some residual water/guar used in the injection mixing tanks may require off-site disposal. Soils will be disposed of in accordance with RCRA Hazardous Waste generator, transporter, treatment and disposal requirements.

Components of this technology include the following:

- Identify and isolate subsurface utilities that are present at the proposed trench location.
- Install approximately 37 frac boreholes (in multiple rows with borehole spacing of approximately 20 feet within each row) to a depth of 28 feet bgs.
- Excavated materials below the top 35 feet will be handled and treated as hazardous waste until tested and determined to be non-hazardous.
- Within each borehole a total of 8 fractures will be created for ZVI emplacement, one fracture to be initiated every 2.5 feet from 25.5 feet bgs to 8 feet bgs.
- No new monitoring wells required for performance monitoring.

6.1.8.1 **Overall Protection of Human Health and the Environment**

Implementation of this alternative would result in minimal exposure risk to the community, workers, and the environment. This alternative will comply with chemical-specific ARARs for COCs in the saturated zone beneath the Main Building by providing actual in-situ contaminant treatment. The treatment will result in irreversible dechlorination of Alcas Source Area COCs that would reduce the contaminant volume underneath the Main Building and prevent mobility to the upper aquitard. Groundwater monitoring would be used to assess achievement of RAOs. This alternative would be protective of human health and the environment by reducing COC mass and flux from the source area, thereby decreasing both the concentration of COCs and the operational timeframe at 18M.

6.1.8.2 **Compliance with ARARs**

This alternative will comply with chemical-specific ARARs for COCs in the saturated zone beneath the Main Building by dechlorinating Alcas Source Area COCs before they can spread in the Upper Aquitard.

6.1.8.3 **Long-Term Effectiveness and Permanence**

TCE has been shown to be reduced by ZVI, provided that sufficient contaminant residence time is allowed through the iron barrier (EPA/600/F-97/008 July 1997). In recent studies conducted by Naval Facilities Engineering Service Center, the longevity of ZVI PRBs were found to be performing as designed with a predicted performance duration of at least 30 years. The NFESC study found that the longevity of the reactivity of the iron deteriorates progressively with exposure to groundwater however, because it is a relatively new technology, there is limited field data documenting potential loss of permeability due to precipitation (Battelle, 2002).

The release of soluble iron into the groundwater would not impact wellhead treatment at 18M and/or 37/38M, as increased iron concentrations typically do not extend more than a few feet down gradient of the PRB except in low pH conditions.

The timeframe for completion and attainment of RAOs cannot accurately be determined since the exact quantity of contaminant underneath the Main Building is unknown.

6.1.8.4 **Reduction of Mobility, Toxicity, or Volume**

This alternative would provide actual in-situ COC treatment resulting in irreversible dechlorination of Alcas Source Area COCs that would result in reducing the contaminant volume underneath the Main Building and mobility to the upper aquitard. This alternative does not transfer COCs to other media.

6.1.8.5 **Short-Term Effectiveness**

Implementation of this alternative would result in minimal exposure risk to the community, workers, and the environment which would be managed by worker training. There is minimal potential for cross-media contamination as contaminants are treated in-situ and not brought to the surface. Waste generated during the installation of frac boreholes would be managed using approved methods.

6.1.8.6 **Implementability**

Treating the residual sources in the Upper Aquitard by installing ZVI filled frac boreholes would be technically feasible; however, accessibility of drilling equipment inside the Main Building is a limiting factor. The time and access required to implement this alternative under the Main Building would likely be quite disruptive to operations at the existing Cutco Corporation facility. No administrative implementation obstacles are expected. The materials and services necessary for the installation of frac boreholes and for the injection of the ZVI slurry are readily available.

6.1.8.7 **Cost**

The periodic monitoring of performance-monitoring wells, initial disposal of excavated borehole soil, and comparably low O&M costs compared to other technologies has contributed to a relatively low cost for this technology. Capital costs include system design and injection of ZVI. The total capital costs are estimated to be approximately $1,201,269. There are no further actions to be implemented and therefore, no O&M costs. A Remedial Action Completion Report will be prepared at the end of the 30th year at $22,000. The total present value cost is estimated to be $1,200,000. A detailed cost analysis is included in Appendix A.

6.1.8.8 **Phase Time Estimation**

Phase time estimates are based on the conceptual design, current conditions, and available technologies, and are subject to change.

Phase	Time
Construction	1-2 years
Implementation	3-5 years
Remedial Action Objectives	30 years

6.1.9 Alternative A.9a - ISCO using Activated Persulfate

As part of the conceptual design for ISCO using activated persulfate, approximately eight (8) injection wells will be installed within the Main Building and adjacent to the southern portion of the Main Building at the source area. The injection wells will be used to deliver a solution of alkaline-activated sodium persulfate to the UWBZ beneath the Main Building to treat the residual source area. Soils and water generated during well installation will be disposed of in accordance with RCRA Hazardous Waste generator, transporter, treatment and disposal requirements.

The conceptual design includes the following components:

- Installation of injection wells within the source area adjacent to and beneath the Main Building.
- Three injection events with activated sodium persulfate over a period of up to 5 years.
- Installation of additional new monitoring wells for performance monitoring. A monitoring well network will be developed during the Remedial Design phase but for the purposes of developing a cost estimate for this alternative, 3 new monitoring wells were used.

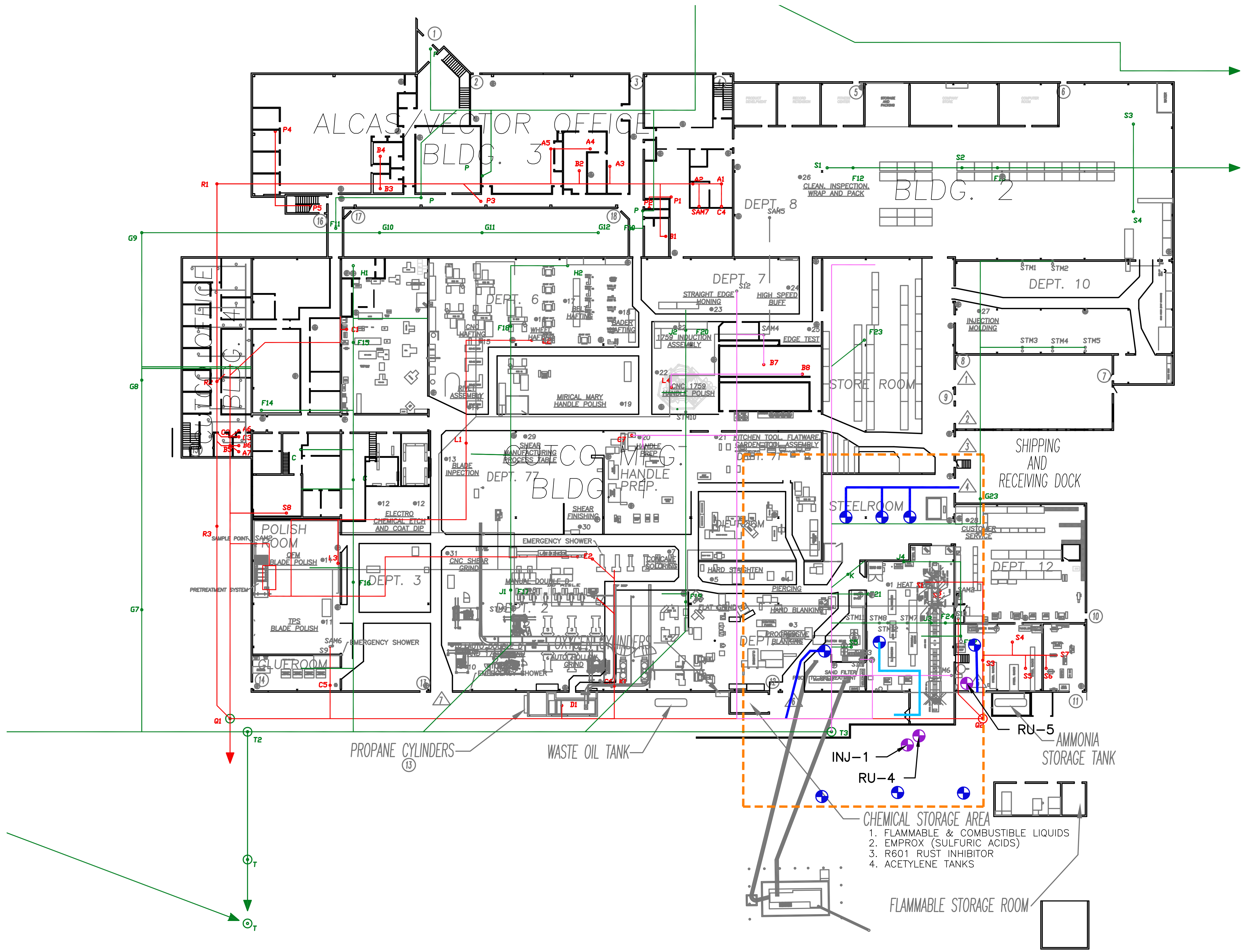
A conceptual layout of the ISCO design is included as Figure 6-9. A pilot study utilizing activated sodium persulfate was completed at the Alcas Source Area as part of this FFS. The report summarizing the pilot study results is presented in Appendix C. Injection locations on Figure 6-9 are based both on the distribution of sodium persulfate observed in the pilot study, and on the constraints imposed by the operating equipment within the Main Building. The pilot test suggested that amendments could be reliably distributed to an effective radius of at least 5 to 10 feet. The conceptual design will be updated, if necessary, based on additional data collected during the Remedial Design phase.

This alternative also includes the following components:

- Long-term monitoring of the VOC contamination transformation resulting from the ISCO injections and the attenuation processes to ensure that the groundwater quality improves until the cleanup levels are achieved.
- Groundwater sampling would also monitor degradation by-products generated by the treatment processes to ensure that drinking water quality standards are met at the nearby municipal water supply well 18M.
- Institutional controls in the form of proprietary controls, such as deed restrictions for groundwater and soil use**,** existing governmental controls, such as well permit requirements, and informational devices, such as publishing advisories in local newspapers and issuing advisory letters to local governmental agencies regarding groundwater use in the impacted area.
- A Site Management Plan ("SMP") would be developed to provide for the proper management of the Alcas Source Area remedy post-construction, such as through the use of institutional controls until RAOs are met, and will also include long-term groundwater monitoring, periodic reviews and certifications. Until the RAOs are achieved, the SMP would also provide for the proper management of any contaminated unsaturated soils remaining beneath the concrete slab of the building.

6.1.9.1 **Overall Protection of Human Health and the Environment**

This alternative would be protective of human health and the environment. Protectiveness under this alternative requires a combination of actively reducing contaminant concentrations and limiting exposure to residual contaminants through institutional controls until RAOs are met.



N

NOT TO SCALE

LEGEND

- PROPOSED LOCATIONS FOR REMEDIAL ACTION INJECTION WELLS (PENDING ACCESS)
- SHALLOW CONCRETE TRENCH FOR INJECTION PIPING
- OVERHEAD INJECTION PIPING
- APPROXIMATE AREA FOR SOURCE TREATMENT
- EXISTING MONITORING WELLS AND PILOT STUDY INJECTION WELL (INJ–1)
- SANITARY
- STORM DRAIN
- DRAIN LINES FROM DEGREASERS

A – FLOOR DRAINS
B – REST ROOMS
C – SINKS
D – STAND PIPE FOR DRAINING SETTLING TANKS
E – CLEANING EQUIPMENT
F – DOWN SPOUTS
G – CATCH BASINS
H – SPRINKLER DRAW OFF
J – COOLING WATER DISCHARGE
K – DRINKING FOUNTAINS
L – ROTOCLONE DRAINS
STM – MACHINE DRAINS (STORM SEWER)
SAM – MACHINE DRAINS (SANITARY SEWER)
N – DOWN TO 1st FLOOR
P – DOWN FROM 2nd FLOOR
Q – MANHOLE – SANITARY SEWER
R – CLEAN OUT
S – PLUGGED FLOOR DRAINS
T – MANHOLE – STORM SEWER
U – AFTER COOLER DRAINAGE COMPRESSOR

NOTE:

THIS GRAPHIC WAS CREATED TO ILLUSTRATE THE CONCEPTUAL COMPONENTS OF THE REMEDIAL ACTION ALTERNATIVE. ACTUAL REMEDY COMPONENTS WOULD BE CHOSEN DURING THE REMEDIAL DESIGN.

CDM Smith

FIGURE 6-9
ISCO WITH PERSULFATE TO TREAT THE SOURCE IN THE UA
ALCAS PROPERTY
OLEAN, NEW YORK

6.1.9.2 **Compliance with ARARs**

This alternative will comply with chemical-, location-, and action-specific ARARs.

6.1.9.3 **Long-Term Effectiveness and Permanence**

Long-term effectiveness and permanence would be achieved using the ISCO alternative. The pilot study, included as Appendix C, determined that the oxidant can oxidize dissolved phase TCE in the groundwater and indicated that the oxidant can impact residual nonaqueous TCE. This alternative will significantly reduce COC mass in the shallow groundwater, which will significantly reduce the flux into the upper City Aquifer.

6.1.9.4 **Reduction of Mobility, Toxicity, or Volume**

This alternative would provide actual in-situ COC treatment resulting in irreversible oxidation of Alcas Source Area COCs that would result in reducing the contaminant mass and mobility to the upper aquitard. As much as a 50 percent reduction in TCE concentrations was observed in the pilot study within the treatment area when compared to historical concentrations. Also the pilot study indicated that the oxidant can oxidize a portion of the residual nonaqueous TCE. This alternative does not transfer COCs to other media.

6.1.9.5 **Short-Term Effectiveness**

This alternative may have potential short-term impacts to the community, workers, and the environment which would be managed by engineering controls and worker training. Measures would be implemented to mitigate potential impacts to workers and the community through the use of personnel protective equipment and standard health and safety practices. Some potential for volatilization of COCs exists due to the exothermic nature of the chemical oxidation reaction. While this is not expected to be a significant concern, indoor air monitoring should be considered during injections if this alternative is selected. Waste generated during the injection of oxidants would be managed using approved methods. In addition, the proximity of well 18M is a limiting factor for in situ treatment technologies employing injection of treatment reagents. Such injections must be implemented such that no detrimental impact to well 18M water quality is realized.

6.1.9.6 **Implementability**

Treating the sources underneath the Main Building by injecting activated persulfate would be technically feasible; however, accessibility of drilling equipment inside the Main Building is a limiting factor. No administrative implementation obstacles are expected. The materials and services necessary for the installation of injection wells and for the injection of the chemical oxidant are readily available. The well installation and injection activities can be sequenced in a manner that will allow for minimal disruption to manufacturing activities at the existing Cutco Corporation facility. Additionally, injection lines to a majority of the wells inside the Main Building can be trenched in place to allow for injection to occur without disruption of existing Cutco Corporation facility operations.

The effectiveness of the ISCO will be controlled by the ability to distribute the oxidant in the subsurface. The challenge distribution presents was demonstrated during the pilot test. However, through injection of sufficient oxidant volumes at locations spaced throughout the source area, distribution of chemical oxidant in the subsurface can be achieved at the Alcas Source Area.

6.1.9.7 **Cost**

Capital costs include injection system design, installation of injection and monitoring wells and injection infrastructure, and injection of activated persulfate solution. Total capital costs are estimated to be approximately $484,000 for the remediation system, including two full-scale injection events completed during Year 0. Periodic costs include the injection of persulfate solution after the first year of implementation and well maintenance. Total periodic costs are estimated to $299,000. Total monitoring costs are estimated to be $422,000. Annual O&M costs are estimated to average $82,994 per year over years 1 through 6. The total present value life cycle costs of this alternative using a discount rate of 7 percent is $1,101,000. A detailed cost analysis is included in Appendix A.

6.1.9.8 **Phase Time Estimation**

Phase time estimates are based on the conceptual design, current conditions, and available technologies, and are subject to change.

Phase	Time
Construction	1-2 years
Implementation	3-5 years
Remedial Action Objectives	20 years

6.1.10 Alternative A.9b - ISCO using Activated Persulfate with Excavation

This alternative includes the remedial measures included in Section 6.1.9 above (ISCO using activated persulfate), and adds excavation of what is estimated to be approximately 70 cubic yards of soils if, subsequent to treatment with ISCO, soils remain beneath or adjacent to the main building at the Alcas facility at concentrations that are impacting the ability to achieve the groundwater RAOs using ISCO alone, and if and when a determination is made that it is not inappropriate to access the material based upon factors including the use of the building. Excavation would remove remaining contaminated soils serving as a source material to the groundwater contamination of the upper aquifer.

This alternative also includes the following components:

- Long-term monitoring of the VOC contamination transformation resulting from the ISCO injections and the attenuation processes to ensure that the groundwater quality improves until the cleanup levels are achieved.
- Groundwater sampling would also monitor degradation by-products generated by the treatment processes to ensure that drinking water quality standards are met at the nearby municipal water supply well 18M.
- Institutional controls in the form of proprietary controls, such as deed restrictions for groundwater and soil use, existing governmental controls, such as well permit requirements, and informational devices, such as publishing advisories in local

newspapers and issuing advisory letters to local governmental agencies regarding groundwater use in the impacted area.

- A Site Management Plan ("*SMP*") would be developed to provide for the proper management of the Alcas Source Area remedy post-construction, such as through the use of institutional controls until RAOs are met, and will also include long-term groundwater monitoring, periodic reviews and certifications. Until the RAOs are achieved, the SMP would also provide for the proper management of any contaminated unsaturated soils remaining beneath the concrete slab of the building.

6.1.10.1 **Overall Protection of Human Health and the Environment**

This alternative would be protective of human health and the environment. Protectiveness under this alternative requires a combination of actively reducing contaminant concentrations and limiting exposure to residual contaminants through institutional controls until RAOs are met.

6.1.10.2 **Compliance with ARARs**

This alternative would comply with chemical-, location, and action-specific ARARs. Excavation would be conducted only after efforts to remediate using ISCO with persulfate no longer demonstrate an ability to reduce VOC to concentrations that no longer impact the City Aquifer and such excavation is feasible. Excavation of contaminated soils could be performed at any time during implementation of ISCO, if it is determined that accessibility is no longer an issue and the soil excavation would reduce the time frame to meet the RAOs.

6.1.10.3 **Long-Term Effectiveness and Permanence**

This alternative would achieve long-term effectiveness and permanence. Excavation activities, if necessary could be performed thereby eliminating additional contaminated soils. Off-site treatment/disposal of the contaminated soil at a secure, permitted hazardous waste facility is reliable because these types of facilities are designed with safeguards to secure the waste material.

6.1.10.4 **Reduction of Mobility, Toxicity, or Volume**

This alternative would provide actual in-situ COC treatment resulting in irreversible oxidation of Alcas Source Area COCs that would result in reducing the contaminant mass and mobility to the upper aquitard. As much as a 50 percent reduction in TCE concentrations was observed in the pilot study within the treatment area when compared to historical concentrations. Also the pilot study indicated that the oxidant can oxidize a portion of the residual nonaqueous TCE. In addition, if this excavation is performed, this alternative provides a reduction in the volume of the soil contamination through removal and disposal at an approved off-site facility of some of the contaminated soils.

6.1.10.5 **Short-Term Effectiveness**

This alternative may have potential short-term impacts to the community, workers, and the environment which would be managed by engineering controls and worker training. Measures would be implemented to mitigate potential impacts to workers and the community through the use of personnel protective equipment and standard health and safety practices. Some potential for volatilization of COCs exists due to the exothermic nature of the chemical oxidation reaction. While this is not expected to be a significant concern, indoor air monitoring should be considered during injections if this alternative is selected. Waste generated during the injection of oxidants would be managed using approved methods. In addition, removal of contaminated soil under this alternative presents short-term risk because of the potential for exposure associated with excavation and transportation of contaminated soil. However, measures would be implemented to mitigate potential impacts to workers and the community through the use of personnel protective equipment and standard health and safety practices. Under this alternative, appropriate transportation safety measures would be required during the shipping of the contaminated soil to the off-site disposal facility.

6.1.10.6 **Implementability**

The locations of the source material under the Main Building provide a formidable challenge for delivery of any technology. The fact that the Main Building houses an active, large manufacturing operation congested with large pieces of equipment which cannot be moved further limits accessibility. Excavation has implementation challenges due to the limited accessibility underneath the existing operating facility. Excavation activities determined to be necessary to achieve the groundwater RAOs under this alternative requires a significant amount of coordination given the existing manufacturing operations at the Alcas Facility. Existing operations at the Alcas Facility would be negatively impacted by the excavation alternative as certain areas of the building critical to the manufacturing process would need to be fully or partially demolished. However if future operations change, or for instance if the portion of the building overlying the contamination is no longer in use or demolished, impacts resulting from excavation may not be significant; in fact, if the building is demolished excavation would be more readily implementable and be more important as unsaturated soils may be more amenable to leaching if the slab is compromised.

6.1.10.7 **Cost**

For cost estimating and planning purposes, 70 cubic yards of soil from a single excavation area was assumed. In addition to the costs provided in Section 6.1.9a, total capital costs for the excavation portion of the alternative are estimated to be approximately $190,000. There are no periodic costs included in the conceptual design for this alternative. A detailed cost analysis is included in Appendix A.

6.1.10.8 **Phase Time Estimation**

For cost-estimating and planning purposes, excavation activities would be conducted subsequent to the implementation of the ISCO injections.

Phase	Time
Construction	3- 6 months
Implementation	Undetermined
Remedial Action Objectives	20 years

6.2 *Detailed Analysis of Alternatives to Address Groundwater Contamination in the Upper Aquitard on Parcel B.*

Five remedial alternatives were retained for detailed analysis to reduce the dissolved phase COC concentrations in the upper aquitard on Parcel B. The detailed analysis of the remedial alternatives is presented in the following sections.

6.2.1 Alternative B.1 - No Action

The following sections present a detailed analysis of conducting no action to the dissolved phase COCs in the upper aquitard located on Parcel B. This alternative was retained to provide a baseline for comparison to all other alternatives

6.2.1.1 **Overall Protection of Human Health and the Environment**

The No Action alternative does not reduce existing concentrations in groundwater or minimize migration of COCs to the City Aquifer. However, it would not incorporate implementing activities that would present exposure risks to the community, workers, or the environment. This alternative does not include monitoring or institutional controls. The No Action alternative does not achieve groundwater RAOs.

6.2.1.2 **Compliance with ARARs**

This alternative would not comply with chemical-, action-, or location-specific ARARs.

6.2.1.3 **Long-Term Effectiveness and Permanence**

No remedial action is associated with this alternative therefore, no long-term effectiveness or permanence will be achieved.

6.2.1.4 **Reduction of Mobility, Toxicity, or Volume**

This action offers no reduction of toxicity, mobility, or volume through treatment.

6.2.1.5 **Short-Term Effectiveness**

The No Action alternative does not include any implementation activities, and thus poses no risks to the community, workers or the environment.

6.2.1.6 **Implementability**

Since no remedial actions are associated with this alternative, this alternative would be technically and administratively feasible and not cause a disruption to operations at the existing Cutco Corporation facility. No difficulties are foreseen in regards to the availability of services and materials.

6.2.1.7 **Cost**

The capital and O&M costs associated with this alternative are $0 since there are no remedial actions associated with this alternative. The total costs for this alternative are estimated to be approximately $0 in 2012 dollars.

6.2.1.8 **Phase Time Estimation**

Phase time estimates are based on the conceptual design, current conditions, and available technologies, and are subject to change.

Phase	Time
Construction	0 years
Implementation	0 years
Remedial Action Objectives	Does not meet

6.2.2 Alternative B.2 - ISCO using Persulfate

ISCO would be implemented in select locations on Parcel B, generally targeting areas where high concentrations of COCs have historically been observed, specifically, where concentrations of TCE exceed 100 µg/L. ISCO would be implemented using temporary injection to inject oxidant into the subsurface. Three new monitoring wells will be installed to monitor the persulfate treatment. Performance monitoring would be conducted to monitor oxidation of COCs. Disruption will occur during the first three years when implementing the injections, but the impact to the existing Cutco Corporation facility would be minimal. Soils will be disposed of in accordance with RCRA Hazardous Waste generator, transporter, treatment and disposal requirements.

Components of this technology include the following:

- Install temporary injection points (in multiple rows with borehole spacing of approximately 40 feet within each row) to a depth of 20 feet bgs. The injection point network will be developed during the Remedial design phase but for the purposes of developing a cost estimate for this alternative, 13 temporary injection points were used.
- Multiple injection events with activated persulfate.
- Install new monitoring wells for performance monitoring. A monitoring well network will be developed during the Remedial design phase but for the purposes of developing a cost estimate for this alternative, 3 new monitoring wells were used.

The locations of the injection points are located on Figure 6-10.

6.2.2.1 **<u>Overall Protection of Human Health and the Environment</u>**

This alternative is not expected to result in exposure risks to the community, workers, or the environment. ISCO using activated persulfate has been determined to adequately oxidize Alcas Source Area COCs in a reasonable time period but it is not expected to reduce groundwater concentrations to below MCLs. The alternative would, however, reduce COC concentrations such that the time required for natural attenuation processes to restore groundwater will be significantly reduced.

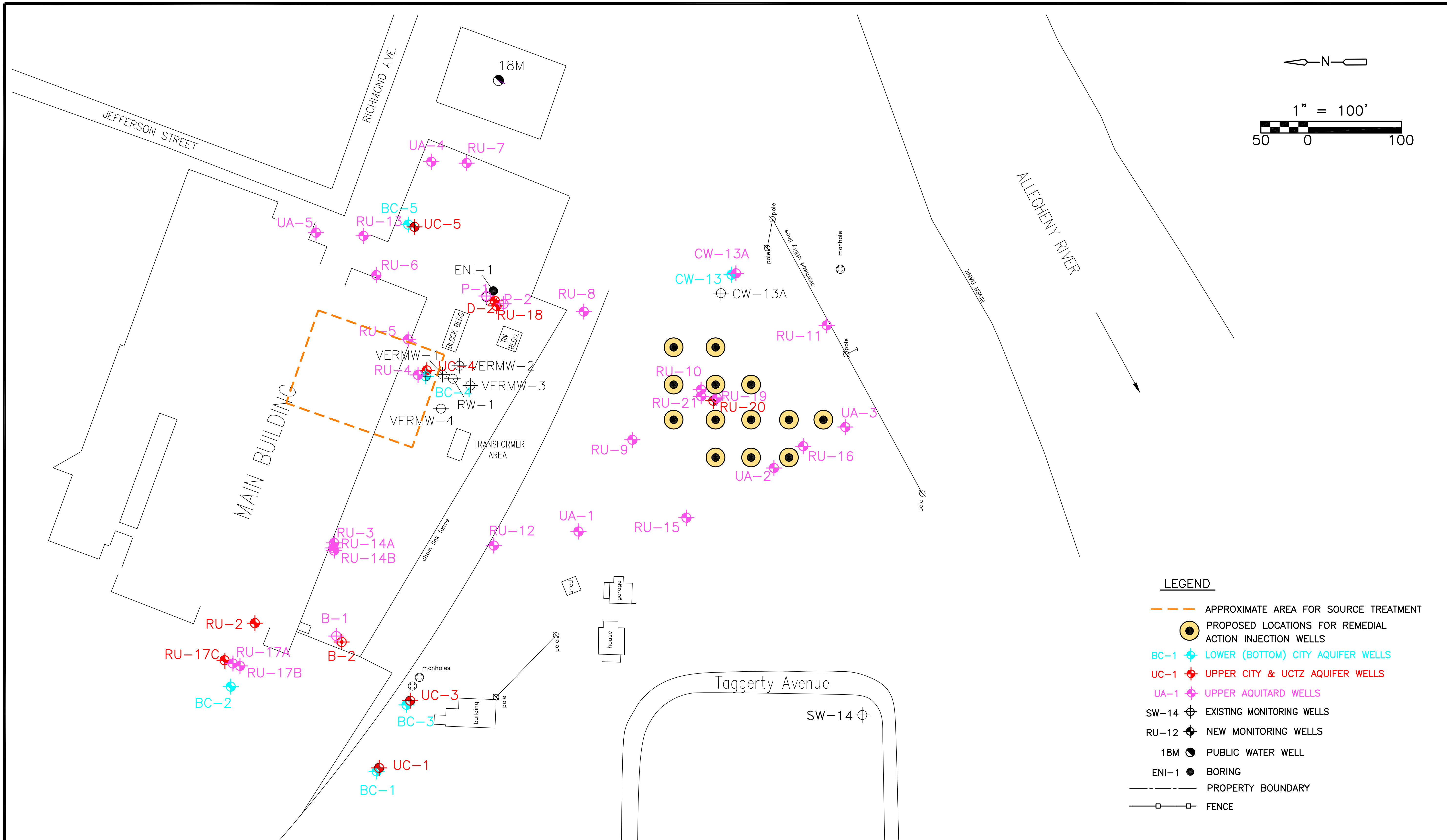
6.2.2.2 **<u>Compliance with ARARs</u>**

This alternative would comply with chemical-specific ARARs by oxidizing Alcas Source Area COCs and reducing concentrations in groundwater south of the Main Building.

6.2.2.3 **<u>Long-Term Effectiveness and Permanence</u>**

Long-term effectiveness and permanence would be achieved through the ISCO alternative. The pilot study determined that the oxidant can oxidize dissolved phase TCE in the groundwater. This alternative will therefore decrease the timeframe for groundwater restoration by natural attenuation processes.

The pilot test evaluated constituents evaluated as having a potential to affect water quality, included dissolved metals and bromate. The pilot study concluded that within the treatment zone, a temporary increase in dissolved metals concentration can be expected immediately following oxidant injection, but that the effects are short-lived and the metals are likely to



CDM Smith

FIGURE 6-10
ISCO WITH PERSULFATE - PARCEL B
ALCAS PROPERTY
OLEAN, NEW YORK

attenuate following depletion of the oxidant. Hexavalent chromium and bromate were not found to be present at levels detrimental to water quality.

6.2.2.4 Reduction of Mobility, Toxicity, or Volume

This alternative would provide actual in-situ COC treatment resulting in irreversible oxidation of Alcas Source Area COCs. The pilot study indicates that activated persulfate can be effective for oxidizing Alcas Source Area COCs. As much as a 50 percent reduction in TCE concentrations was observed in the pilot study within the treatment area when compared to historical concentrations.

6.2.2.5 Short-Term Effectiveness

Implementation of this alternative would result in minimal exposure risk to the community, workers, and the environment which would be managed by worker training. Waste generated during the injection of electron donor would be managed using approved methods.

6.2.2.6 Implementability

Treating the dissolved phase plume in the upper aquitard south of the Main Building by injecting activated persulfate would be technically feasible and would have minimal impact to operations at Cutco. No administrative implementation obstacles are expected. The materials and services necessary for the installation of injection wells and for the injection of the chemical oxidant are readily available.

The effectiveness of the ISCO will be controlled by the ability to distribute the oxidant in the subsurface, and to achieve adequate mixing with dissolved TCE. The challenge distribution presents was demonstrated during the pilot test. However, through sequenced injection of sufficient oxidant volumes at appropriate spacing throughout the treatment area, distribution of chemical oxidant in the subsurface can be achieved at the Alcas Source Area.

6.2.2.7 Cost

Capital costs include system design, installation of injection wells, and waste disposal. Total capital costs are estimated to be approximately $524,000 for the remediation system. Additional costs include multiple rounds of injections and groundwater monitoring. Total additional costs are estimated to $488,670. Annual O&M costs are estimated to average $81,444 per year over years 1 through 6. The total present value life cycle costs of this alternative using a discount rate of 7 percent is $1,010,000. A detailed cost analysis is included in Appendix A.

6.2.2.8 Phase Time Estimation

Phase time estimates are based on the conceptual design, current conditions, and available technologies, and are subject to change.

Phase	Time
Construction	1-2 years
Implementation	3-5 years
Remedial Action Objectives	20 years

6.2.3 Alternative B.3 - ISCO using Ozone

Under the conceptual design for ISCO using ozone, ozone gas would be injected into the upper aquitard to treat the dissolved phase plume south of the Main Building. This alternative would be implemented in select locations on Parcel B, generally targeting areas where higher concentrations of COCs have historically been observed; specifically where TCE concentrations exceed 100 µg/L. One hundred and seventy injection points would be installed to the south of the Main Building to a depth of 20 feet bgs. The injection points would be aligned in multiple rows with borehole spacing of approximately 10 feet between each row. Three new monitoring wells will be installed to monitor the ozone treatability. This alternative also includes the following components:

- performance monitoring would be conducted to monitor oxidation of COCs.
- Long-term monitoring of the VOC contamination transformation resulting from the ISCO injections and the attenuation processes to ensure that the groundwater quality improves until the cleanup levels are achieved.
- Groundwater sampling would also monitor degradation by-products generated by the treatment processes to ensure that drinking water quality standards are met at the nearby municipal water supply well 18M.
- Institutional controls in the form of proprietary controls, such as deed restrictions for groundwater and soil use**,** existing governmental controls, such as well permit requirements, and informational devices, such as publishing advisories in local newspapers and issuing advisory letters to local governmental agencies regarding groundwater use in the impacted area.
- A Site Management Plan ("SMP") would be developed to provide for the proper management of the Alcas Source Area remedy post-construction, such as through the use of institutional controls until RAOs are met, and will also include long-term groundwater monitoring, periodic reviews and certifications.

6.2.3.1 **Overall Protection of Human Health and the Environment**

Ozone is a powerful oxidant, stronger than persulfate or permanganate, and readily reacts with toxic organics, including chlorinated ethenes. Significant quantities of gas are expected during the oxidation process creating the potential for stripping of VOCs from the groundwater into unsaturated soils at the Alcas Source Area. The off-gas generated during the stripping process might present a potential risk to workers, via the inhalation of off-gas, and the environment, via the spread of contaminants from the groundwater to unsaturated soils. For this reason, air monitoring for COCs during injection operations would be an important aspect of implementing this alternative. If safe breathing levels were exceeded, mitigation would be required, which could include the use of respirators, or even installation of a vapor extraction system. ISCO using ozone would be likely to adequately oxidize Alcas Source Area COCs. Protectiveness under this alternative requires a combination of actively reducing contaminant concentrations and limiting exposure to residual contaminants through institutional controls until RAOs are met.

6.2.3.2 **Compliance with ARARs**

This alternative would comply with chemical-, location-, and action-specific ARARs.

6.2.3.3 **Long-Term Effectiveness and Permanence**

ISCO using ozone involves the introduction of ozone gas to degrade organic contaminants. The bench scale treatability test conducted to assess the feasibility of ISCO technology in oxidizing dissolved phase COCs with chemical oxidants, included as Appendix D, determined that ozone generated significant quantities of gas during the oxidation process. This proved difficult to manage during initial bench scale testing. The test determined that approximately 5 to 10 ozone applications were required to completely oxidize high concentrations of dissolved phase TCE. Like most injection technologies, dissolved contaminants concentrations may rebound weeks or months following treatment. Additional injection rounds may be required to maintain RAOs.

Once decayed, ozone leaves no taste or odor in water and thus, not expected to impact wellhead treatment at 18M or 38/38M.

6.2.3.4 **Reduction of Mobility, Toxicity, or Volume**

This alternative would provide actual in-situ COC treatment resulting in irreversible oxidation of Alcas Source Area COCs. Injecting ozone is expected to reduce VOC mass near the injection points. However, the ozone gas is expected to cause stripping of contaminants from the groundwater that may spread to unsaturated soils and off-gas.

6.2.3.5 **Short-Term Effectiveness**

The quantity of ozone gas required to remove dissolved phase contaminates is believed to have the potential to generate stripping of VOCs from the groundwater into unsaturated soils at the Alcas Source Area. This alternative may have potential short-term impacts to remediation workers, the public, and the environment during implementation. Drilling activities, including the installation of monitoring and injection wells, could produce contaminated liquids that present some risk to remediation workers at the Alcas Source Area. However, measures would be implemented to mitigate exposure risks through the use of personnel protective equipment and standard health and safety practices. The off-gas generated during the stripping process would present a potential risk to workers, via the inhalation of off-gas, and the environment, via the spread of contaminants from the groundwater to unsaturated soils.

6.2.3.6 **Implementability**

The implementation of oxidant injections is technically feasible with no foreseen administrative impediments. The injection of ozone gas is seen as problematic because of the highly heterogeneous soils that would prevent uniform distribution of the gas. Ozone gas that does contact COCs is expected to react rapidly, hindering ozone’s ability to travel laterally, thus creating a limited radius of influence.

The proximity of public drinking water supply well 18M to the treatment area also increases the design challenges with ISCO using ozone. However, the proper placement of injection wells and management of ozone gas quantities is not expected to impact the public supply wells.

6.2.3.7 **Cost**

Capital costs include system design, installation of injection wells, and waste disposal. Total capital costs are estimated to be approximately $524,000 for the remediation system. Additional costs include multiple rounds of injections and groundwater monitoring. Total additional costs are estimated to $488,670. Annual O&M costs are estimated to average $81,444 per year over years 1 through 6. The total present value life cycle costs of this alternative using a discount rate of 7 percent is $1,010,000. A detailed cost analysis is included in Appendix A.

6.2.3.8 **Phase Time Estimation**

Phase time estimates are based on the conceptual design, current conditions, and available technologies, and are subject to change.

Phase	Time
Construction	1-2 years
Implementation	3-5 years
Remedial Action Objectives	20 years

6.2.4 Alternative B.4 - Monitored Natural Attenuation

Under the conceptual design for MNA, three new monitoring wells will be installed to monitor Alcas Source Area conditions. Following installation, eight quarterly monitoring events will be conducted in the first two years. Assuming EPA approval to a reduction of the monitoring frequency, annual monitoring events will be conducted for the next 28 years. Soils will be disposed of in accordance with RCRA Hazardous Waste generator, transporter, treatment and disposal requirements.

The results of the Monitored Natural Attenuation demonstration are included as Appendix E.

6.2.4.1 **Overall Protection of Human Health and the Environment**

This alterative is not expected to result in exposure risks to the community, workers, or the environment. Given the Alcas Source Area conditions geochemistry, it will take in excess of 30 years for the MNA to remediate the groundwater to below MCLs. Other MNA mechanisms such as dilution and dispersion are also not expected to reduce groundwater concentrations to below MCLs if the source area persists. Monitored natural attenuation alone is not likely to reduce Alcas Source Area COCs in a reasonable time period and thus the alternative does not comply with chemical specific ARARs for groundwater.

6.2.4.2 **Compliance with ARARs**

This alternative by itself would not comply with chemical specific ARARs because it is not believed to reduce Alcas Source Area COCs within a reasonable time period.

6.2.4.3 **Long-Term Effectiveness and Permanence**

The natural attenuation evaluation determined that although evidence of biodegradation is observed, the lack of available electron donors at the Alcas Source Area inhibits effective degradation of Alcas Source Area COCs in a reasonable time period. Degradation byproducts are not expected to impact wellhead treatment at municipal wells. Natural attenuation as a remedial alternative by itself is not believed to be able of attaining Alcas Source Area-specific remediation objectives.

6.2.4.4 **Reduction of Mobility, Toxicity, or Volume**

The Natural attenuation alternative will reduce Alcas Source Area COCs toxicity and volume but not affect mobility. The biodegradation of Alcas Source Area COCs is permanent and irreversible. Complete degradation is expected to exceed 30 years, leaving residual COCs at concentrations above chemical specific ARARs beyond that time.

6.2.4.5 **Short-Term Effectiveness**

Implementation of this alternative would result in minimal exposure risk to the community, workers, and the environment which would be managed by worker training. Waste generated during the installation of additional monitoring wells would be managed using approved methods.

6.2.4.6 **Implementability**

Implementation of this alternative is technically feasible, as the technology to install additional monitoring wells and collect groundwater samples is well established. The materials and services to necessary for the installation of additional monitoring wells and for the collection and analysis of groundwater samples are readily available. The installation and sampling activities are not expected to significantly impact operations at the existing Cutco Corporation facility.

6.2.4.7 **Cost**

Capital costs include system design, installation of additional monitoring wells, and waste disposal. Total capital costs are estimated to be approximately $307,000. O&M costs include groundwater monitoring. Annual O&M costs are estimated to average $14,700 per year over 30 years. The total present value life cycle costs of this alternative using a discount rate of 7 percent is $460,000. A detailed cost analysis is included in Appendix A

6.2.4.8 **Phase Time Estimation**

Phase time estimates are based on the conceptual design, current conditions, and available technologies, and are subject to change.

Phase	Time
Construction	0 years
Implementation	30 years
Remedial Action Objectives	To Be Determined

6.2.5 Alternative B.5 - Enhanced Anaerobic Bioremediation

The Enhanced Anaerobic Bioremediation ("*EAB*") pilot study completed at the Alcas Source Area (Appendix F) indicates that Alcas Source Area COCs can be effectively degraded using this technology. Under the conceptual design for EAB, selected locations on Parcel B would be generally targeting areas where higher concentrations of COCs have historically been observed; specifically where TCE concentrations exceed 100 µg/L. EAB would be implemented using temporary injection points to inject slow-release electron donor solutions into the subsurface. Based on the pilot study, bioaugmentation will likely be necessary in order to supplement the existing bacterial community at the Alcas Source Area in order for EAB to be effective.

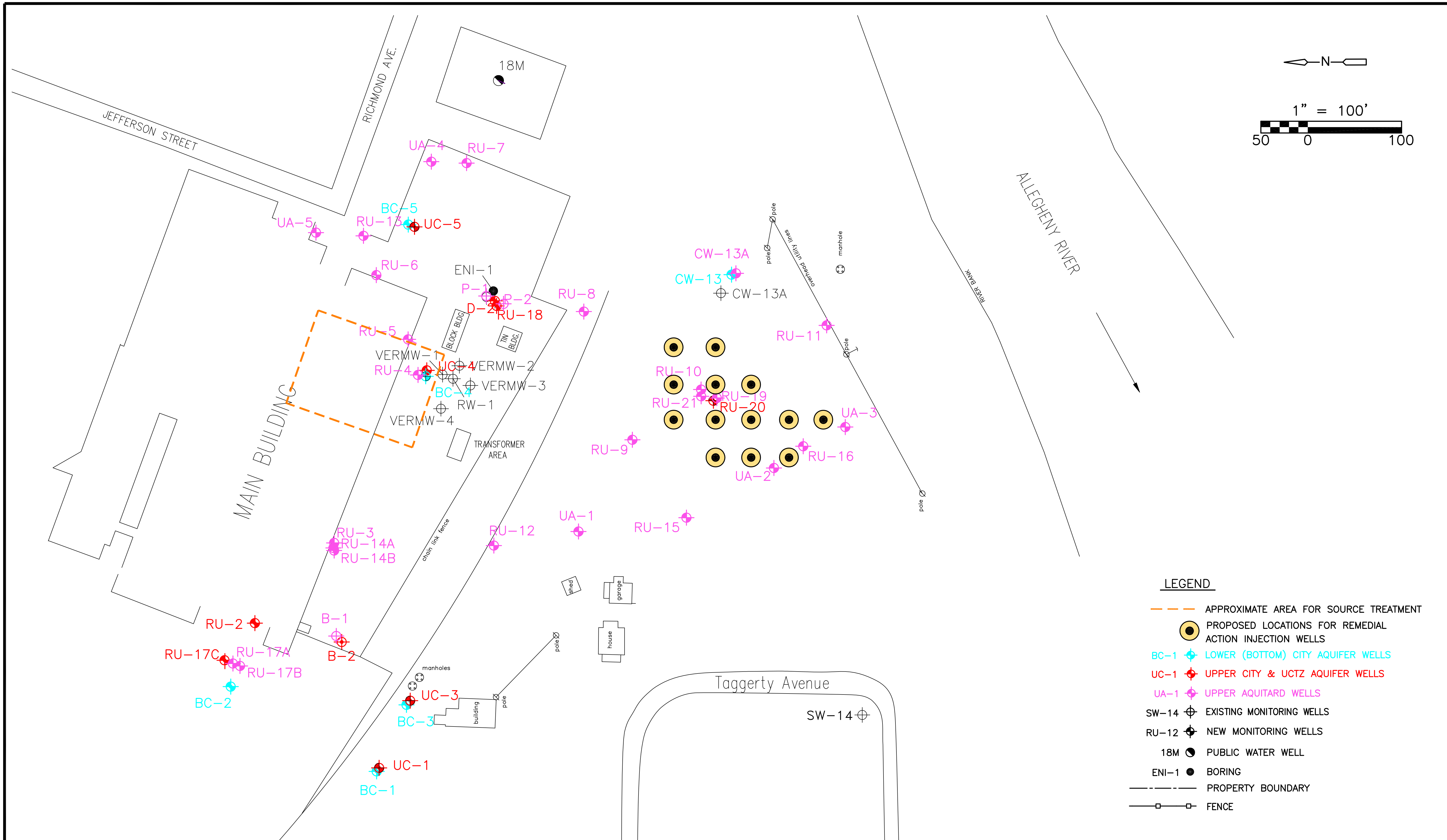
Disruption will occur periodically during the first six years when implementing the injections. Soils will be disposed of in accordance with RCRA Hazardous Waste generator, transporter, treatment and disposal requirements.

Components of this technology include the following:

- Install temporary injection points (in multiple rows with borehole spacing of approximately 40 feet within each row) to depths between 10 and 40 feet bgs. The injection point network will be developed during the Remedial design phase but for the purposes of developing a cost estimate for this alternative, 13 temporary injection points were used.
- Inject 100 gallons of slow-release electron donor amendment per vertical foot of injection interval at each point.
- Assume three rounds of injection (one every two years).
- Install new monitoring wells for performance monitoring. A monitoring well network will be developed during the Remedial design phase but for the purposes of developing a cost estimate for this alternative, 3 new monitoring wells were used.

Figure 6-11 presents the conceptual layout of the EAB injection points. While the effective radius of influence for each injection well is expected to be 8 to 10 feet based on the pilot test, the use of multiple, staggered rows of injection wells allows the spacing to be doubled while still establishing a complete treatment zone. It is expected that the large quantity of electron donor distributed over the area illustrated in Figure 6-11 will be sufficient to maintain strongly reducing conditions for up to 2 years. This is longer than the pilot test because in that case the injection zone was much smaller, which allowed untreated water to move through the treatment zone much more rapidly than will be the case during a full-scale application. Performance monitoring data will be used to determine whether the injection layout is achieving objectives or needs to be modified. This alternative also includes the following components:

- performance monitoring would be conducted to monitor oxidation of COCs.
- Long-term monitoring of the VOC contamination transformation and the attenuation processes to ensure that the groundwater quality improves until the cleanup levels are achieved.
- Groundwater sampling would also monitor degradation by-products generated by the treatment processes to ensure that drinking water quality standards are met at the nearby municipal water supply well 18M.
- Institutional controls in the form of proprietary controls, such as deed restrictions for groundwater and soil use, existing governmental controls, such as well permit requirements, and informational devices, such as publishing advisories in local newspapers and issuing advisory letters to local governmental agencies regarding groundwater use in the impacted area.
- A Site Management Plan ("SMP") would be developed to provide for the proper management of the Alcas Source Area remedy post-construction, such as through the use of institutional controls until RAOs are met, and will also include long-term groundwater monitoring, periodic reviews and certifications.



CDM Smith

FIGURE 6-11
ENHANCED ANAEROBIC BIOREMEDIATION - PARCEL B
ALCAS PROPERTY
OLEAN, NEW YORK

6.2.5.1 Overall Protection of Human Health and the Environment

This alternative would restore groundwater quality within a reasonable timeframe. Protectiveness under this alternatives requires a combination of actively reducing contaminant concentrations and limiting exposure to residual contaminants through institutional controls until RAOs are met.

6.2.5.2 Compliance with ARARs

This alternative would comply with chemical-, location-, and action-specific ARARs.

6.2.5.3 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence would be achieved through an enhanced anaerobic bioremediation treatment alternative. The pilot study determined that reductive dechlorination conditions can be achieved through the injection of an electron donor allowing for the biodegradation of chlorinated ethenes.

Metals become more soluble under reducing conditions and several metals exhibited slight increases in concentration during the pilot study. While slight increases in dissolved metals concentrations were observed following electron donor injection, these increases are not expected to lead to migration of metals outside of the treatment area, as the metals become more immobile as redox conditions become less reducing outside of the treatment area. Treatment byproducts are not expected to impact wellhead treatment at municipal wells.

The electron donor did have a slight effect on hydraulic conductivity in the immediate vicinity of the injection points. As the overall decrease in conductivity attributable to electron donor injection was less than one order of magnitude, and the conductivity should increase over time as electron donor is depleted, the long-term effect on hydraulic conductivity is not expected to be significant.

6.2.5.4 Reduction of Mobility, Toxicity, or Volume

This alternative would provide actual in-situ COC treatment resulting in irreversible reduction of Alcas Source Area COCs. Based on the results of the pilot study, included as Appendix F, it was concluded that redox condition will shift in areas impacted directly by the electron donor injection, and that the conditions are favorable for reductive dechlorination. The pilot study determined that reductive dechlorination occurred with a reduction in TCE concentration of approximately 95 percent and a reduction in total chloroethenes of approximately 85 percent. The remaining chloroethene mass was predominantly composed of vinyl chloride and ethene. This transformation would need to be monitored and managed to prevent exposure via drinking contaminated water or inhalation through the vapor intrusion pathway. Given the 5-month duration of the pilot study and the observation that methanogenesis was only just beginning, it is likely that additional ethene generation will occur over the long term.

6.2.5.5 Short-Term Effectiveness

This alternative may have potential short-term impacts to remediation workers, the public, and the environment during implementation. Drilling activities, including the installation of monitoring and injection wells, could produce contaminated liquids that present some risk to remediation workers at the Alcas Source Area. However, measures would be implemented to mitigate exposure risks through the use of personnel protective equipment and standard health and safety practices. Methane will be generated in the subsurface during EAB. If injections are performed under buildings, or immediately adjacent to them, periodic monitoring of air or sub-slab soil gas should be considered to ensure concentrations do not exceed occupational safety levels. In the case of the treatment area illustrated in Figure 6-11, the area is open and undeveloped with no buildings that would allow for accumulation of methane or other gases, so this will not be an issue. No difficulties are foreseen with the required quantity of the injection material needed for this alternative, as it is nonhazardous. Waste generated during the injection of electron donor would be managed using approved methods.

6.2.5.6 **Implementability**

Implementation of this alternative is technically feasible, as the technology to inject electron donor is well established. The materials and services to necessary for the injection are readily available. The enhanced biodegradation activities are not expected to significantly impact operations at the existing Cutco Corporation facility.

The results of the pilot test indicate that effective electron donor distribution can be achieved using DPT injection techniques. Due to the relatively low, but highly variable, permeability of the aquifer formations at the Alcas Source Area, pressurized DPT injection using a top-down approach is an effective method for distributing the electron donor bother horizontally and vertically at the Alcas Source Area.

6.2.5.7 **Cost**

Capital costs include injection design, installation of temporary injection points, and initial injection of electron donor. Total capital costs are estimated to be approximately $294,000 for the implementation, first electron donor injection, and bioaugmentation. Periodic costs include two subsequent electron donor injection events and maintenance. Total periodic costs are estimated to be $348,000. Monitoring costs are estimated to be $649,000. Annual O&M costs are estimated to average $101,000 per year during years 1 through 8. The total present value life cycle costs of this alternative using a discount rate of 7 percent is $1,103,000. A detailed cost analysis is included in Appendix A.

6.2.5.8 **Phase Time Estimation**

Phase time estimates are based on the conceptual design, current conditions, and available technologies, and are subject to change.

Phase	Time
Construction	1-2 years
Implementation	3-5 years
Remedial Action Objectives	30 years

7.0 Comparative Analysis of Alternatives

This section will present a comparative analysis of alternatives address soil and groundwater contamination at the Alcas Facility and Parcel B. The analysis will compare the relative performance of each alternative in relation to each specific evaluation criterion. This analysis will identify the advantages and disadvantages of each alternative relative to one another so that the key tradeoffs can be identified. The USEPA has categorized the nine evaluation criteria into three groups, which have varying levels of importance in the selection of the remedial alternative.

- Threshold Criteria – Overall protection of human health and the environment and compliance with ARARs are threshold requirements that each alternative must meet in order to be eligible for selection.

- Balancing Criteria – The five primary balancing criteria are long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; Implementability; and cost. The alternative that is protective of human health and the environment, complies with ARARs, and affords the most favorable balancing criteria will be identified as the preferred remedial alternative.

- Modifying Criteria – State and community acceptance are modifying criteria that shall be considered in the remedy selection. State and community acceptance will be addressed after comments to this FFS Report are received.

7.1 *Comparative Analysis of Alternatives for the Alcas Facility*

This section provides a comparative analysis of the expected performances of each alternative to identify the most suitable alternative to minimizing the migration of COCs from the Alcas Source Area to the City Aquifer

7.1.1 Overall Protection of Human Health and the Environment

Each alternative, with the exception of the No Action alternative, provides protection of human health and the environment and achieves some measure of the RAOs. The means of achieving protection is somewhat different for each alternative. Alternative A.4 (Groundwater Extraction via Trench) and Alternative A.5 (Groundwater Extraction via Wells) provide protection by intercepting COCs before they reach the City Aquifer. The degree of containment is high, but the mass removal is low. Alternative A.9 (ISCO with Activated Persulfate) provides protection by decreasing mass to a much larger extent, which will in turn reduce mass flux of COCs to the City Aquifer. Similarly, Alternative A.9b (ISCO with Activated Persulfate) and excavation provides protection by actively reducing contaminant concentrations and limiting exposure to residual contaminants through institutional controls until RAOs are met. The degree of mass reduction is high, but the degree of containment is potentially somewhat lower. Alternative A.6 (ZVI PRB) and Alternative A.8 (ZVI Treatment Zones) provide somewhat greater containment than Alternative A.9 (ISCO with Activated Persulfate), but less mass reduction. Alternative A.3 (VER), Alternative A.7 (Barrier Wall), and Alternative A.2 (Excavation) provide the least containment and mass reduction of the alternatives.

7.1.2 Compliance with ARARs

Only three alternatives, Alternative A.8 (ZVI Treatment Zones), Alternative A.9a (ISCO with Activated Persulfate) and Alternative A.9b (ISCO with Activated Persulfate and Excavation) will comply with chemical-specific ARARs for COCs in the saturated zone beneath the Main Building by oxidizing or dechlorinating Alcas Source Area COCs before they can spread in the Upper Aquitard. The remainder of alternatives would not comply with chemical-specific ARARs for soil or groundwater as the alternatives would have minimal or no effectiveness in remediating, controlling or abating the contamination source situated underneath the Main Building.

7.1.3 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence is similar for Alternative A.4 (Groundwater Extraction via Trench), Alternative A.5 (Groundwater Extraction via Wells)and Alternative A.9 (ISCO with Activated Persulfate), although differences exist. In the case of Alternative A.4 (Groundwater Extraction via Trench) and Alternative A.5 (Groundwater Extraction via Wells), the alternatives are well understood and proven to provide hydraulic containment, and the systems can be maintained for decades with periodic maintenance. However, the residual COC mass left in place is much higher for Alternative A.4 (Groundwater Extraction via Trench) and Alternative A.5 (Groundwater Extraction via Wells) than for Alternative A.9a (ISCO with Activated Persulfate), which provides a permanent reduction in residual COC mass, but perhaps less certainty with respect to the immediate COC flux reduction. Alternative A.9b (ISCO with Activated Persulfate and Excavation) could potentially provide the highest degree of long-term effectiveness and permanence since additional excavation activities could be performed in the future, if necessary.

Alternative A.8 (ZVI Treatment Zones) follows Alternative A.4 (Groundwater Extraction via Trench), Alternative A.5 (Groundwater Extraction via Wells) and Alternative A.9 (ISCO with Activated Persulfate) for this criterion. This alternative provides less certainty regarding mass flux reduction than groundwater extraction, and less mass reduction (i.e., more residual COC mass) than Alternative A.9 (ISCO with Activated Persulfate), though it provides both. The Alternative A.6 (ZVI PRB) would be next as again, the certainty of containment is less than for groundwater extraction, but the mass removal would likely be similar.

Alternative A.7 (Barrier Wall) would provide long-term effectiveness if constructed successfully. However, since certainty of successfully constructing the barrier is low, and residual COC mass is high, the alternative does not provide a high degree of certainty for long-term effectiveness. Alternative A.2 (Excavation) and Alternative A.3 (VER) have the least long-term effectiveness due to the residual risk from remaining, unexcavated or untreated soil impacts underneath the Main Building and the lack of flux reduction.

7.1.4 Reduction of Mobility, Toxicity, or Volume

Alternative A.9b (ISCO with Activated Persulfate and Excavation) in and around the Main Building would provide the largest reduction of constituent mass, mobility, and toxicity, followed by Alternative A.9a (ISCO with Activated Persulfate) and the Alternative A.8 (ZVI Treatment Zones). Alternative A.4 (Groundwater Extraction via Trench), Alternative A.5 (Groundwater Extraction via Wells) and Alternative A.6 (ZVI PRB) would also reduce contaminant mobility, but will have less of an impact on mass and toxicity due to the residual source material underneath the Main Building. In addition, Alternative A.4 (Groundwater Extraction via Trench) and Alternative A.5 (Groundwater Extraction via Wells) does not provide COC destruction, but instead transfers them to the atmosphere, albeit at levels below regulatory limits. Alternative A.7 (Barrier Wall) will prevent mobility but will not reduce mass or toxicity. Alternative A.2 (Excavation) is not expected to significantly reduce mobility, toxicity or volume. Alternative A.3 (VER) will likely remove some mass but has the potential to increase mobility of COC to the City Aquifer if upwelling occurs.

7.1.5 Short-Term Effectiveness

The implementation of each alternative analyzed would result in minimal exposure risks to the community, workers, and the environment. These risks would be limited through engineering controls and worker training.

7.1.6 Implementability

Alternative A.3 (VER), Alternative A.4 (Groundwater Extraction via Trench) and Alternative A.5 (Groundwater Extraction via Wells), Alternative A.6 (ZVI PRB), Alternative A.9 (ISCO with Activated Persulfate) and Alternative A.2 (Excavation) are technically and administratively feasible. However, the groundwater extraction and treatment alternatives would result in the most risk through the continuous operation of a treatment system that is susceptible to potential malfunctions and shut-downs. The services and material necessary to implement each alternative discussed are readily available. More care will be required when working within the existing Cutco Corporation facility to access the source material underneath the Main Building. For this reason, Alternative A.8 (ZVI Treatment Zones) is not likely implementable. Alternative A.7 (Barrier Wall) is the most difficult to implement as a great deal of precision will be required to construct the bottom barrier. The level of detail for the bottom barrier extends well beyond the ordinary requirements for a horizontal well installation. Alternative A.9b (ISCO with Activated Persulfate) and excavation has implementation challenges due to the limited accessibility underneath the existing operating facility. Excavation activities determined to be necessary to achieve the groundwater RAOs under this alternative would require a significant amount of coordination given the existing manufacturing operations at the Alcas Facility. Existing operations at the Alcas Facility would be negatively impacted by the excavation alternative as certain areas of the building critical to the manufacturing process would need to be fully or partially demolished. However if future operations change, or for instance if the portion of the building overlying the contamination is no longer in use or demolished, impacts resulting from excavation may not be significant; in fact, if the building is demolished excavation would be more readily implementable and be more important as unsaturated soils may be more amenable to leaching if the slab is compromised.

7.1.7 Costs

The No Action alternative with no cost is the most economical option. Alternative A.2 (Excavation) is the next most economical at an estimated present value cost of $309,000. Alternative A.3 (VER), Alternative A.6 (ZVI PRB), Alternative A.9a (ISCO with Activated Persulfate) and Alternative A.9b (ISCO with Activated Persulfate with Excavation) are all estimated to have relatively similar costs, between $1 and 1.5 million. The construction of Alternative A.7 (Barrier Wall) and installation of multiple horizontal boreholes to construct the bottom barrier makes the barrier wall alternative the most expensive alternatives at an estimated present worth value of $7,730,000. Alternative A.4 (Groundwater Extraction via Trench) and Alternative A.5 (Groundwater Extraction via Wells) have a costs range between 2.8 and 3.2 million due to the costs associated with operating the treatment system. The least expensive of the three extraction alternatives is by Alternative A.4 (Groundwater Extraction via Trench), followed by Alternative A.5 (Groundwater Extraction via Wells) by vertical wells, and then Alternative A.5 (Groundwater Extraction via Wells) by horizontal wells.

7.2 *Comparative Analysis of Alternatives for Parcel B*

This section provides a comparative analysis of the expected performances of each alternative to identify the most suitable alternative to reduce the dissolved phase COC Concentrations in the upper aquitard south of the Alcas Source Area.

7.2.1 Overall Protection of Human Health and the Environment

As no exposure pathways currently exist, all of the alternatives are protective of human health and the environment. Alternative B.2 (ISCO using Persulfate) and Alternative B.4 (EAB) could achieve the RAO through destruction and degradation of Alcas Source Area COCs. Alternative B.3 (ISCO using Ozone) would oxidize constituent mass in the subsurface and achieve the RAO but would lead to the generation of off-gas that would present a potential risk to workers and the environment. Alternative B.5 (MNA) alone is not expected to reduce contaminants within a reasonable time period. However, used in conjunction with Alternative B.4 (EAB) and potentially the ISCO alternatives, Alternative B.5 (MNA) may prove successful.

7.2.2 Compliance with ARARs

Each of the alternatives, with the exception of No Action, would attain ARARs in the long-term. The timeframe for Alternative B.5 (MNA) on its own to achieve ARARs might not be acceptable however.

7.2.3 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence would be achieved by both Alternative B.4 (EAB) and Alternative B.2 (ISCO using Persulfate). However, Alternative B.4 (EAB) will likely reduce long-term risk more than Alternative B.2 (ISCO using Persulfate). Alternative B.4 (EAB) will create a bacterial community that will continue to degrade COCs for some time after active treatment, providing more long-term COC destruction and facilitating attenuation processes that will reduce the overall cleanup timeframe. Alternative B.3 (ISCO using Ozone) provides less certainty than either of these alternatives regarding effectiveness.

7.2.4 Reduction of Mobility, Toxicity, or Volume

Alternative B.2 (ISCO using Persulfate), Alternative B.3 (ISCO using Ozone), and Alternative B.4 (EAB) would reduce constituent mass through in situ destruction and prevent the further migration of COCs. Alternative B.4 (EAB) is estimated to achieve a higher reduction in constituent mass than Alternative B.2 (ISCO using Persulfate) and Alternative B.3 (ISCO using Ozone). Alternative B.5 (MNA) alone is not expected to reduce contaminants within a reasonable time period.

7.2.5 Short-Term Effectiveness

Alternative B.2 (ISCO using Persulfate)and Alternative B.4 (EAB) would result in minimal exposure risk to the community and the environment. Both alternatives require similar remedial actions to implement and have limited O&M activities; however, handling of chemical oxidants does pose more risk to workers. In particular the use of ozone may require air monitoring for COCs during injection operations. If safe breathing levels were exceeded, mitigation would be required, which could include the use of respirators, or even installation of a vapor extraction system. Alternative B.5 (MNA) would also be highly rated in this category. Alternative B.3 (ISCO using Ozone) is the lowest rated for short-term effectiveness because its implementation would have the most risk.

7.2.6 Implementability

Alternative B.4 (EAB) and Alternative B.2 (ISCO using Persulfate) are technically and administratively feasible. Both alternatives require similar remedial actions to implement and have limited O&M activities. Limited separation exists between the two alternatives with regard to implementability. Alternative B.5 (MNA) is also straightforward to implement. Alternative B.3 (ISCO using Ozone) has the most implementation challenges.

7.2.7 Cost

Alternative B.2 (ISCO using Persulfate) and Alternative B.3 (ISCO using Ozone) have an estimated present value total cost of $1,010,000. Alternative B.4 (EAB) has an estimate present value total cost of $1,103,000 and Alternative B.5 (MNA) has the lowest estimated present value cost of $460,000.

8.0 References

Arnold, W., Roberts, L., 2000. “Pathways and Kinetics of Chlorinated Ethylene and Chlorinated Acetylene Reaction with Fe(0) Particles”. Environ. Sci. Technol. 34(2), 1794-1805.

Battelle, 2002. Evaluating the Longevity of Hydraulic Performance of Permeable Reactive Barriers at Department of Defense Sites. Final Report prepared for NFESC, April 24.

Lookman, R., Bastiaens, L., Borremans, B., Maesen, M., Gemoets, J., Diels, L., 2004. “Batch-test study on the dechlorination of 1,1,1-trichloroethane in contaminated aquifer material by zero-valent iron”. J. Cont. Hydrol. 74. 133-144.

National Research Council, 2012. *Alternatives for Managing the Nation’s Complex Contaminated Groundwater Sites.* National Academies Press, Washington, D.C. 326 pp.

United States Environmental Protection Agency, 1988. Guidance for Conduction Remedial Investigations and Feasibility Studies Under CERCLA EPA/540/G-89/004 OSWER Directive 9355-3-01, October.

United States Environmental Protection Agency, 1997. Permeable Reactive Subsurface Barriers for the Interception and Remediation of Chlorinated Hydrocarbon and Chromium (VI) Plumes in Groundwater. EPA 600/F-97/008, July.

United States Environmental Protection Agency, 1999. A Guide for Preparing for Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents. EPA 540/R-98/031, July.

United States Environmental Protection Agency, 2000. A Guide to Developing and Documenting Cost Estimates during the Feasibility Study. EPA 540-R-00-002, July.

United States Environmental Protection Agency, 2011. Groundwater Road Map Recommended Process for Restoring Contaminated Groundwater at Superfund Sites. OSWER 9283.1-34

United States Environmental Protection Agency, 2012. National Strategy to Expand Superfund Optimization Practices from Site Assessment to Site Completion. OSWER Directive 9200.3-75

United States Environmental Protection Agency, 2014. Groundwater Remedy Completion Strategy. OSWER directive 9200.2-144, May.

Appendix A

Alternative Costing Details

Excavation Cost Estimate Summary
Alcas Facility - Olean, NY

Item No.	Item Description	Quantity	Unit Cost	Unit	Extension
CAPITAL COSTS					
1.Management, Design, and Planning					
	Project Management and Engineering Support	1	$ 36,635	LS	$ 36,635
	System Design	1	$ -	LS	$ -
	Remediation Plans and Regulatory Approval	1	$ 31,096	LS	$ 31,096
	Permitting	1	$ 6,240	LS	$ 6,240
	Total Management, Design, and Planning Costs				**$ 73,971**
2. Supplemental Investigation / Phased Implementation					
	Total Transition Zone investigation/Phased Implementation Costs	1	$ -	LS	**$ -**
3. Ssytem Installation					
3a.	Excavation of Shallow Soils	1	$ 195,000	LS	$ 195,000
		1	$ -	LS	$ -
		1	$ -	LS	$ -
	Total System Installation Costs				**$ 195,000**
	SUBTOTAL CAPITAL COSTS				**$ 268,971**
4.	Overhead and Profit (15%)				$ 40,346
	TOTAL CAPITAL COST				**$ 309,317**
OPERATION, MONITORING, & MAINTENANCE (OM&M) COSTS					
5a.	Project Management	1	$ -	LS	$ -
5b.	Groundwater Monitoring	1	$ -	LS	$ -
		1	$ -	LS	$ -
	Subtotal Annual OM&M Cost				**$ -**
6.	OM&M Overhead and Profit (10%)				$ -
	TOTAL ANNUAL OM&M COST				**$ -**
	PRESENT WORTH OF TOTAL OM&M COST				**$ -**
PRESENT VALUE					
	TOTAL PRESENT VALUE (7% DISCOUNT RATE)				**$ 309,317**

SAY $ 300,000

Vacuum Enhanced Recovery Treatment Cost Estimate Summary
Alcas Facility - Olean, NY

Item No.	Item Description	Quantity	Unit Cost	Unit	Extension
CAPITAL COSTS					
1.General Conditions					
	General Administrative Conditions	1	$ 13,000	LS	$ 13,000
	Permitting	1	$ 13,000	LS	$ 13,000
	Survey	1	$ 26,000	LS	$ 26,000
	Total General Conditions Costs				**$ 52,000**
2. Construction Costs					
2a.	Mobilization	1	$ 13,000	LS	$ 13,000
2b.	VER Well Installation	1	$ 100,000	LS	$ 100,000
2c.	Vacuum Pump System	1	$ 80,000	LS	$ 80,000
2d.	Institutional Control	1	$ -	LS	$ -
	Total Construction Costs				**$ 193,000**
3. Transportation & Disposal (T&D)					
3a.	Hazardous, Subtitle C	0	$ 142	CY	$ -
3b.	Non Hazardous, Subtitle D	0	$ 98	CY	$ -
3c.	Non Hazardous, Concrete and Debris	0	$ 98	CY	$ -
	Total T&D Costs				**$ -**
4. Treatment (NOT APPLICABLE)					$ -
	SUBTOTAL CAPITAL COSTS				**$ 245,000**
5.	Pre-construction Sampling/Delineation	1	$ 26,000	LS	$ 26,000
6.	Design Engineering (5% capital cost)				$ 12,250
7.	General Contractor Overhead and Profit (20% GC & Construction, 10% T&D)				$ 49,000
8.	Resident Engineering (2.5% capital cost)				$ 6,125
	TOTAL CAPITAL COST				**$ 338,375**
OPERATION & MAINTENANCE (O&M) COSTS					
Annual O&M Costs					
9.	**Total Annual OM&M Cost (Year 1-30)**	1	$ 100,000	LS	**$ 100,000**
Periodic Costs					
10.	**Site restoration (at the end 30th year)**	1	$ 4,622	LS	**$ 4,622**
11.	**Remedial Action Report**	1	$ 22,035	LS	**$ 22,035**
	PRESENT WORTH OF TOTAL O&M COST				**$ 1,063,557**
PRESENT VALUE					
	TOTAL PRESENT VALUE (7% DISCOUNT RATE)				**$ 1,401,932**
				SAY	**$ 1,400,000**

Hydraulic Control System Cost Estimate Summary
Collection Trench
Alcas Facility - Olean, NY

Item No.	Item Description	Quantity	Unit Cost	Unit	Extension
CAPITAL COSTS					
1.Management, Design, and Planning					
	Project Management and Engineering Support	1	$ 36,635	LS	$ 36,635
	System Design	1	$ 86,503	LS	$ 86,503
	Remediation Plans and Regulatory Approval	1	$ 31,096	LS	$ 31,096
	Permitting	1	$ 6,240	LS	$ 6,240
	Total Management, Design, and Planning Costs				**$ 160,475**
2. Supplemental Investigation / Phased Implementation					
	Total Transition Zone investigation/Phased Implementation Costs	1	$ 89,330	LS	**$ 89,330**
3. Ssytem Installation					
3a.	Hydraulic Collection Trench	1	$ 395,627	LS	$ 395,627
3b.	System Installation	1	$ 228,491	LS	$ 228,491
	Total System Installation Costs				**$ 624,117**
	SUBTOTAL CAPITAL COSTS				**$ 873,922**
4.	Overhead and Profit (15%)				$ 131,088
	TOTAL CAPITAL COST				**$ 1,005,010**
OPERATION, MONITORING, & MAINTENANCE (OM&M) COSTS					
5a.	Project Management	1	$ 27,268	LS	$ 27,268
5b.	Groundwater Monitoring	1	$ 36,122	LS	$ 36,122
5c.	Maintenance and System Compliance	1	$ 61,065	LS	$ 61,065
	Subtotal Annual OM&M Cost				**$ 124,454**
6.	OM&M Overhead and Profit (10%)				$ 12,445
	TOTAL ANNUAL OM&M COST				**$ 136,900**
	PRESENT WORTH OF TOTAL OM&M COST				**$ 1,698,793**
PRESENT VALUE					
	TOTAL PRESENT VALUE (7% DISCOUNT RATE)				**$ 2,703,803**

SAY $ 2,700,000

Hydraulic Control System Cost Estimate Summary
Vertical Extraction Wells
Alcas Facility - Olean, NY

Item No.	Item Description	Quantity	Unit Cost	Unit	Extension
CAPITAL COSTS					
1.Management, Design, and Planning					
	Project Management and Engineering Support	1	$ 36,635	LS	$ 36,635
	System Design	1	$ 86,503	LS	$ 86,503
	Remediation Plans and Regulatory Approval	1	$ 31,096	LS	$ 31,096
	Permitting	1	$ 6,240	LS	$ 6,240
	Total Management, Design, and Planning Costs				**$ 160,475**
2. Supplemental Investigation / Phased Implementation					
	Total Transition Zone investigation/Phased Implementation Costs	1	$ 89,330	LS	**$ 89,330**
3. Ssytem Installation					
3a.	Extraction and Monitoring Well Installation	1	$ 123,505	LS	$ 123,505
3b.	System Installation	1	$ 260,991	LS	$ 260,991
3c.	Waste Management and Disposal	1	$ 30,706	LS	$ 30,706
	Total System Installation Costs				**$ 415,202**
	SUBTOTAL CAPITAL COSTS				**$ 665,006**
4.	Overhead and Profit (15%)				$ 99,751
	TOTAL CAPITAL COST				**$ 764,757**
OPERATION, MONITORING, & MAINTENANCE (OM&M) COSTS					
5a.	Project Management	1	$ 27,268	LS	$ 27,268
5b.	Groundwater Monitoring	1	$ 36,122	LS	$ 36,122
5c.	Maintenance and System Compliance	1	$ 87,065	LS	$ 87,065
	Subtotal Annual OM&M Cost				**$ 150,454**
6.	OM&M Overhead and Profit (10%)				$ 15,045
	TOTAL ANNUAL OM&M COST				**$ 165,500**
	PRESENT WORTH OF TOTAL OM&M COST				**$ 2,053,692**
PRESENT VALUE					
	TOTAL PRESENT VALUE (7% DISCOUNT RATE)				**$ 2,818,449**

SAY $ 2,810,000

Hydraulic Control System Cost Estimate Summary
Horizontal Extraction Wells
Alcas Facility - Olean, NY

Item No.	Item Description	Quantity	Unit Cost	Unit	Extension
CAPITAL COSTS					
1.Management, Design, and Planning					
	Project Management and Engineering Support	1	$ 36,635	LS	$ 36,635
	System Design	1	$ 86,503	LS	$ 86,503
	Remediation Plans and Regulatory Approval	1	$ 31,096	LS	$ 31,096
	Permitting	1	$ 6,240	LS	$ 6,240
	Total Management, Design, and Planning Costs				**$ 160,475**
2. Supplemental Investigation / Phased Implementation					
	Total Transition Zone investigation/Phased Implementation Costs	1	$ 89,330	LS	**$ 89,330**
3. Ssytem Installation					
3a.	Extraction and Monitoring Well Installation	1	$ 296,412	LS	$ 296,412
3b.	System Installation	1	$ 260,991	LS	$ 260,991
3c.	Waste Management and Disposal	1	$ 30,706	LS	$ 30,706
	Total System Installation Costs				**$ 588,109**
	SUBTOTAL CAPITAL COSTS				**$ 837,914**
4.	Overhead and Profit (15%)				$ 125,687
	TOTAL CAPITAL COST				**$ 963,601**
OPERATION, MONITORING, & MAINTENANCE (OM&M) COSTS					
5a.	Project Management	1	$ 27,268	LS	$ 27,268
5b.	Groundwater Monitoring	1	$ 36,122	LS	$ 36,122
5c.	Maintenance and System Compliance	1	$ 87,065	LS	$ 87,065
	Subtotal Annual OM&M Cost				**$ 150,454**
6.	OM&M Overhead and Profit (10%)				$ 15,045
	TOTAL ANNUAL OM&M COST				**$ 165,500**
	PRESENT WORTH OF TOTAL OM&M COST				**$ 2,053,692**
PRESENT VALUE					
	TOTAL PRESENT VALUE (7% DISCOUNT RATE)				**$ 3,017,292**
				SAY	**$ 3,010,000**

ZVI Permeable Reactive Barrier to treat intercepted flow Cost Estimate Summary (Frac Method)
Alcas Facility - Olean, NY

Item No.	Item Description	Quantity	Unit Cost	Unit	Extension
CAPITAL COSTS					
1.General Conditions					
	General Administrative Conditions	1	$ 39,000	LS	$ 39,000
	Permitting	1	$ 13,000	LS	$ 13,000
	Survey	1	$ 26,000	LS	$ 26,000
	Total General Conditions Costs				**$ 78,000**
2. Construction Costs					
	Total Construction Costs (with 10% Contingency)				**$ 579,547**
3. Transportation & Disposal (T&D)					
3a.	Hazardous, Subtitle C	0	$ 142	Ton	$ -
3b.	Non Hazardous, Subtitle D	0	$ 98	Ton	$ -
3c.	Non Hazardous, Concrete and Debris	0	$ 98	Ton	$ -
	Total T&D Costs				**$ -**
4. Treatment (NOT APPLICABLE)					$ -
	SUBTOTAL CAPITAL COSTS				**$ 657,547**
5.	Pre-construction Sampling/Delineation	1	$ 180,000	LS	$ 180,000
6.	Design Engineering (5% capital cost)				$ 32,877
7.	General Contractor Overhead and Profit (20% GC & Construction, 10% T&D)				$ 131,509
8.	Resident Engineering (2.5% capital cost)				$ 16,439
	TOTAL CAPITAL COST				**$ 1,018,373**
OPERATION & MAINTENANCE (O&M) COSTS					
9.	**Total Annual OM&M Cost**	1	$ 14,730	LS	**$ 14,730**
Periodic Costs					
10.	**Site Restoration**			LS	**$ -**
11.	**Remedial Action Report (at the end of 30th year)**	1	$ 22,035	LS	**$ 22,035**
	PRESENT WORTH OF TOTAL OM&M COST				**$ 185,684**
PRESENT VALUE					
	TOTAL PRESENT VALUE (7% DISCOUNT RATE)				**$ 1,204,056**

SAY $ 1,200,000

Barrier Wall Containment System Cost Estimate Summary
Alcas Facility - Olean, NY

Item No.	Item Description	Quantity	Unit Cost	Unit	Extension
CAPITAL COSTS					
1.Management, Design, and Planning					
	Project Management and Engineering Support	1	$ 28,181	LS	$ 28,181
	System Design	1	$ 66,541	LS	$ 66,541
	Remediation Plans and Regulatory Approval	1	$ 23,920	LS	$ 23,920
	Permitting	1	$ 4,800	LS	$ 4,800
	Total Management, Design, and Planning Costs				**$ 123,442**
2. Supplemental Investigation / Phased Implementation					
	Total Transition Zone investigation/Phased Implementation Costs	1	$ 89,330	LS	**$ 89,330**
3. Ssytem Installation					
3a.	Hydraulic Collection Trench	1	$ 304,328	LS	$ 304,328
	Horizontal Wells	25	$ 228,010	LS	$ 5,700,240
3b.	System Installation	1	$ 175,762	LS	$ 175,762
	Total System Installation Costs				**$ 6,180,330**
	SUBTOTAL CAPITAL COSTS				**$ 6,393,102**
4.	Overhead and Profit (15%)				$ 958,965
	TOTAL CAPITAL COST				**$ 7,352,067**
OPERATION, MONITORING, & MAINTENANCE (OM&M) COSTS					
5a.	Project Management	1	$ -	LS	$ -
5b.	Groundwater Monitoring	1	$ 27,786	LS	$ 27,786
5c.	Maintenance and System Compliance	1	$ -	LS	$ -
	Subtotal Annual OM&M Cost				**$ 27,786**
6.	OM&M Overhead and Profit (10%)				$ 2,779
	TOTAL ANNUAL OM&M COST				**$ 30,565**
	PRESENT WORTH OF TOTAL OM&M COST				**$ 379,277**
PRESENT VALUE					
	TOTAL PRESENT VALUE (7% DISCOUNT RATE)				**$ 7,731,345**

SAY $ 7,730,000

Multiple ZVI Treatment Zones using Frac Method to Treat Source Area Cost Estimate Summary
Alcas Facility - Olean, NY

Item No.	Item Description	Quantity	Unit Cost	Unit	Extension
CAPITAL COSTS					
1.General Conditions					
	General Administrative Conditions	1	$ 39,000	LS	$ 39,000
	Permitting	1	$ 13,000	LS	$ 13,000
	Survey	1	$ 26,000	LS	$ 26,000
	Total General Conditions Costs				**$ 78,000**
2. Construction Costs					
	Total Construction Costs (with 10% Contingency)				**$ 843,780**
3. Transportation & Disposal (T&D)					
3a.	Hazardous, Subtitle C	0	$ 142	Ton	$ -
3b.	Non Hazardous, Subtitle D	0	$ 98	Ton	$ -
3c.	Non Hazardous, Concrete and Debris	0	$ 98	Ton	$ -
	Total T&D Costs				**$ -**
4. Treatment (NOT APPLICABLE)					$ -
	SUBTOTAL CAPITAL COSTS				**$ 921,780**
5.	Pre-construction Sampling/Delineation	1	$ 26,000	LS	$ 26,000
6.	Design Engineering (5% capital cost)				$ 46,089
7.	General Contractor Overhead and Profit (20% GC & Construction, 10% T&D)				$ 184,356
8.	Resident Engineering (2.5% capital cost)				$ 23,044
	TOTAL CAPITAL COST				**$ 1,201,269**
OPERATION & MAINTENANCE (O&M) COSTS					
9.	**Total Annual OM&M Cost**	1	$ -	LS	**$ -**
Periodic Costs					
10.	**Site Restoration**			LS	**$ -**
11.	**Remedial Action Report (at the end of 30th year)**	1	$ 22,035	LS	**$ 22,035**
	PRESENT WORTH OF TOTAL OM&M COST				**$ 2,227**
PRESENT VALUE					
	TOTAL PRESENT VALUE (7% DISCOUNT RATE)				**$ 1,203,496**

SAY $ 1,200,000

Dissolved Phase Plume in Aquitard ISCO Treatment Cost Estimate Summary
Using Persulfate or Ozone
Alcas Facility - Olean, NY

Item No.	Item Description	Quantity	Unit Cost	Unit	Extension
CAPITAL COSTS					
1.General Conditions					
	General Administrative Conditions	1	$19,500.00	LS	$ 19,500
	Permitting	1	$13,000.00	LS	$ 13,000
	Survey	1	$26,000.00	LS	$ 26,000
	Total General Conditions Costs				**$ 58,500**
2. Construction Costs					
2a.	Mobilization	1	$ 13,000.00	LS	$ 13,000
2b.	Well Installation	1	$ 16,035.50	LS	$ 16,036
2c.	Amendment Injection	1	$ 303,388.80	LS	$ 303,389
	Total Construction Costs				**$ 332,424**
3. Transportation & Disposal (T&D)					
3a.	Hazardous, Subtitle C	0	$ 142.00	Ton	$ -
3b.	Non Hazardous, Subtitle D	0	$ 98.00	Ton	$ -
3c.	Non Hazardous, Concrete and Debris	0	$ 98.00	Ton	$ -
	Total T&D Costs				**$ -**
4. Treatment (NOT APPLICABLE)					$ -
	SUBTOTAL CAPITAL COSTS				**$ 390,924**
5.	Pre-construction Sampling/Delineation	1	$ 26,000	LS	$ 26,000
6.	Design Engineering (5% capital cost)				$ 19,546
7.	General Contractor Overhead and Profit (20% GC & Construction, 10% T&D)				$ 78,185
8.	Resident Engineering (2.5% capital cost)				$ 9,773
	TOTAL CAPITAL COST				**$ 524,428**
OPERATION & MAINTENANCE (O&M) COSTS					
Annual O&M Costs					
9.	**Semi-annual Bioremediation Monitoring (Year 1)**	1	$ 28,587	LS	**$ 28,587**
10.	**Annual Bioremediation Monitoring (Year 2-6)**	1	$ 14,294	LS	**$ 14,294**
Periodic Costs					
11.	**Second round injection at the end of 2nd year**	1	$ 303,389	LS	**$ 303,389**
12.	**Third round injection at the end of 4th year**	1	$ 151,694	LS	**$ 151,694**
13.	**Site restoration (at the end 6th year)**	1	$ 4,622	LS	**$ 4,622**
14.	**Remedial Action Report**	1	$ 22,035	LS	**$ 22,035**
	PRESENT WORTH OF TOTAL EAB O&M COST				**$ 488,667**
PRESENT VALUE					
	TOTAL PRESENT VALUE (7% DISCOUNT RATE)				**$ 1,013,095**

SAY $ 1,010,000

ISCO with Excavation Cost Estimate Summary (Excavation Only)
Alcas Facility - Olean, NY

Item No.	Item Description	Quantity	Unit Cost	Unit	Extension
CAPITAL COSTS					
1.Management, Design, and Planning					
	Project Management and Engineering Support	1	$ 36,635	LS	$ 36,635
	System Design	1	$ -	LS	$ -
	Remediation Plans and Regulatory Approval	1	$ 31,096	LS	$ 31,096
	Permitting	1	$ 6,240	LS	$ 6,240
	Total Management, Design, and Planning Costs				**$ 73,971**
2. Supplemental Investigation / Phased Implementation					
	Total Transition Zone investigation/Phased Implementation Costs	1	$ -	LS	**$ -**
3. Excavation Installation					
3a.	Limited Excavation of Shallow Soils (70 Cubic Yards)	1	$ 15,000	LS	$ 15,000
3b.	Off-site transportation & disposal	1	$ 21,000	LS	$ 21,000
3c.	Post excavation sampling	1	$ 4,500	LS	$ 4,500
3d.	Backfill	1	$ 1,890	LS	$ 1,890
3e.	Demolition activities	1	$ 15,000	LS	$ 15,000
3f.	Restoration activities	1	$ 35,000	LS	$ 35,000
	Total Excavation Installation Costs				**$ 92,390**
	SUBTOTAL CAPITAL COSTS				**$ 166,361**
4.	Overhead and Profit (15%)				$ 24,954
	TOTAL CAPITAL COST				**$ 191,315**
OPERATION, MONITORING, & MAINTENANCE (OM&M) COSTS					
5a.	Project Management	1	$ -	LS	$ -
5b.	Groundwater Monitoring	1	$ -	LS	$ -
		1	$ -	LS	$ -
	Subtotal Annual OM&M Cost				**$ -**
6.	OM&M Overhead and Profit (10%)				$ -
	TOTAL ANNUAL OM&M COST				**$ -**
	PRESENT WORTH OF TOTAL OM&M COST				**$ -**
PRESENT VALUE					
	TOTAL PRESENT VALUE (7% DISCOUNT RATE)				**$ 191,315**

SAY $ 190,000

Dissolved Phase Plume in Aquitard Monitored Natural Attenuation Cost Estimate Summary
Alcas Facility - Olean, NY

Item No.	Item Description	Quantity	Unit Cost	Unit	Extension
CAPITAL COSTS					
1.General Conditions					
	General Administrative Conditions	1	$ 13,000	LS	$ 13,000
	Permitting	1	$ 13,000	LS	$ 13,000
	Survey	1	$ 26,000	LS	$ 26,000
	Total General Conditions Costs				**$ 52,000**
2. Construction Costs					
2a.	Monitoring Well Installation	1	$ 12,063	LS	$ 12,063
2b.	Quarterly Monitored Natural Attenuation Sampling (Year 1-2)	8	$ 14,730	LS	$ 117,842
2c.	Evaluation of Monitored Natural Attenuation Sampling & Modeling	1	$ 39,000	LS	$ 39,000
2d.	Institutional Control	1	$ -	LS	$ -
	Total Construction Costs				**$ 168,905**
3. Transportation & Disposal (T&D)					
3a.	Hazardous, Subtitle C	0	$ 142	CY	$ -
3b.	Non Hazardous, Subtitle D	0	$ 98	CY	$ -
3c.	Non Hazardous, Concrete and Debris	0	$ 98	CY	$ -
	Total T&D Costs				**$ -**
4. Treatment (NOT APPLICABLE)					$ -
	SUBTOTAL CAPITAL COSTS				**$ 220,905**
5.	Pre-construction Sampling/Delineation	1	$ 26,000	LS	$ 26,000
6.	Design Engineering (5% capital cost)				$ 11,045
7.	General Contractor Overhead and Profit (20% GC & Construction, 10% T&D)				$ 44,181
8.	Resident Engineering (2.5% capital cost)				$ 5,523
	TOTAL CAPITAL COST				**$ 307,654**
OPERATION & MAINTENANCE (O&M) COSTS					
Annual O&M Costs					
9.	**Annual MNA Monitoring (Year 3-30)**	1	$ 14,730	LS	**$ 14,730**
Periodic Costs					
10.	**Site restoration (at the end 30th year)**	1	$ 4,622	LS	**$ 4,622**
11.	**Remedial Action Report**	1	$ 22,035	LS	**$ 22,035**
	PRESENT WORTH OF TOTAL MNA O&M COST				**$ 159,652**
PRESENT VALUE					
	TOTAL PRESENT VALUE (7% DISCOUNT RATE)				**$ 467,306**

SAY $ 460,000

In Situ Chemical Oxidation (ISCO) Alternative

COST ESTIMATE SUMMARY

Site: Alcas Cutlery Corporation Facility
Location: Olean, New York
Phase: Feasibility Study
Base Year: 2012
Date: November 2012

Description: This alternative involves treating groundwater beneath the CUTCO facility using In Situ Chemical Oxidation (ISCO) to address the Source Area in the Upper Aquitard. A conceptual layout of the remedy components for this alternative is presented in Figure 1. The 2- inch injection wells would be installed using limited access mud rotary rigs. Where accessible, shallow trenches would be installed within the concrete to enclose the injection piping, to allow for injection activities to occur without disruption to operations inside the building. In places where access is prohibitive, the injection piping would be hung from the ceiling and dropped down to the injection well using flexible tubing. Long-term groundwater monitoring would be implemented to monitor changes in site conditions.

CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Injection Well Installation	CW-ISCO-1	1	EA	$57,975	$57,975	
Monitoring Well Installation	CW-ISCO-2	1	EA	$16,576	$16,576	
Full Scale Injection Event (9 Wells)	CW-ISCO-3	2	EA	$103,774	$207,548	
				SUBTOTAL	$282,099	
Contingency (Scope and Bid)		20%			$56,420	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
				SUBTOTAL	$338,519	
Project Management		8%			$27,082	Recommended range from EPA 540-R-00-002 was used.
Remedial Design		15%			$50,778	Recommended range from EPA 540-R-00-002 was used.
Construction Management		10%			$33,852	Recommended range from EPA 540-R-00-002 was used.
Technical Support		10%			$33,852	
				TOTAL	$484,083	
				TOTAL CAPITAL COST	**$484,000**	Total capital cost is rounded to the nearest $1,000.

INJECTION PERIODIC COSTS: (Assumed to be Incurred During Year 1)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Full Scale Injection Event (9 wells)	CW-ISCO-3	1	EA	$103,774	$103,774	
Polishing Injection Event (3 wells)	CW-ISCO-4	1	EA	$43,943	$43,943	
				SUBTOTAL	$147,717	
Contingency (Scope and Bid)		20%			$29,543	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
				SUBTOTAL	$177,260	
Project Management		8%			$14,181	The low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		15%			$26,589	Middle value of the recommended range in EPA 540-R-00-002 was used.
				TOTAL	$218,030	
				TOTAL INJECTION COST	**$218,000**	Total periodic injection cost is rounded to the nearest $1,000.

In Situ Chemical Oxidation (ISCO) Alternative

COST ESTIMATE SUMMARY

Site: Alcas Cutlery Corporation Facility
Location: Olean, New York
Phase: Feasibility Study
Base Year: 2012
Date: November 2012

Description: This alternative involves treating groundwater beneath the CUTCO facility using In Situ Chemical Oxidation (ISCO) to address the Source Area in the Upper Aquitard. A conceptual layout of the remedy components for this alternative is presented in Figure 1. The 2- inch injection wells would be installed using limited access mud rotary rigs. Where accessible, shallow trenches would be installed within the concrete to enclose the injection piping, to allow for injection activities to occur without disruption to operations inside the building. In places where access is prohibitive, the injection piping would be hung from the ceiling and dropped down to the injection well using flexible tubing. Long-term groundwater monitoring would be implemented to monitor changes in site conditions.

INJECTION PERIODIC COSTS: (Assumed to be Incurred During Year 2)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Polishing Injection Event (3 wells)	CW-ISCO-4	1	EA	$43,943	$43,943	
				SUBTOTAL	$43,943	
Contingency (Scope and Bid)		20%			$8,789	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
				SUBTOTAL	$52,732	
Project Management		10%			$5,273	The low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		15%			$7,910	Middle value of the recommended range in EPA 540-R-00-002 was used.
				TOTAL	$65,915	
				TOTAL INJECTION COST	**$66,000**	Total periodic injection cost is rounded to the nearest $1,000.

QUARTERLY MONITORING ANNUAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Miscellaneous Requirements for Sampling	CW-ISCO-5	1	EA	$17,658	$17,658	
Groundwater Sampling Event	CW-ISCO-6	4	EA	$19,382	$77,528	
Groundwater Monitoring Event Report Preparation	CW-ISCO-7	4	EA	$2,878	$11,512	
				SUBTOTAL	$106,698	
Contingency (Scope and Bid)		20%			$21,340	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
				SUBTOTAL	$128,038	
Project Management		8%			$10,243	Middle value of the recommended range in EPA 540-R-00-002 was used.
Technical Support		15%			$19,206	Middle value of the recommended range in EPA 540-R-00-002 was used.
				TOTAL	$157,487	
				TOTAL QUARTERLY MONITORING COST	**$157,000**	Total quarterly monitoring cost is rounded to the nearest $1,000.

SEMIANNUAL MONITORING ANNUAL COSTS: (Assumed to be Incurred During Year 1)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Groundwater Sampling Event	CW-ISCO-6	2	EA	$19,382	$38,764	
Groundwater Monitoring Event Report Preparation	CW-ISCO-7	2	EA	$2,878	$5,756	
				SUBTOTAL	$44,520	
Contingency (Scope and Bid)		20%			$8,904	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
				SUBTOTAL	$53,424	
Project Management		10%			$5,342	The high end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		15%			$8,014	Middle value of the recommended range in EPA 540-R-00-002 was used.
				TOTAL	$66,780	
				TOTAL SEMIANNUAL MONITORING COST	**$67,000**	Total semiannual monitoring cost is rounded to the nearest $1,000.

In Situ Chemical Oxidation (ISCO) Alternative

COST ESTIMATE SUMMARY

Site: Alcas Cutlery Corporation Facility
Location: Olean, New York
Phase: Feasibility Study
Base Year: 2012
Date: November 2012

Description: This alternative involves treating groundwater beneath the CUTCO facility using In Situ Chemical Oxidation (ISCO) to address the Source Area in the Upper Aquitard. A conceptual layout of the remedy components for this alternative is presented in Figure 1. The 2- inch injection wells would be installed using limited access mud rotary rigs. Where accessible, shallow trenches would be installed within the concrete to enclose the injection piping, to allow for injection activities to occur without disruption to operations inside the building. In places where access is prohibitive, the injection piping would be hung from the ceiling and dropped down to the injection well using flexible tubing. Long-term groundwater monitoring would be implemented to monitor changes in site conditions.

ANNUAL MONITORING ANNUAL COSTS: (Assumed to be Incurred During Year 2 through the end of the Period of Evaluation)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Groundwater Sampling Event	CW-ISCO-6	1	EA	$19,382	$19,382	
Groundwater Monitoring Event Report Preparation	CW-ISCO-7	1	EA	$2,878	$2,878	
				SUBTOTAL	$22,260	
Contingency (Scope and Bid)		20%			$4,452	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
				SUBTOTAL	$26,712	
Project Management		10%			$2,671	The high end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		15%			$4,007	Middle value of the recommended range in EPA 540-R-00-002 was used.
				TOTAL	$33,390	
		TOTAL ANNUAL MONITORING COST			**$33,000**	Total annual monitoring cost is rounded to the nearest $1,000.

MONITORING WELL MAINTENANCE PERIODIC COSTS (Year 10 and 20)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitoring Well Maintenance	CW-ISCO-8	1	LS	$4,326	$4,326	
				SUBTOTAL	$4,326	
Contingency (Scope and Bid)		20%			$865	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
				SUBTOTAL	$5,191	
Project Management		10%			$519	The high end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		15%			$779	Middle value of the recommended range in EPA 540-R-00-002 was used.
				TOTAL	$6,489	
	TOTAL MONITORING WELL MAINTENANCE PERIODIC COST				**$6,000**	Periodic cost is rounded to the nearest $1,000.

FUTURE CAPITAL COSTS: (Assumed to be Incurred in Last Year of Period of Evaluation)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Well Abandonment	CW-ISCO-9	1	EA	$1,805	$1,805	
				SUBTOTAL	$1,805	
Contingency (Scope and Bid)		20%			$361	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
				SUBTOTAL	$2,166	
Project Management		10%			$217	Recommended range from EPA 540-R-00-002 was used.
Remedial Design		20%			$433	Recommended range from EPA 540-R-00-002 was used.
Construction Management		15%			$325	Recommended range from EPA 540-R-00-002 was used.
				TOTAL	$3,141	
			TOTAL FUTURE CAPITAL COST		**$3,000**	Total future capital cost is rounded to the nearest $1,000.

In Situ Chemical Oxidation (ISCO) Alternative — COST ESTIMATE SUMMARY

Site:	Alcas Cutlery Corporation Facility	**Description:**	This alternative involves treating groundwater beneath the CUTCO facility using In Situ Chemical Oxidation (ISCO) to address the Source Area in the Upper Aquitard. A conceptual layout of the remedy components for this alternative is presented in Figure 1. The 2- inch injection wells would be installed using limited access mud rotary rigs. Where accessible, shallow trenches would be installed within the concrete to enclose the injection piping, to allow for injection activities to occur without disruption to operations inside the building. In places where access is prohibitive, the injection piping would be hung from the ceiling and dropped down to the injection well using flexible tubing. Long-term groundwater monitoring would be implemented to monitor changes in site conditions.
Location:	Olean, New York		
Phase:	Feasibility Study		
Base Year:	2012		
Date:	November 2012		

Notes:

Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000. Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

Abbreviations:

EA Each
QTY Quantity
LS Lump Sum

In Situ Chemical Oxidation (ISCO) Alternative

PRESENT VALUE ANALYSIS

Site: Alcas Cutlery Corporation Facility

Location: Olean, New York

Phase: Feasibility Study

Base Year: 2012

Discount Rate: 7.00%

		ANNUAL COSTS	PERIODIC COSTS		Total Annual		
Year[1]	Capital Costs[2]	Monitoring Costs	Injection Costs	Well Maintenance	Expenditure[3]	Discount Factor	Present Value[4,5]
0	$484,000	$157,000	$0	$0	$641,000	1.0000	$641,000
1	$0	$67,000	$218,000	$0	$285,000	0.9346	$266,361
2	$0	$33,000	$66,000	$0	$99,000	0.8734	$86,467
3	$0	$33,000	$0	$0	$33,000	0.8163	$26,938
4	$0	$33,000	$0	$0	$33,000	0.7629	$25,176
5	$0	$33,000	$0	$0	$33,000	0.7130	$23,529
6	$0	$33,000	$0	$0	$33,000	0.6663	$21,988
7	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$0	0.5820	$0
9	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$6,000	$6,000	0.5083	$3,050
11	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$0	0.3878	$0
15	$0	$0	$0	$0	$0	0.3624	$0
16	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$0	0.2959	$0
19	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$6,000	$6,000	0.2584	$1,550
21	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$0	0.2257	$0
23	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	0.1842	$0
26	$0	$0	$0	$0	$0	0.1722	$0
27	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$33,000	$0	$3,000	$36,000	0.1314	$4,730
TOTALS:	**$484,000**	**$422,000**	**$284,000**	**$15,000**	**$1,205,000**		$1,100,789
TOTAL PRESENT VALUE OF ISCO ALTERNATIVE							**$1,101,000**

Notes:

1 - Duration is assumed to be 30 years for present value analysis.

2 - Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on the ISCO Cost Estimate Summary

3 - Total annual expenditure is the total cost per year with no discounting.

4 - Present value is the total cost per year including a discount factor for that year. See Table PV-ADRFT for details.

5 - Total present value is rounded to the nearest $1,000. Depreciation is excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

Enhanced Anaerobic Bioremediation (EAB) Alternative

COST ESTIMATE SUMMARY

Site: Alcas Cutlery Corporation Facility
Location: Olean, New York
Phase: Feasibility Study
Base Year: 2012
Date: November 2012

Description: This alternative involves treating groundwater using In Situ Enhanced Anaerobic Bioremediation (EAB) to focus on the dissolved phase plume in the UWBZ south of the source area to provide TCE mass removal and act as a treatment barrier to reduce or eliminate migration of affected groundwater. Figure 2 presents a conceptual layout of the EAB injection wells focusing on the elevated concentrations of TCE in the off-Site area south of the facility. A direct push technology (DPT) drill rig will be used to complete electron donor injections. The electron donor will be a slow-release, vegetable oil-based electron donor similar to that used during the pilot study. Long-term groundwater monitoring would be implemented to monitor changes in site conditions.

CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitoring Well Installation	CW-EAB-1	1	LS	$18,055	$18,055	
EAB Injection Event	CW-EAB-2	1	EA	$117,755	$117,755	
Bioaugmentation Injection Event (Initial Event)	CW-EAB-3	1	EA	$48,466	$48,466	
				SUBTOTAL	$184,276	
Contingency (Scope and Bid)		20%			$36,855	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
				SUBTOTAL	$221,131	
Project Management		8%			$17,690	Recommended range from EPA 540-R-00-002 was used.
Remedial Design		15%			$33,170	Recommended range from EPA 540-R-00-002 was used.
Construction Management		10%			$22,113	Recommended range from EPA 540-R-00-002 was used.
				TOTAL	$294,104	
				TOTAL CAPITAL COST	**$294,000**	Total capital cost is rounded to the nearest $1,000.

INJECTION PERIODIC COSTS: (Assumed to be Incurred Durning Years 2 and 4)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
EAB Injection Event	CW-EAB-2	1	EA	$117,755	$117,755	
				SUBTOTAL	$117,755	
Contingency (Scope and Bid)		20%			$23,551	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
				SUBTOTAL	$141,306	
Project Management		8%			$11,304	The low end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		15%			$21,196	Middle value of the recommended range in EPA 540-R-00-002 was used.
				TOTAL	$173,806	
				TOTAL INJECTION COST	**$174,000**	Total periodic injection cost is rounded to the nearest $1,000.

Enhanced Anaerobic Bioremediation (EAB) Alternative

COST ESTIMATE SUMMARY

Site: Alcas Cutlery Corporation Facility
Location: Olean, New York
Phase: Feasibility Study
Base Year: 2012
Date: November 2012

Description: This alternative involves treating groundwater using In Situ Enhanced Anaerobic Bioremediation (EAB) to focus on the dissolved phase plume in the UWBZ south of the source area to provide TCE mass removal and act as a treatment barrier to reduce or eliminate migration of affected groundwater. Figure 2 presents a conceptual layout of the EAB injection wells focusing on the elevated concentrations of TCE in the off-Site area south of the facility. A direct push technology (DPT) drill rig will be used to complete electron donor injections. The electron donor will be a slow-release, vegetable oil-based electron donor similar to that used during the pilot study. Long-term groundwater monitoring would be implemented to monitor changes in site conditions.

QUARTERLY MONITORING ANNUAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Miscellaneous Requirements for Sampling	CW-EAB-4	1	EA	$17,658	$17,658	
Groundwater Sampling Event	CW-EAB-5	4	EA	$22,976	$91,904	
Groundwater Monitoring Event Report Preparation	CW-EAB-6	4	EA	$2,641	$10,564	
				SUBTOTAL	$102,468	
Contingency (Scope and Bid)		20%			$20,494	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
				SUBTOTAL	$122,962	
Project Management		8%			$9,837	The high end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		15%			$18,444	Middle value of the recommended range in EPA 540-R-00-002 was used.
				TOTAL	$151,243	
				TOTAL QUARTERLY MONITORING COST	**$151,000**	Total quarterly monitoring cost is rounded to the nearest $1,000.

SEMIANNUAL MONITORING ANNUAL COSTS: (Assumed to be Incurred During Years 1 through 4)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Groundwater Sampling Event	CW-EAB-5	2	EA	$22,976	$45,952	
Groundwater Monitoring Event Report Preparation	CW-EAB-6	2	EA	$2,641	$5,282	
				SUBTOTAL	$51,234	
Contingency (Scope and Bid)		20%			$10,247	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
				SUBTOTAL	$61,481	
Project Management		10%			$6,148	The high end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		15%			$9,222	Middle value of the recommended range in EPA 540-R-00-002 was used.
				TOTAL	$76,851	
				TOTAL SEMIANNUAL MONITORING COST	**$77,000**	Total semiannual monitoring cost is rounded to the nearest $1,000.

ANNUAL MONITORING ANNUAL COSTS: (Assumed to be Incurred During Year 5 through 8)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Groundwater Sampling Event	CW-EAB-5	1	EA	$22,976	$22,976	
Groundwater Monitoring Event Report Preparation	CW-EAB-6	1	EA	$2,641	$2,641	
				SUBTOTAL	$25,617	
Contingency (Scope and Bid)		20%			$5,123	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
				SUBTOTAL	$30,740	
Project Management		10%			$3,074	The high end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		15%			$4,611	Middle value of the recommended range in EPA 540-R-00-002 was used.
				TOTAL	$38,425	
				TOTAL ANNUAL MONITORING COST	**$38,000**	Total annual monitoring cost is rounded to the nearest $1,000.

Enhanced Anaerobic Bioremediation (EAB) Alternative

COST ESTIMATE SUMMARY

Site: Alcas Cutlery Corporation Facility
Location: Olean, New York
Phase: Feasibility Study
Base Year: 2012
Date: November 2012

Description: This alternative involves treating groundwater using In Situ Enhanced Anaerobic Bioremediation (EAB) to focus on the dissolved phase plume in the UWBZ south of the source area to provide TCE mass removal and act as a treatment barrier to reduce or eliminate migration of affected groundwater. Figure 2 presents a conceptual layout of the EAB injection wells focusing on the elevated concentrations of TCE in the off-Site area south of the facility. A direct push technology (DPT) drill rig will be used to complete electron donor injections. The electron donor will be a slow-release, vegetable oil-based electron donor similar to that used during the pilot study. Long-term groundwater monitoring would be implemented to monitor changes in site conditions.

WELL MAINTENANCE PERIODIC COSTS (Year 10 and 20)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitoring Well Maintenance	CW-EAB-7	1	LS	$4,598	$4,598	
				SUBTOTAL	$4,598	
Contingency (Scope and Bid)		20%			$920	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
				SUBTOTAL	$5,518	
Project Management		10%			$552	The high end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		15%			$828	Middle value of the recommended range in EPA 540-R-00-002 was used.
				TOTAL	$6,898	
				TOTAL WELL MAINTENANCE PERIODIC COST	**$7,000**	Periodic cost is rounded to the nearest $1,000.

FUTURE CAPITAL COSTS: (Assumed to be Incurred During Year 30)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Monitoring Well Abandonment	CW-EAB-8	29	EA	$611	$17,719	
				SUBTOTAL	$17,719	
Contingency (Scope and Bid)		20%			$3,544	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
				SUBTOTAL	$21,263	
Project Management		10%			$2,126	Recommended range from EPA 540-R-00-002 was used.
Remedial Design		20%			$4,253	Recommended range from EPA 540-R-00-002 was used.
Construction Management		15%			$3,189	Recommended range from EPA 540-R-00-002 was used.
				TOTAL	$30,831	
				TOTAL FUTURE CAPITAL COST	**$31,000**	Total future capital cost is rounded to the nearest $1,000.

Notes:

Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000. Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

Abbreviations:

EA Each
QTY Quantity
LS Lump Sum

Enhanced Anaerobic Bioremediation (EAB) Alternative

PRESENT VALUE ANALYSIS

Site: Alcas Cutlery Corporation Facility
Location: Olean, New York
Phase: Feasibility Study
Base Year: 2012

Real Discount Rate: 7.00%

		ANNUAL COSTS	PERIODIC COSTS		Total Annual		
Year[1]	Capital Costs[2]	Monitoring Costs	Injection Costs	Well Maintenance	Expenditure[3]	Discount Factor	Present Value[4,5]
0	$294,000	$151,000	$0	$0	$445,000	1.0000	$445,000
1	$0	$77,000	$0	$0	$77,000	0.9346	$71,964
2	$0	$77,000	$174,000	$0	$251,000	0.8734	$219,223
3	$0	$77,000	$0	$0	$77,000	0.8163	$62,855
4	$0	$77,000	$174,000	$0	$251,000	0.7629	$191,488
5	$0	$38,000	$0	$0	$38,000	0.7130	$27,094
6	$0	$38,000	$0	$0	$38,000	0.6663	$25,319
7	$0	$38,000	$0	$0	$38,000	0.6227	$23,663
8	$0	$38,000	$0	$0	$38,000	0.5820	$22,116
9	$0	$0	$0	$0	$0	0.5439	$0
10	$0	$0	$0	$7,000	$7,000	0.5083	$3,558
11	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$0	$0	0.3878	$0
15	$0	$0	$0	$0	$0	0.3624	$0
16	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$0	0.2959	$0
19	$0	$0	$0	$0	$0	0.2765	$0
20	$0	$0	$0	$7,000	$7,000	0.2584	$1,809
21	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$0	0.2257	$0
23	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$0	$0	0.1971	$0
25	$0	$0	$0	$0	$0	0.1842	$0
26	$0	$0	$0	$0	$0	0.1722	$0
27	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$0	$0	0.1406	$0
30	$0	$38,000	$0	$31,000	$69,000	0.1314	$9,067
TOTALS:	**$294,000**	**$649,000**	**$348,000**	**$45,000**	**$1,336,000**		$1,103,156
TOTAL PRESENT VALUE OF EAB ALTERNATIVE							**$1,103,000**

Notes:

1 - Duration is assumed to be 30 years for present value analysis.

2 - Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on the EAB Cost Estimate Summary

3 - Total annual expenditure is the total cost per year with no discounting.

4 - Present value is the total cost per year including a discount factor for that year. See Table PV-ADRFT for details.

5 - Total present value is rounded to the nearest $1,000. Depreciation is excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

TABLE PV-ADRFT

ANNUAL DISCOUNT RATE FACTORS TABLE

Site: Alcas Cutlery Corporation Facility
Location: Olean, New York
Phase: Feasibility Study
Base Year: 2012

Discount Rate (Percent): 7.00%

Year	Discount Factor[1,2]	Year	Discount Factor[1,2]	Year	Discount Factor[1,2]
0	1.0000	34	0.1002	68	0.0100
1	0.9346	35	0.0937	69	0.0094
2	0.8734	36	0.0875	70	0.0088
3	0.8163	37	0.0818	71	0.0082
4	0.7629	38	0.0765	72	0.0077
5	0.7130	39	0.0715	73	0.0072
6	0.6663	40	0.0668	74	0.0067
7	0.6227	41	0.0624	75	0.0063
8	0.5820	42	0.0583	76	0.0058
9	0.5439	43	0.0545	77	0.0055
10	0.5083	44	0.0509	78	0.0051
11	0.4751	45	0.0476	79	0.0048
12	0.4440	46	0.0445	80	0.0045
13	0.4150	47	0.0416	81	0.0042
14	0.3878	48	0.0389	82	0.0039
15	0.3624	49	0.0363	83	0.0036
16	0.3387	50	0.0339	84	0.0034
17	0.3166	51	0.0317	85	0.0032
18	0.2959	52	0.0297	86	0.0030
19	0.2765	53	0.0277	87	0.0028
20	0.2584	54	0.0259	88	0.0026
21	0.2415	55	0.0242	89	0.0024
22	0.2257	56	0.0226	90	0.0023
23	0.2109	57	0.0211	91	0.0021
24	0.1971	58	0.0198	92	0.0020
25	0.1842	59	0.0185	93	0.0019
26	0.1722	60	0.0173	94	0.0017
27	0.1609	61	0.0161	95	0.0016
28	0.1504	62	0.0151	96	0.0015
29	0.1406	63	0.0141	97	0.0014
30	0.1314	64	0.0132	98	0.0013
31	0.1228	65	0.0123	99	0.0012
32	0.1147	66	0.0115	100	0.0012
33	0.1072	67	0.0107		

Notes:

[1] Annual discount factors were calculated using the formulas and guidance presented in Section 4.0 of *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, EPA 2000.

[2] The discount rate used to determine the present value was used based based on *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, EPA 2000.

ENI, LLC

Appendix B

Modeling Report for Evaluation of Groundwater Extraction as a Remedial Alternative

And

Olean Groundwater Model Calibration and Capture Simulations Memorandum

Modeling Report for Evaluation of Groundwater Extraction as a Remedial Alternative

FOR THE

ALCAS CUTLERY CORPORATION FACILITY SITE
OLEAN, NEW YORK

Prepared for

ALCOA, Inc.
Alcoa, Tennessee

January 31, 2013

Prepared by

ENI Engineering, LLC

Groundwater Modeling

To assist with FS development, ENVIRONEERING developed a 3-D groundwater flow model of the Site. This model was calibrated to recent groundwater level data which was taken in February 2012. The modeling was performed using Visual MODFLOW Premium Version 4.6.0.160 (“VMOD©”). VMOD© is copyrighted by Waterloo Hydrogeologic, Inc.

The modeling effort included model setup, model calibration, and remediation scenario evaluation using the calibrated model.

Model Setup

The first step in groundwater modeling is to develop a node point grid so that the Site’s physical properties could be adequately depicted over the area of interest. Within the area of interest node point grid spacing is critical in achieving simulation resolution to show effects of a groundwater containment system or over all flow within the surficial aquifer. A map showing the area modeled is presented as **Figure B-1**. A 2-foot by 2-foot grid was used at Site and surrounding areas encompassing all existing monitoring wells, resulting in a 250 cell by 250 cell area centered at the Site. This small grid spacing was selected so that various remedial scenarios could be evaluated. Spacing between grid lines extended to 5 feet for the next 20 cells outside of this area, to 10 feet for the next 20 cells beyond, to 20 feet for the next 20 cells beyond, to 40 feet for the next 20 cells beyond, and to 80 feet for the remaining cells. The final model encompassed an area of 6,700' by 9,000' (1,384 acres), and was subdivided to 450 rows and 490 columns (220,500 cells for each layer).

The model grid is presented on **Figure B-2**. The model grid was oriented orthogonal to groundwater flow. Primary groundwater flow in the UWBZ is believed to be north to south. Primary groundwater flow in the UC and BC is believed to be east to west. The model is based on the assumption that the major axis of the model grid is parallel to groundwater flow and to the hydraulic conductivity tensor.

The model was set up to contain four layers to simulate groundwater flow. The top layer was used to simulate the UWBZ. Southern limits for the UWBZ were set at the Allegany River. The second layer was used to simulate the UA/UCTZ. The third layer was used to simulate the UC, and the bottom layer was used to simulate the BC.

The thickness of each zone was determined from geologic cross-sections and boring logs from the Site and surrounding areas. Outside of the lines of cross-section, surveyed site maps and available boring logs were used to construct top layer surficial elevations. Outside of the Site, boring logs from adjacent properties were used to construct the layers. Where data was not present, approximate surficial elevations were estimated from the USGS National Map database and estimated unit thicknesses were used. Contour maps of the top of each layer are shown on **Figures B-3 through B-6**.

The initial parameters selected for all layers were:

Parameter	Value	Units
Specific Storage	3.048×10^{-6}	ft^{-1}
Specific Yield	1×10^{-2}	Unitless
Effective Porosity	0.15	Unitless
Total Porosity	0.30	Unitless
Recharge	0	in/year
Evapotranspiration	0	in/year

cm/sec - centimeters per second
ft - feet
in/year - inches per year

Constant head boundaries were used in the UWBZ, UC, and BC to impose the regional hydraulic gradient on the model. The UWBZ extended from the top of the model (north of the Site) to the Allegany River (south of the Site). The UC and BC extended from the right side of the model (east of the Site) to the left side of the model (west of the Site).

Based on the pumping test data, initial conductivities for each layer was set as follows:

Layer	Unit	Conductivity-$K_{horizontal}$ (cm/sec)	Conductivity-$K_{vertical}$ (cm/sec)
Layer 1	UWBZ	0.005	0.005
Layer 2	UA/UCTZ	1×10^{-6}	1×10^{-6}
Layers 3 and 4	UC/BC	0.0005	0.0005

cm/sec - centimeters per second

Municipal Wells

A portion of the Olean municipal well field was included in the model since these wells are active pumping wells. The two municipal wells, 18M and 37M/38M, were simulated in the model using historical pumping rates provided by the City of Olean Public Works Department. The pumping rates for the municipal wells used in the model were:

Well	Modeled Pumping Rate (gpm)
18M	615
37M/38M	609

gpm - gallons per minute

Correspondence with the City of Olean indicated that the wells are screened in the lower ten feet of the City Aquifer.

Flow Model Engine

The above VMOD© inputs were translated and processed by the USGS MODular three-dimensional finite-difference ground-water FLOW model, version 2005 (MODFLOW) engine. MODFLOW can simulate steady state and transient state flow in irregularly shaped flow systems including external stresses to the flow system, such as flow to wells, areal recharge, evapotranspiration, flow to drains, and flow through river beds.

MODFLOW solves the ground water flow equation using the finite-difference approximation. The flow region is subdivided into cells in which the medium properties are assumed to be uniform. In plan view, the cells are made from the previously described grid, and a flow equation is written for each cell. Several solvers are provided by the software for solving the resulting matrix problem.

For the purpose of this modeling effort, the WHS Solver was selected for use. The WHS solver is a proprietary solver developed by Waterloo Hydrogeologic Inc., and uses a Bi-Conjugate Gradient Stabilized acceleration routine implemented with Stone incomplete decomposition for preconditioning of the ground water flow partial differential equations. This solver, as all iterative solvers, approaches the solution of a large set of partial differential equations iteratively through an approximate solution. Because the matrix equation for ground water flow is initially "ill-conditioned", effective pre-conditioning of these matrices is necessary for an efficient solution.

The WHS solver works on a two-tier approach to a solution at one time step. Outer iterations are used to vary the factorized parameter matrix in an approach toward the solution. An outer iteration is where the hydrogeologic parameters of the flow system are updated (i.e., transmissivity, saturated thickness, storativity) in the factorized set of matrices. Different levels of factorization allow these matrices to be initialized differently to increase the efficiency of solution and model stability. Inner iterations are used to iteratively solve the matrices created in the outer iterations.

After completion of the ground water simulation using the MODFLOW engine and WHS solver, the resultant outputs were compared to collected data from the site to assess model calibration.

Model Calibration

Model calibration is a process where the aquifer properties are modified until the modeled hydraulic heads equal the measured hydraulic heads. In practice, the modeled heads never exactly equal measured heads. The modeled heads should be a close approximation of the measured heads. This is accomplished by comparing potentiometric surface contour maps of measured vs. modeled heads. When these two maps have the same or similar shape contours and the value of the contours are the same, the model is considered calibrated.

In order to calibrate this model, hydraulic conductivity, recharge, river, and constant heads were modified in various parts of the model. The distribution of layer hydraulic conductivities for the calibrated model is shown in the Table below.

Layer	Unit	Conductivity-$K_{horizontal}$ (cm/sec)	Conductivity-$K_{vertical}$ (cm/sec)
Layer 1	UWBZ	0.004	0.004
Layer 2	UA/UCTZ	1×10^{-7}	1×10^{-7}

Layer	Unit	Conductivity-$K_{horizontal}$ (cm/sec)	Conductivity-$K_{vertical}$ (cm/sec)
Layers 3 and 4	UC/BC	0.6	0.6

cm/sec - centimeters per second

Recharge over model was calibrated to 3.5 inches per year. Multiple modeling runs were performed with variation in value and distribution of recharge. Modeling outputs showed significant effects of recharge over the final calibrated UWBZ flow field, and very little effects over the final calibrated UC and BC flow fields.

Properties of the river boundary condition were additionally input and modified. The river boundary condition was assigned using a line object in the model, and calculated conductance each cell. During model construction, elevation data indicated that the Allegany River has incised through the UWBZ. As a result, modeling outputs showed no influence of the river system over the final calibrated UWBZ flow field, and localized effects to the UC and BC flow fields.

Initial Output

All parameters were input, and the model was allowed to run to steady state. The output heads were compared with a known data set to assess for calibration. Multiple model runs were conducted by modifying hydraulic conductivity, recharge, river, and constant heads.

Although the gradient in the UC/BC could be simulated, initial model outputs indicated that the actual drawdown effected by the municipal wells in the UWBZ could not be reproduced. The modeled maximum drawdown achieved in the UWBZ had to be less than the drawdown achieved in the UC and BC. Using groundwater elevation data, an estimated drawdown of more than 8 to 10 feet appears to be occurring in the UWBZ. An estimated drawdown of 3 to 5 feet appears to be occurring in the BC. Since more actual drawdown occurs in the non-pumped UWBZ versus the pumped BC, an alternative was sought to increase the modeled drawdown in the UWBZ while maintaining the modeled drawdown in the UC and BC.

Two scenarios were proposed to actively increase drawdown the UWBZ in the vicinity of 18M. The first scenario included a leaky municipal well, 18M. In this scenario, the pumping rate from 18M would be subdivided to allow for pumping from the UWBZ, the UC, and the BC, thus simulating a leaky well casing. The subdivided well pumping scenario presented encouraging results, however it could not fully simulate the increased UWBZ drawdown near the municipal well without drying out the pumped UWBZ cells.

The second scenario simulated an absence of the UA in the vicinity of 18M. In this scenario, the conductivity values of the second layer, which includes the UA and UCTZ, were increased to 10^{-4} cm/sec to simulate a more permeable unit in the vicinity of 18M. This increased conductivity zone is in the UA/UCTZ layer only, and extends approximately 100 feet from the well head. A map showing the conductivity zone surrounding 18M is presented as **Figure B-7.**

Layer/Zone	Unit	Conductivity-$K_{horizontal}$ (cm/sec)	Conductivity-$K_{vertical}$ (cm/sec)
1	UWBZ	0.004	0.004
2	UA/UCTZ	1×10^{-7}	1×10^{-7}
3	UC/BC	0.6	0.6
18M Permeability Zone	UA/UCTZ	1×10^{-6}	0.0008

cm/sec - centimeters per second

The 18M permeability zone scenario demonstrated the best results. Groundwater gradients near 18M in the UWBZ were much steeper than in previous model runs.

Final Steady State Model Run

Since each model has different objectives and must be calibrated to different conditions, the acceptability of calibration can be generally subjective. However, there are some generally accepted methods of evaluating and interpreting the model calibration using both qualitative and quantitative measures.

All parameters were finalized, and the model was allowed to run to steady state using the MODFLOW 2005 engine with WHS Solver Package. The output heads were compared with a known data set to assess for calibration. Calibrated model hydraulic head contour maps that overlie the February 2012 groundwater contour map are presented as **Figures B-8 though B-10**. Qualitatively, the calibrated hydraulic head data reasonably fit the observed head data.

Several statistical inferences were employed to provide a good measure of the overall goodness of fit of the model, which include the Calibrated Residual, the Absolute Residual Mean, the Normalized Root Mean Square, and the Correlation Coefficient.

Calibrated Residual

The Calibration Residual (R_i) is defined as the difference between the calculated results (X_{cal}, or Model Calculated Head) and the observed results (X_{obs}, or Observed Head) at selected data points $i \rightarrow n$ (as shown in the following equation):

$$R_i = X_{cal} - X_{obs}$$

Well	Unit	X_{obs} - Observed Head (ft amsl)	X_{cal} - Model Calculated Head (ft amsl)	R_i - Calibration Residual (ft)
CW-13A	UWBZ	1413.72	1413.585	-0.13467
RU-1	UWBZ	1422.22	1422.957	0.737275
RU-11	UWBZ	1414.87	1414.326	-0.54444
RU-13R	UWBZ	1416.51	1414.18	-2.32958
RU-15	UWBZ	1414.94	1415.945	1.005312
RU-16	UWBZ	1414.47	1415.07	0.599702

Well	Unit	X_{obs} - Observed Head (ft amsl)	X_{cal} - Model Calculated Head (ft amsl)	R_i - Calibration Residual (ft)
RU-17A	UWBZ	1419.75	1419.921	0.171265
RU-4	UWBZ	1416.61	1415.689	-0.92091
RU-5	UWBZ	1416.57	1415.125	-1.44512
RU-6	UWBZ	1416.46	1414.511	-1.94938
RU-7	UWBZ	1407.95	1408.666	0.71626
RU-8	UWBZ	1417.97	1413.387	-4.58279
RU-9	UWBZ	1415.61	1415.456	-0.15407
UA-2	UWBZ	1414.56	1415.297	0.736509
UA-3	UWBZ	1414.88	1414.871	-0.00866
UA-4	UWBZ	1406.69	1410.073	3.382998
UA-5	UWBZ	1416.57	1415.323	-1.24688
UC-1	UC	1406.59	1406.719	0.129116
UC-2	UC	1406.77	1406.856	0.086079
UC-3	UC	1406.59	1406.702	0.111782
UC-4	UC	1406.42	1406.579	0.159346
UC-5	UC	1406.28	1406.459	0.179473
BC-1	BC	1406.63	1406.72	0.09021484
BC-2	BC	1406.61	1406.746	0.1357275
BC-3	BC	1406.59	1406.703	0.1132471
BC-4	BC	1406.39	1406.579	0.1892236
BC-5	BC	1406.28	1406.465	0.1848438
B-1	BC	1419.8	1418.886	-0.91414
18M	BC	1402	1403.08	1.079834
CW-13	BC	1406.26	1406.542	0.282481

ft amsl - feet above mean sea level

The Residual Mean $(\bar{R})$ is a measure of the average Calibration Residual value defined by the equation:

$$\bar{R} = \frac{1}{n}\sum_{i=1}^{n} R_i$$

The average of the residuals at the measurement points is generally a good indicator of how well the model was calibrated. However, positive and negative residual values can either negate each other or produce residual mean values lower than actually present. This can lead to a false interpretation of model calibration. A better interpretation of model calibration, using Absolute Residual Mean, is used as a more adequate indication of calibration than the Residual Mean.

Absolute Residual Mean

The Absolute Residual Mean $|\bar{R}|$ is similar to the Residual Mean except that it is a measure of the average absolute Residual value defined by the equation:

$$|\bar{R}| = \frac{1}{n}\sum_{i=1}^{n} |R_i|$$

The overall Absolute Residual Mean, as well as the Absolute Residual Mean of each unit is presented below:

	Unit	Value
$X_{obs - max}$	Overall	1422.22
$X_{obs - min}$	Overall	1402
Abs. Residual Mean	Overall	0.81
Abs. Residual Mean	UWBZ	0.94
Abs. Residual Mean	UC	0.13
Abs. Residual Mean	BC	0.17

The Absolute Residual Mean of the current model illustrates that on an average, the discrepancy between measured and simulated heads is 0.81 feet. For model calibration, the Absolute Residual Mean divided by the range in head at all targets should be less than 10 percent. The overall model calibrated to 4 percent for all targets, which is an indicator of good model calibration.

Normalized Root Mean Squared

The Root Mean Squared error (RMS) is defined by the following equation:

$$RMS = \sqrt{\frac{1}{n}\sum_{i=1}^{n} R_i^2}$$

The Normalized Root Mean Squared is the RMS divided by the maximum difference in the observed head values, and is expressed by the following equation:

$$NormalizedRMS = \frac{RMS}{(X_{obs})_{max} - (X_{obs})_{min}}$$

The Normalized RMS is expressed as a percentage, and is a more representative measure of the fit than the standard RMS, as it accounts for the scale of the potential range of data values.

The overall RMS and Normalized RMS are presented below:

	Unit	Value
$X_{obs - max}$	Overall	1422.22
$X_{obs - min}$	Overall	1402
RMS	Overall	1.31 feet
Normalized RMS	Overall	6.50%

In the current model, an RMS of 1.31 feet was determined, which is approximately 0.1 percent of the simulated heads in the model. For model calibration, the normalized RMS should be less than 10 percent. During calibration, a normalized RMS of 6.50 percent was calculated, which signifies an acceptable model fit.

Correlation Coefficient

The Correlation Coefficient (*Cor*) is calculated as the covariance (*Cov*) between the calculated results (X_{cal}) and the observed results (X_{obs}) at selected data points divided by the product of their standard deviations. The correlation coefficient is calculated using the following equation:

$$Cor(X_{cal}, X_{obs}) = \frac{Cov(X_{cal}, X_{obs})}{\sigma_{cal} \cdot \sigma_{obs}}$$

The covariance is calculated using the following equation:

$$Cov(X_{cal}, X_{obs}) = \frac{1}{n}\sum_{i=1}^{n}(X_i - \mu_{cal})(X_i - \mu_{obs})$$

Where μ_{cal} and μ_{obs} are the mean values of calculated and observed results, respectively.

$$\mu_{cal} = \frac{1}{n}\sum_{i=1}^{n} X_{cal}$$

$$\mu_{obs} = \frac{1}{n}\sum_{i=1}^{n} X_{obs}$$

The standard deviations are calculated by the equations:

$$\sigma_{cal} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(X_{cal} - \mu_{cal})^2}$$

$$\sigma_{obs} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(X_{obs} - \mu_{obs})^2}$$

Correlation Coefficients range in value from -1.0 to 1.0. The Correlation Coefficient determines whether two ranges of data move together. A Correlation Coefficient of 1.0 would indicate a perfect fit of the data.

In the current model, a Correlation Coefficient of 0.973 feet was determined, which is indicative of large values of one data set associated with large values of the other data set (positive correlation). This Correlation Coefficient signifies an acceptable model fit.

As the result of qualitative and quantitative measures supporting a model calibration, the model was approved for remedial scenario modeling.

Remedial Scenario Modeling

A groundwater containment system was evaluated to capture groundwater flow migrating from the Site towards 18M. Multiple remediation scenarios were input into the calibrated model to assess the efficiency in capturing the Plume Zone. A map showing the modeled remediation scenarios is presented as **Figure B-11**.

Vertical Recovery Well Scenario

To approximate a recovery well scenario, pumping wells were constructed in the model along the southeastern boundary, and downgradient flow side, of the Site. To cover the Plume Zone, eight pumping wells (numbered PW-1 through PW-8 from northeast to southwest) were spaced approximately 20 to 25 feet apart. Each pumping well was screened across the entire thickness of the UWBZ.

To simulate capture of the Plume Zone, the eight wells were pumped to steady state. A pumping rate for each well was selected, and subsequently changed until the Plume Zone was captured without the pumped node going dry. Based on this procedure, the following pumping rates for each well captured the Plume Zone, and are:

Well	Pumping Rate (gpm)	Well	Pumping Rate (gpm)
PW-1	0.75	PW-5	1.0
PW-2	0.75	PW-6	1.1
PW-3	0.8	PW-7	1.25
PW-4	1.0	PW-8	1.25
Total			**7.9**

gpm - gallons per minute

A map showing the modeled UWBZ groundwater contours with eight recovery wells pumping is presented as **Figure B-12**. The eight recovery well scenario indicated that Plume Zone capture from underneath the building is occurring. The recovery well scenario effectively prevents impacted UWBZ groundwater from entering 18M.

These eight wells pumping from the UWBZ also capture groundwater flow across the Plume zone in the UA/UCTZ as shown in **Figure B-13.** Groundwater flow in the City Aquifer was not affected by this pumping.

Horizontal Recovery Trench Scenario

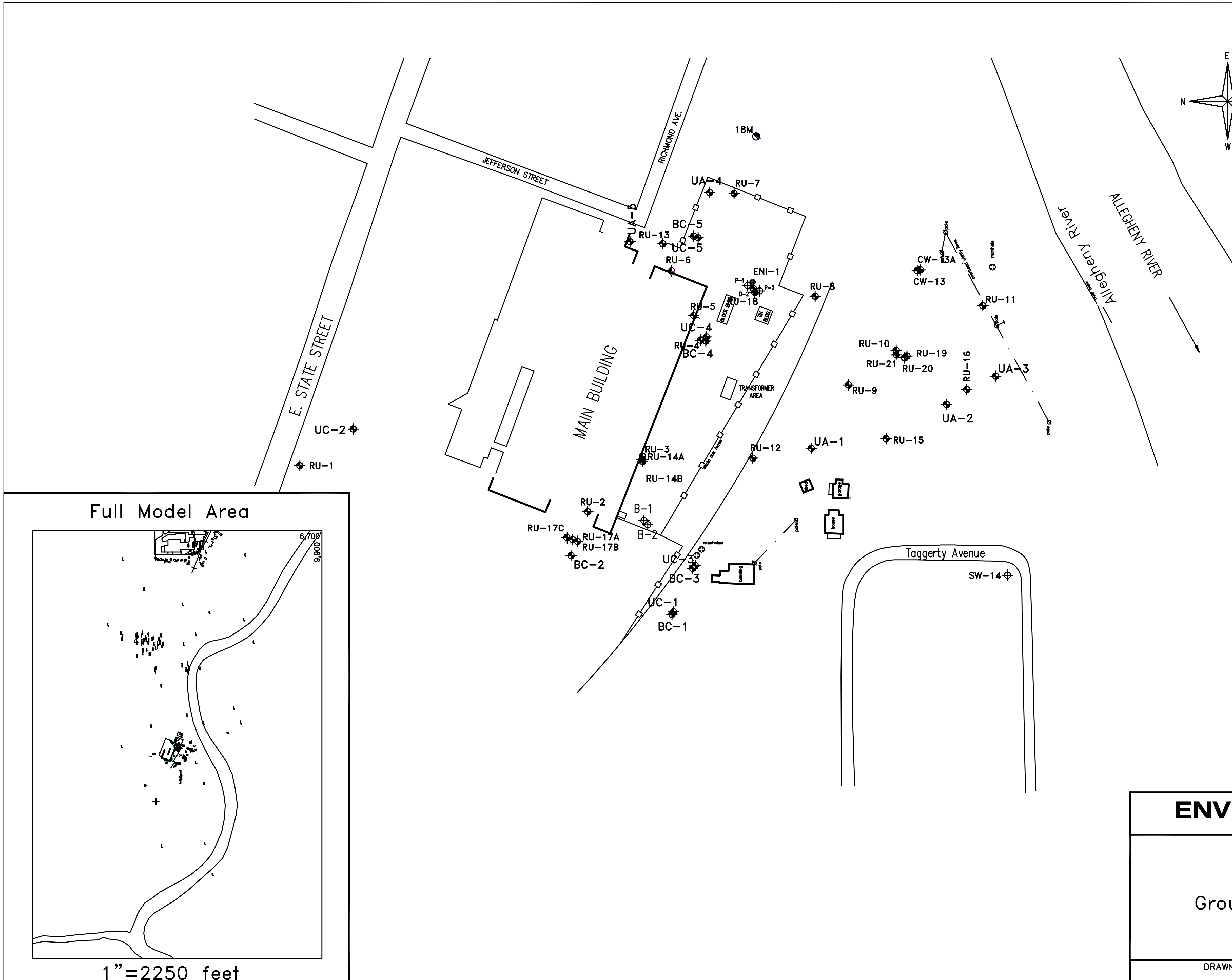
A horizontal recovery trench was modeled using the drain package in MODFLOW. The recovery trench was placed in the same location as the vertical recovery well along the southeastern boundary of the Site between the Site and 18M. The drain was constructed as part of the UWBZ, with the base slightly above the base of the UWBZ and screened for the entire thickness of the UWBZ. Total length of the drain was approximately 160 feet.

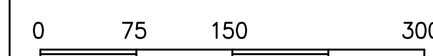
The horizontal recovery trench model was run to steady state at an elevation of 1406 feet amsl. The maximum modeled flow rate for the horizontal recovery trench scenario was approximately 9.6 gpm.

The horizontal recovery trench scenario indicated that Plume Zone capture from underneath the building is occurring. The recovery trench effectively prevents impacted UWBZ groundwater from entering 18M. A map showing the modeled UWBZ groundwater contours with horizontal recovery trench pumping is presented as **Figure B-14**.

The recovery trench pumping from the UWBZ also captures groundwater flow across the Plume Zone in the UA/UCTZ as shown in **Figure B-15.** Groundwater flow in the City Aquifer was not affected by this pumping.

Figures





LEGEND

- UA-1 ALCAS MONITORING WELLS
- SW-14 EXISTING MONITORING WELLS
- 18M PUBLIC WATER WELL
- ENI-1 BORING
- PROPERTY BOUNDARY
- FENCE

Notes:
This plat was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245
Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

0 75 150 300
SCALE IN FEET

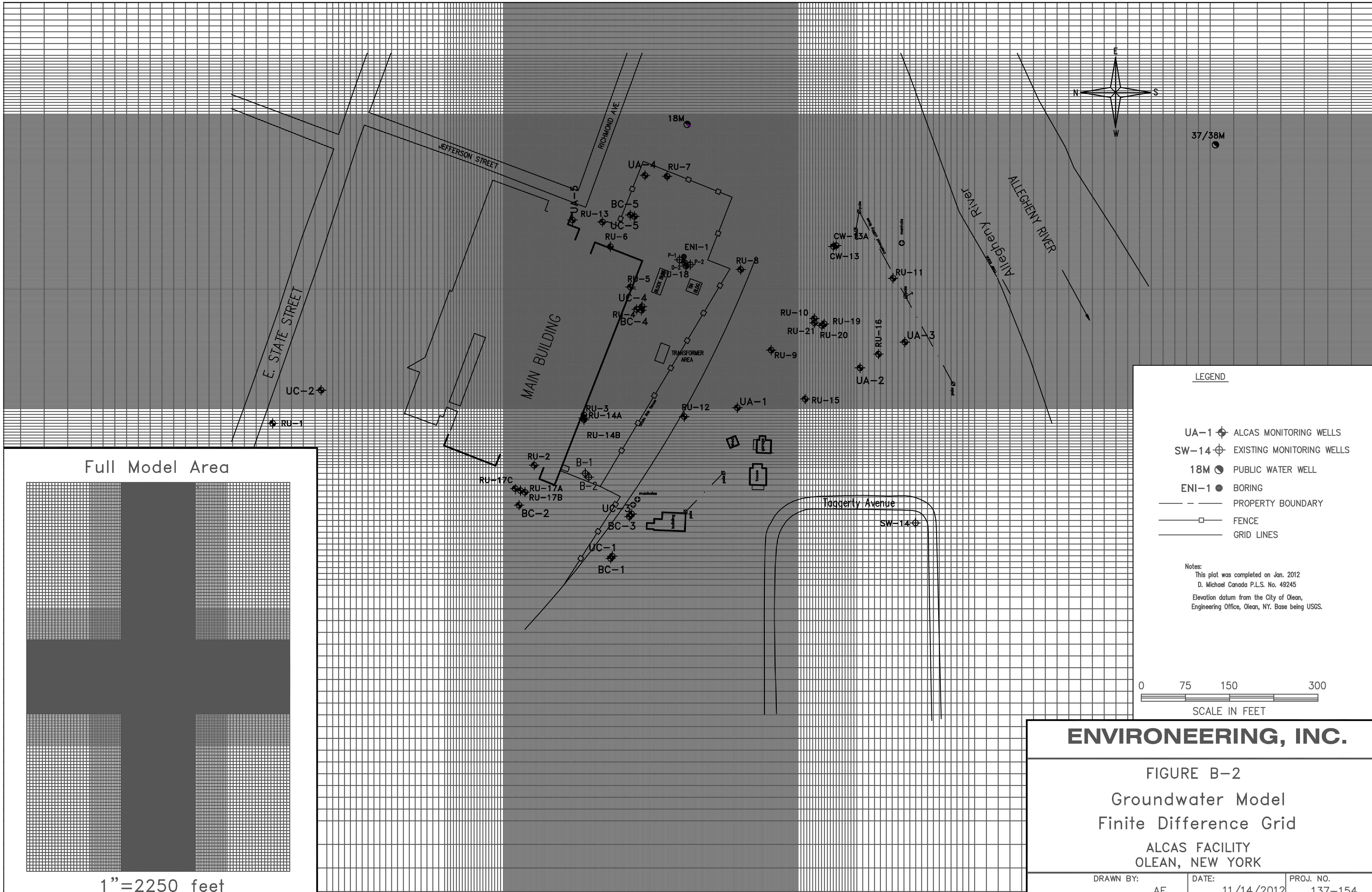
ENVIRONEERING, INC.

FIGURE B-1

Groundwater Model Area

ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	11/14/2012	137-154



LEGEND

UA-1 ALCAS MONITORING WELLS
SW-14 EXISTING MONITORING WELLS
18M PUBLIC WATER WELL
ENI-1 BORING
PROPERTY BOUNDARY
FENCE
GRID LINES

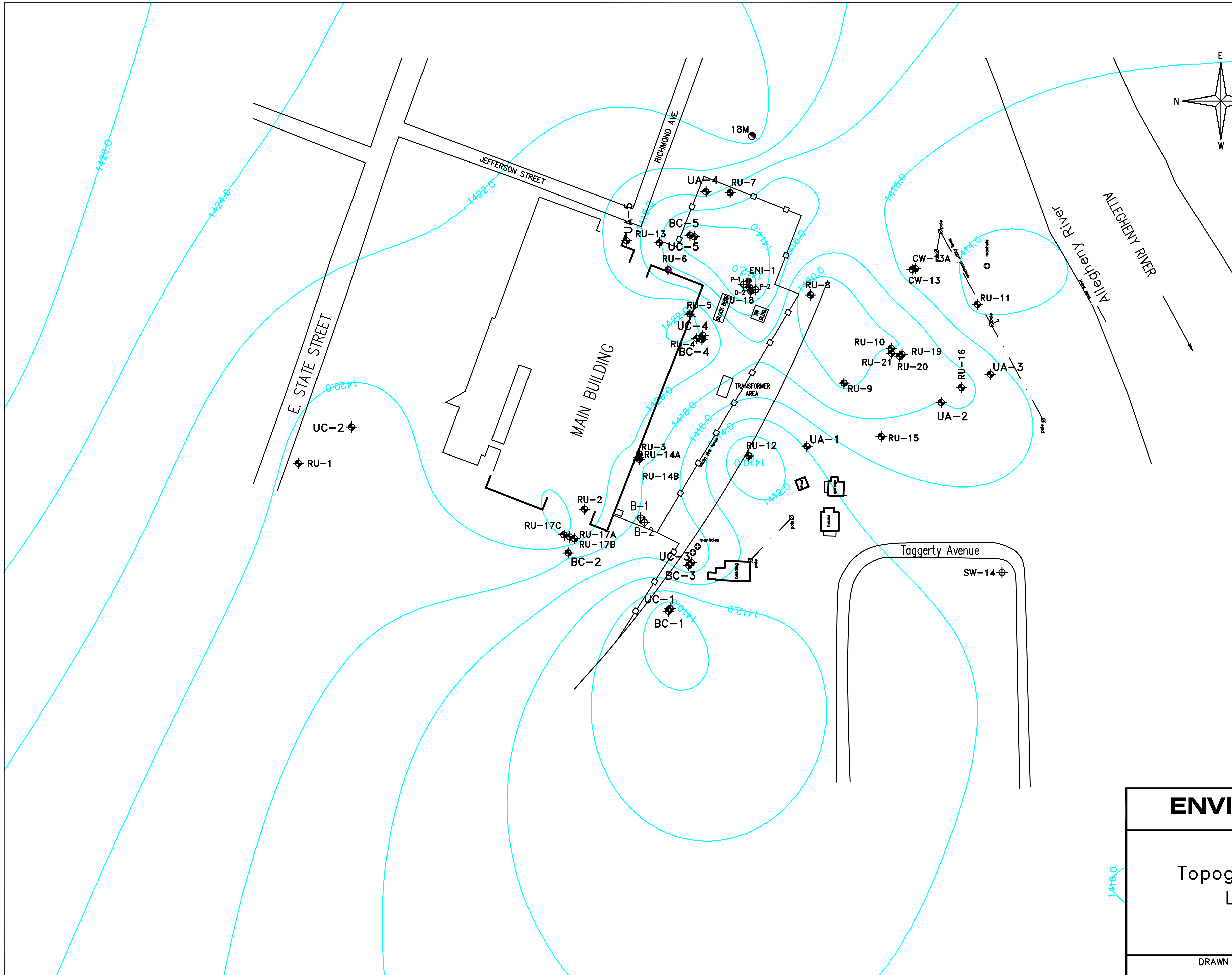
Notes:
This plat was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245
Elevation datum from the City of Olean,
Engineering Office, Olean, NY. Base being USGS.

0 75 150 300
SCALE IN FEET

ENVIRONEERING, INC.

FIGURE B-2
Groundwater Model
Finite Difference Grid
ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	11/14/2012	137-154



LEGEND

UA-1 ALCAS MONITORING WELLS
SW-14 EXISTING MONITORING WELLS
18M PUBLIC WATER WELL
ENI-1 BORING
PROPERTY BOUNDARY
FENCE
MODELED TOPOGRAPHIC SURFACE – UPPER LAYER

Notes:
This plat was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245
Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

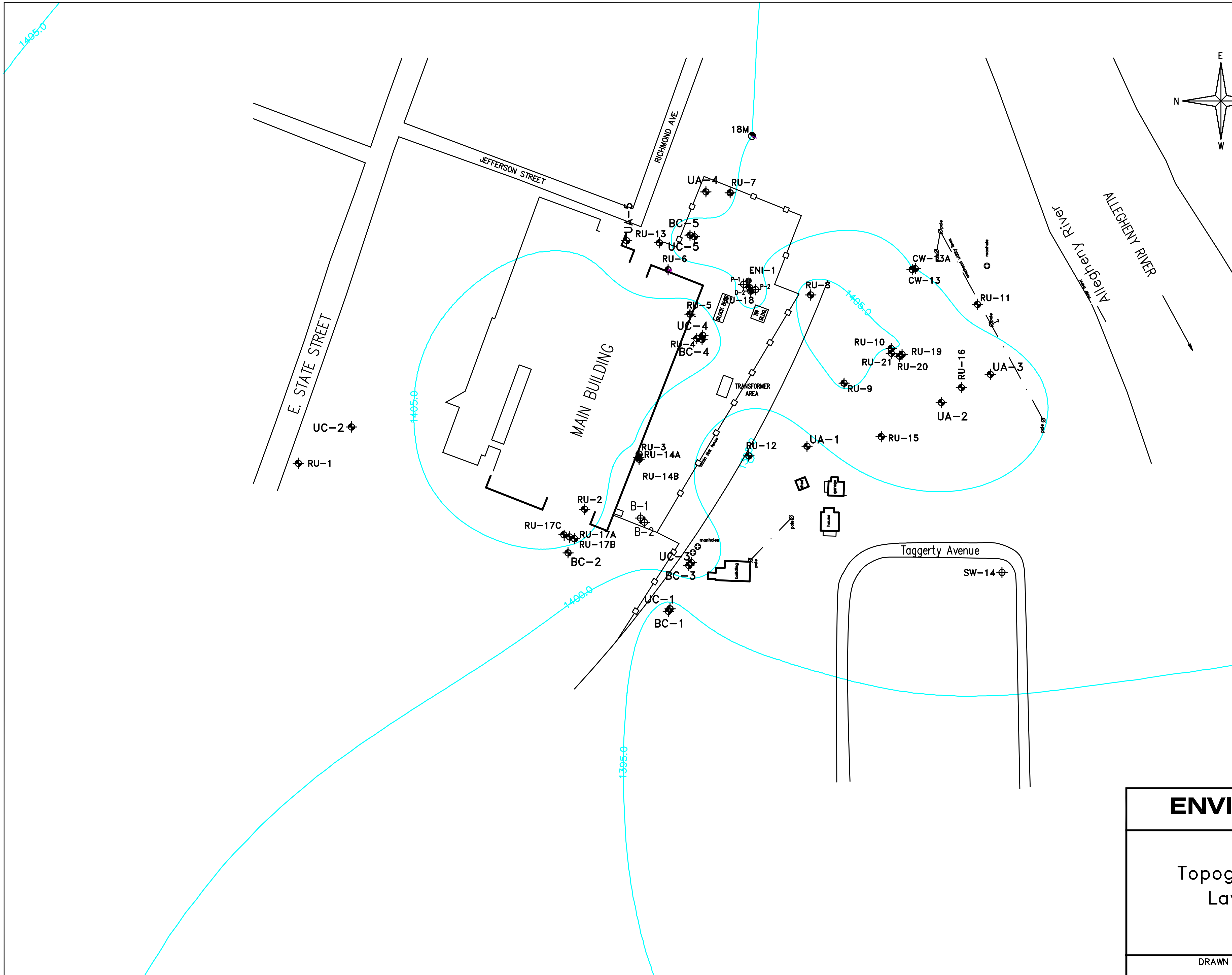
0 75 150 300
SCALE IN FEET

ENVIRONEERING, INC.

FIGURE B-3
Topographic Surface Map
Layer 1 – UWBZ

ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	11/14/2012	137-154



LEGEND

UA-1	ALCAS MONITORING WELLS
SW-14	EXISTING MONITORING WELLS
18M	PUBLIC WATER WELL
ENI-1	BORING
	PROPERTY BOUNDARY
	FENCE
	MODELED TOPOGRAPHIC SURFACE – UPPER LAYER

Notes:
This plat was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245
Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

0 75 150 300
SCALE IN FEET

ENVIRONEERING, INC.

FIGURE B-4
Topographic Surface Map
Layer 2 – UA/UCTZ

ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	11/14/2012	137-154

LEGEND

UA-1	ALCAS MONITORING WELLS
SW-14	EXISTING MONITORING WELLS
18M	PUBLIC WATER WELL
ENI-1	BORING
	PROPERTY BOUNDARY
	FENCE
	MODELED TOPOGRAPHIC SURFACE – UPPER LAYER

Notes:
This plat was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245
Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

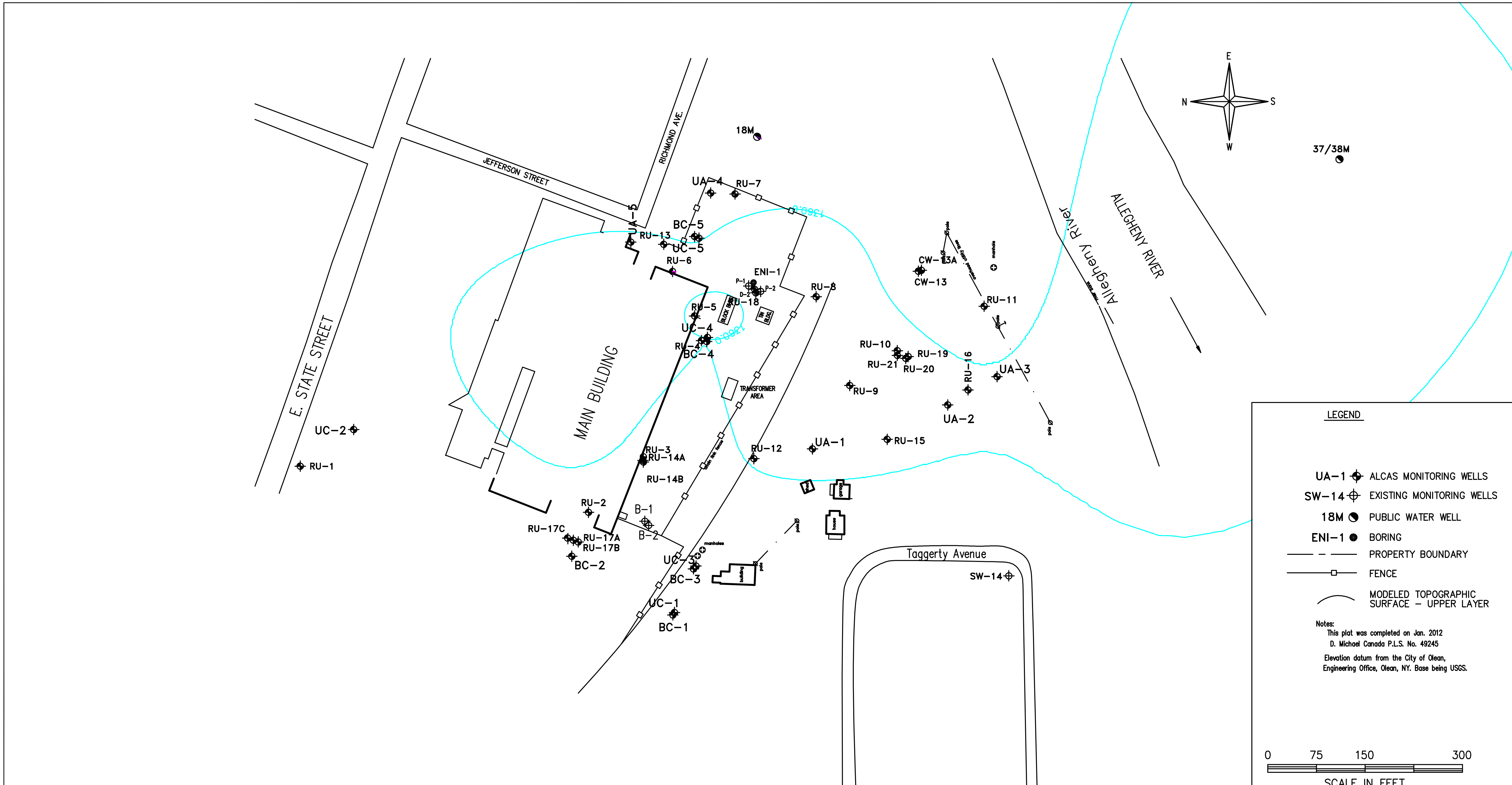
0 75 150 300
SCALE IN FEET

ENVIRONEERING, INC.

FIGURE B-5
Topographic Surface Map
Layer 3 – UC

ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	11/14/2012	137-154

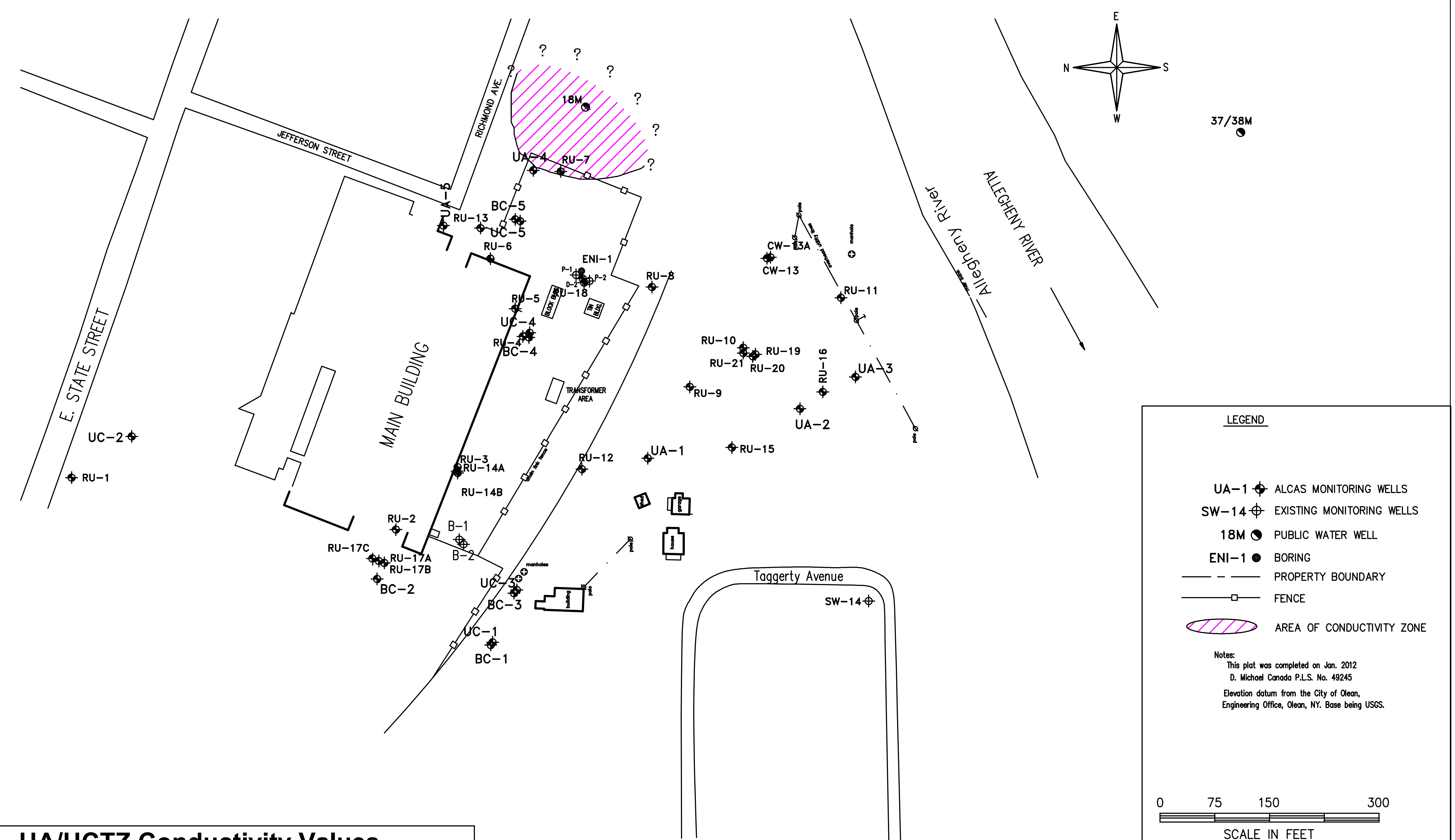


ENVIRONEERING, INC.

FIGURE B-6
Topographic Surface Map
Layer 4 – BC

ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	11/14/2012	137-154



UA/UCTZ Conductivity Values

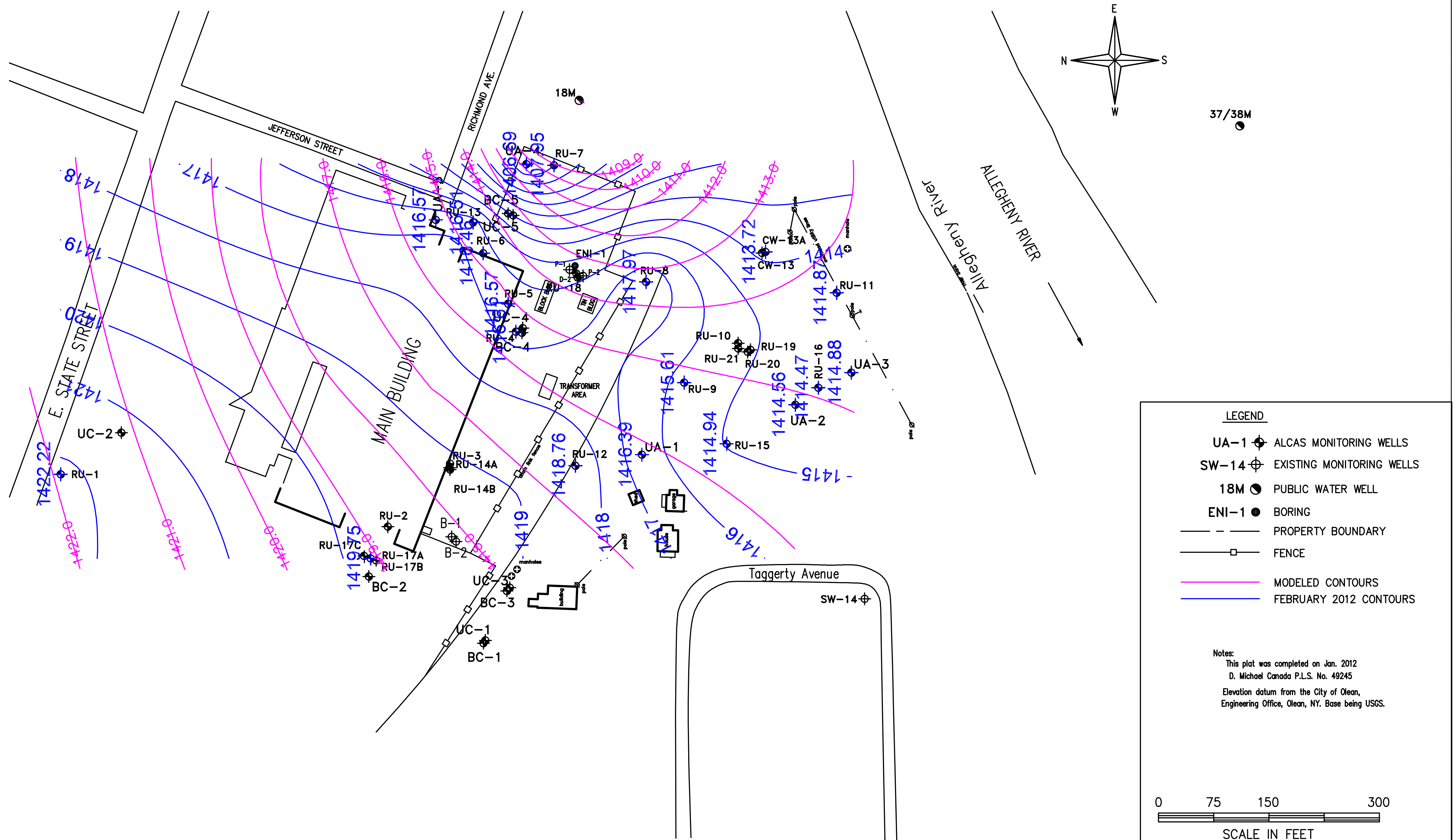
Zone ID	Ky	Kz
UA/UCTZ	0.0000001	0.0000001
Conductivity Zone	0.000001	0.0008

ENVIRONEERING, INC.

FIGURE B-7
Conductivity Zone
Layer 2 – UA/UCTZ

ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	11/14/2012	137-154

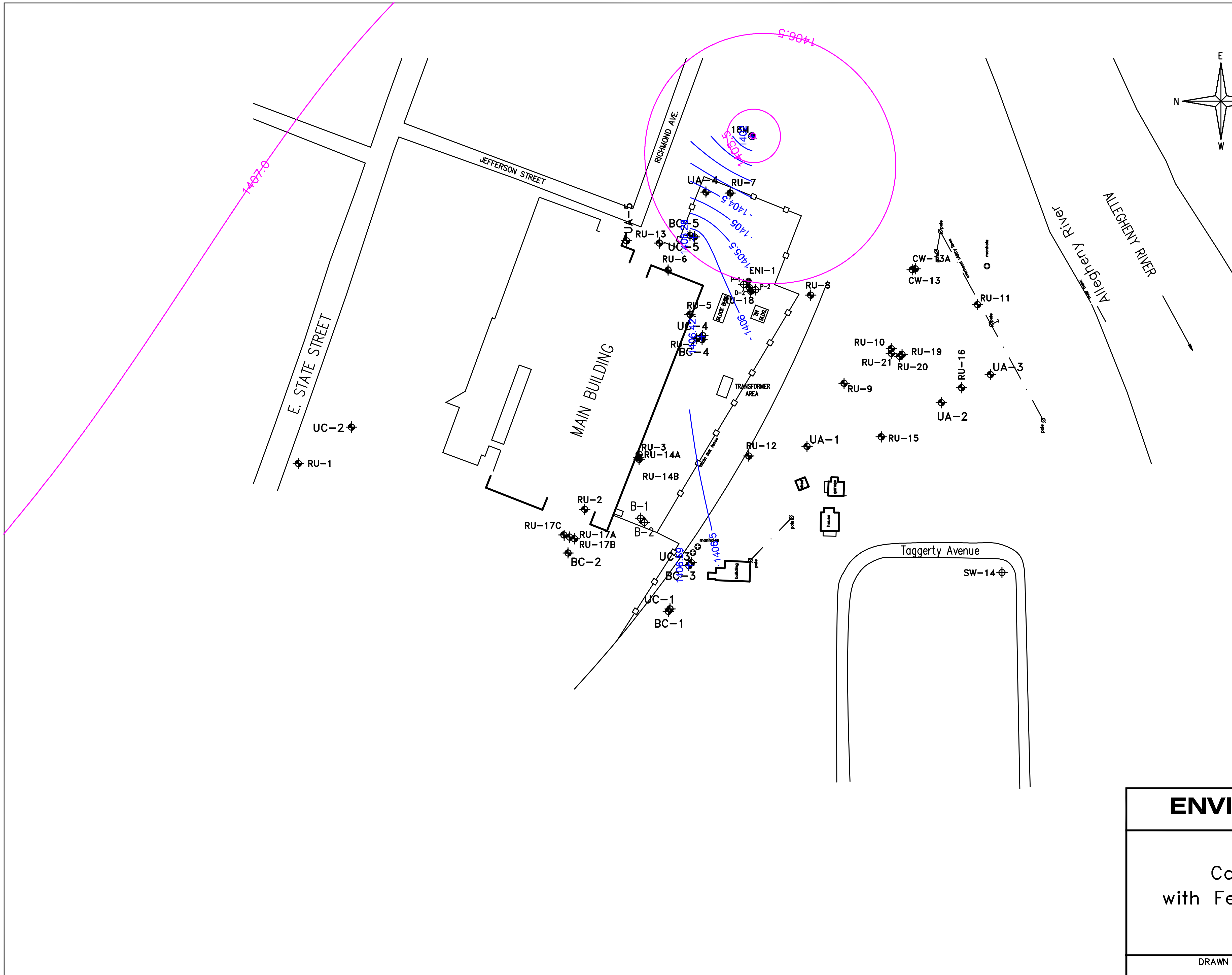


ENVIRONEERING, INC.

FIGURE B-8
Calibrated UWBZ Flow
with February 2012 Contours

ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	11/29/2012	137-154



LEGEND

UA-1 ALCAS MONITORING WELLS
SW-14 EXISTING MONITORING WELLS
18M PUBLIC WATER WELL
ENI-1 BORING
PROPERTY BOUNDARY
FENCE
MODELED CONTOURS
FEBRUARY 2012 CONTOURS

Notes:
This plat was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245
Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

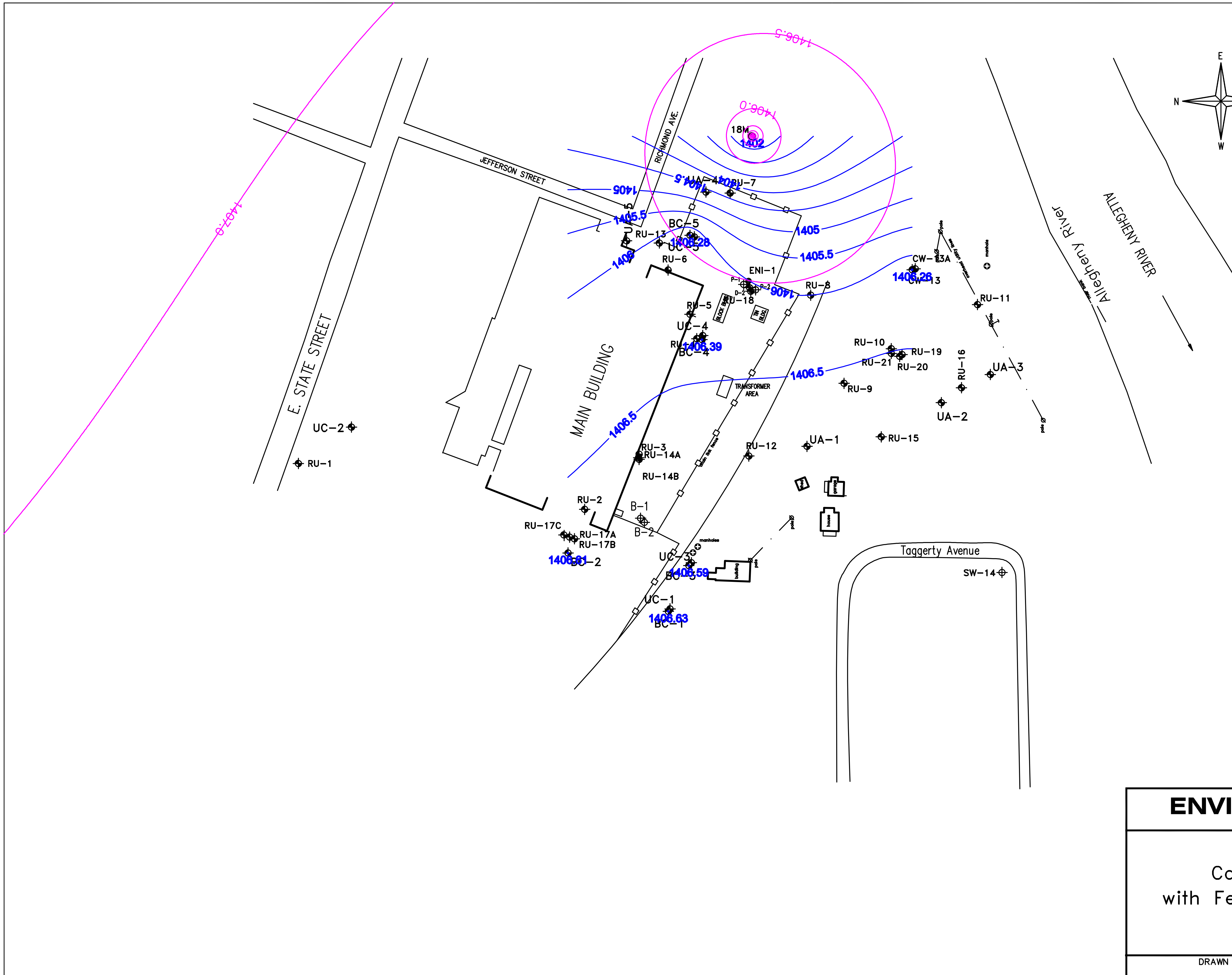
0 75 150 300
SCALE IN FEET

ENVIRONEERING, INC.

FIGURE B-9
Calibrated UC Flow
with February 2012 Contours

ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	11/29/2012	137-154



LEGEND

UA-1 ALCAS MONITORING WELLS
SW-14 EXISTING MONITORING WELLS
18M PUBLIC WATER WELL
ENI-1 BORING
PROPERTY BOUNDARY
FENCE
MODELED CONTOURS
FEBRUARY 2012 CONTOURS

Notes:
This plat was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245
Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

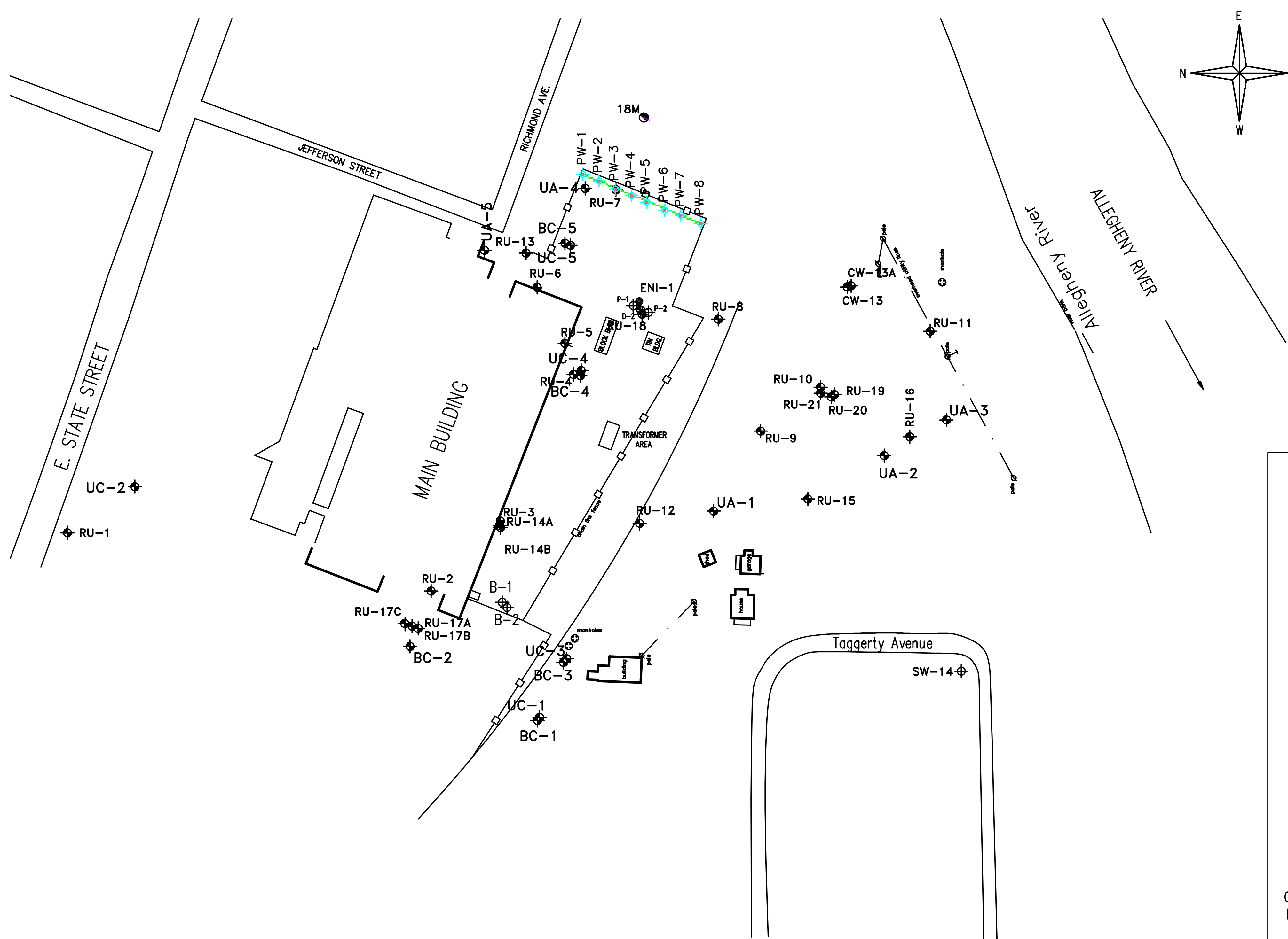
0 75 150 300
SCALE IN FEET

ENVIRONEERING, INC.

FIGURE B-10
Calibrated BC Flow
with February 2012 Contours

ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	11/29/2012	137-154



LEGEND

UA-1 ALCAS MONITORING WELLS
SW-14 EXISTING MONITORING WELLS
18M PUBLIC WATER WELL
ENI-1 BORING
PROPERTY BOUNDARY
FENCE
Remediation Well
Remediation Trench

Notes:
This plat was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245
Elevation datum from the City of Olean,
Engineering Office, Olean, NY. Base being USGS.

0 75 150 300
SCALE IN FEET

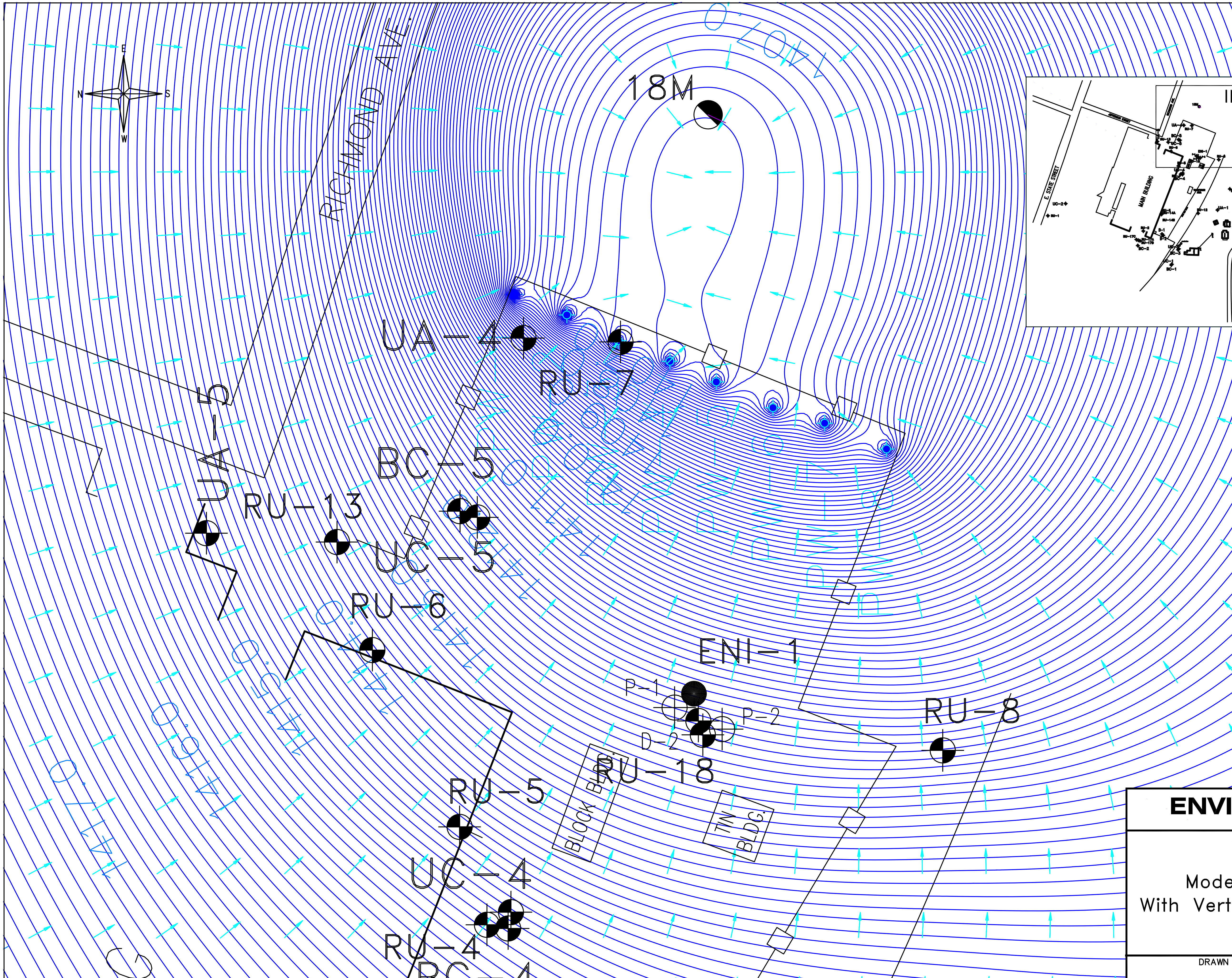
ENVIRONEERING, INC.

FIGURE B-11

Modeled Remediation Scenarios

ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	11/14/2012	137-154



LEGEND

UA-1 ALCAS MONITORING WELLS
SW-14 EXISTING MONITORING WELLS
18M PUBLIC WATER WELL
ENI-1 BORING
PROPERTY BOUNDARY
FENCE
Remediation Well

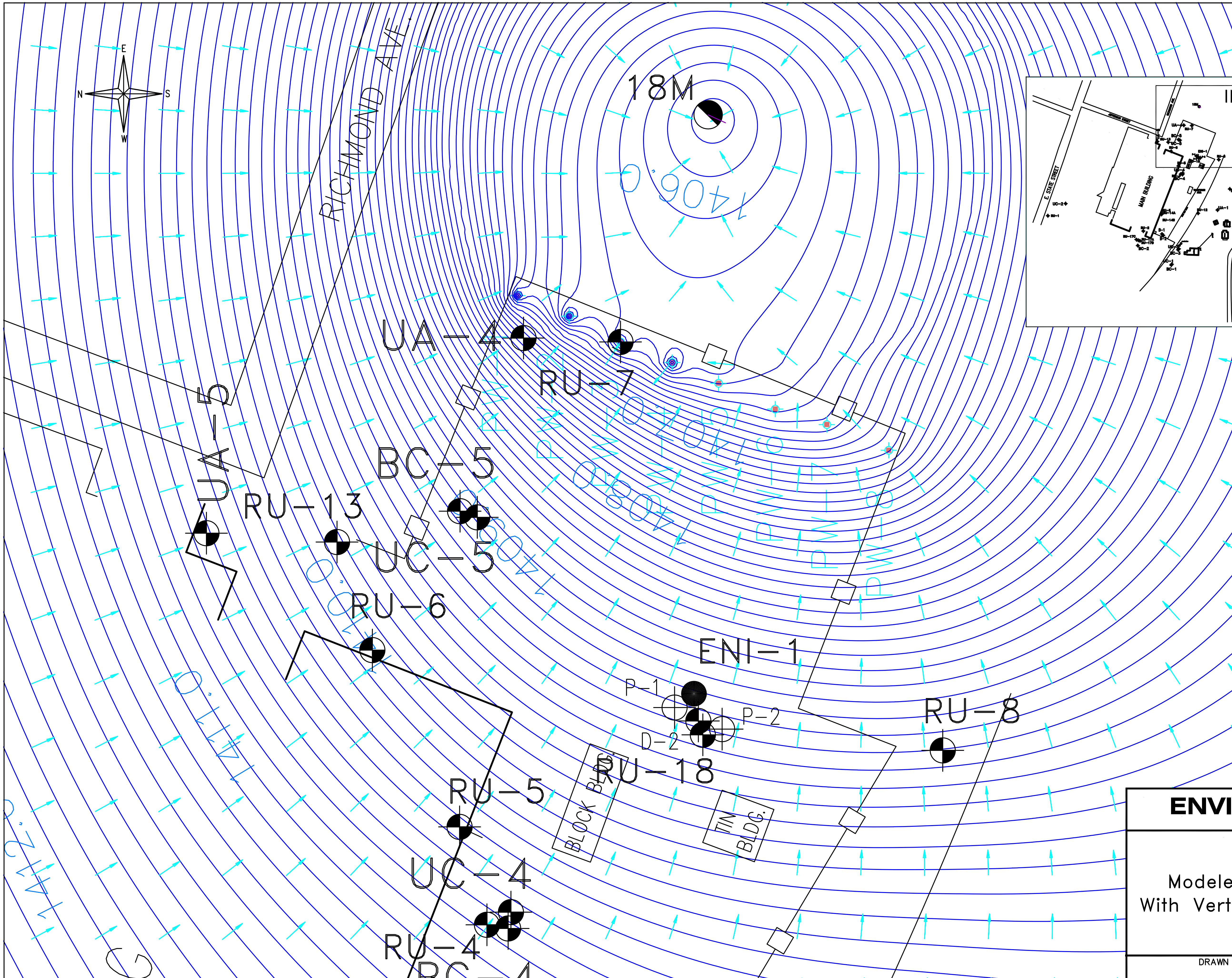
0 20 40 80
SCALE IN FEET

ENVIRONEERING, INC.

FIGURE B-12

Modeled UWBZ Groundwater
With Vertical Recovery Well Scenario
ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	11/14/2012	137-154



LEGEND

UA-1 ALCAS MONITORING WELLS
SW-14 EXISTING MONITORING WELLS
18M PUBLIC WATER WELL
ENI-1 BORING
PROPERTY BOUNDARY
FENCE
Remediation Well

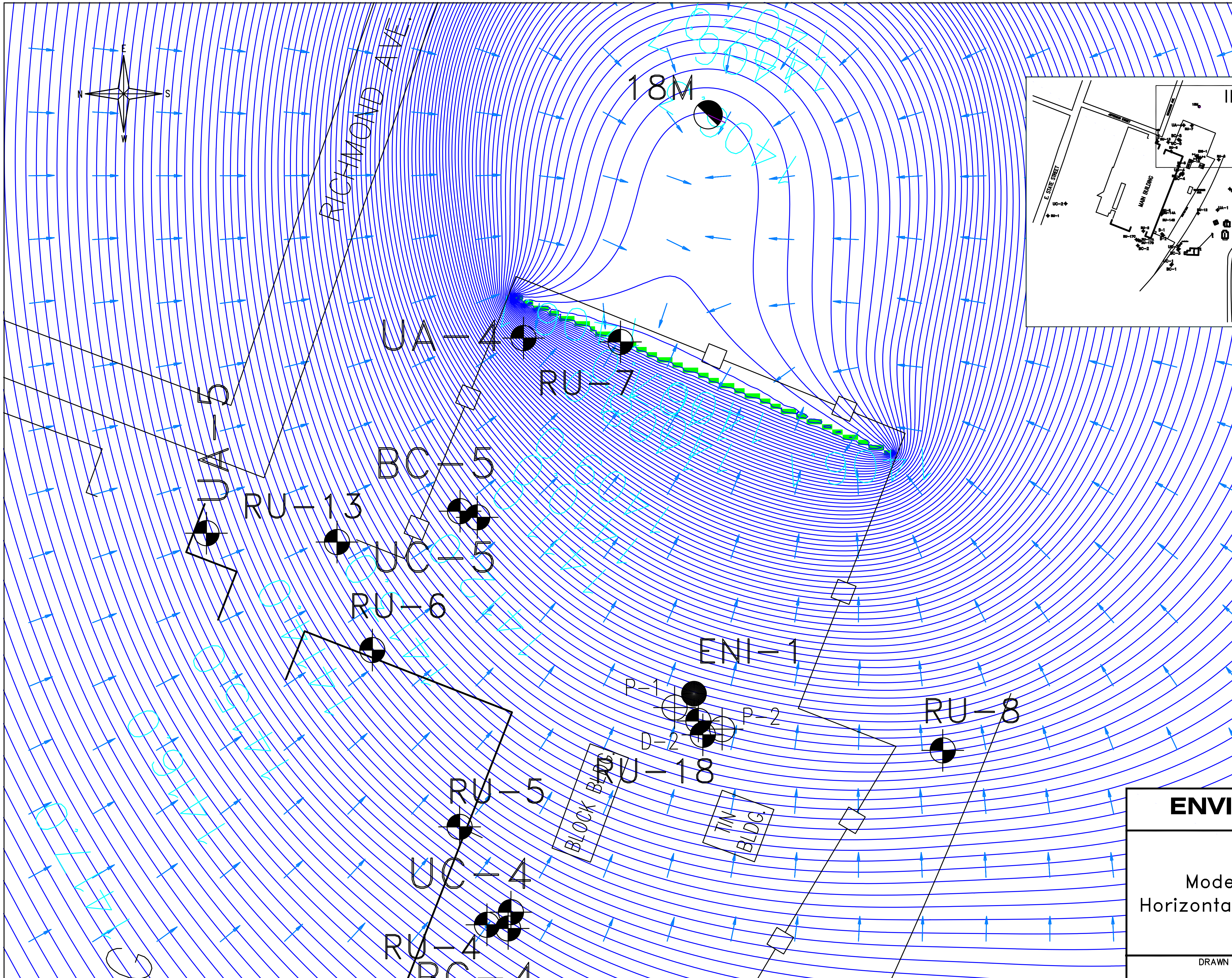
0 20 40 80
SCALE IN FEET

ENVIRONEERING, INC.

FIGURE B-13

Modeled UA/UCTZ Groundwater
With Vertical Recovery Well Scenario
ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	11/14/2012	137-154



LEGEND

UA-1 ALCAS MONITORING WELLS
SW-14 EXISTING MONITORING WELLS
18M PUBLIC WATER WELL
ENI-1 BORING
PROPERTY BOUNDARY
FENCE
Remediation Trench

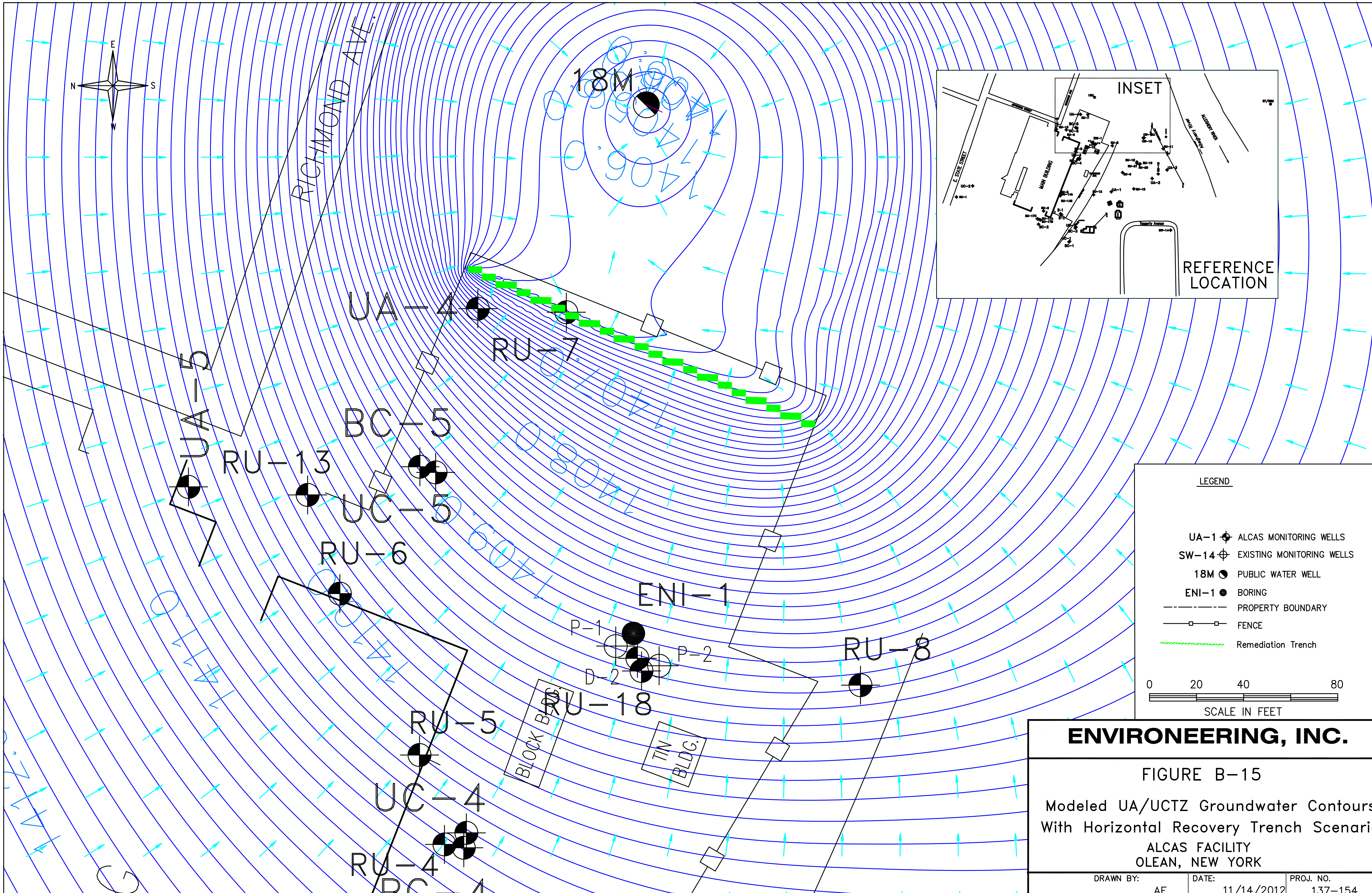
0 20 40 80
SCALE IN FEET

ENVIRONEERING, INC.

FIGURE B-14

Modeled UWBZ Groundwater
Horizontal Recovery Trench Scenario
ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	11/14/2012	137-154



ENVIRONEERING, INC.

FIGURE B-15

Modeled UA/UCTZ Groundwater Contours With Horizontal Recovery Trench Scenario

ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	11/14/2012	137-154

Memorandum

To: *Robert Prezbindowski - Alcoa*

From: *Michael J. Hoffman, PG, C.HG*
Michael J. Smith, PhD – CDM Smith Inc.
Kent S. Sorenson, Jr., PhD, PE – CDM Smith Inc.

Date: *December 17, 2012*

Subject: *Olean Groundwater Model Calibration and Capture Simulations*

This memorandum summarizes modifications to the Olean Groundwater Model (Model) described in Appendix B in order to represent a different conceptual site model. Calibration of a numerical groundwater model will almost always generate a non-unique solution, and in some cases, multiple conceptual site models could be used to produce a numerical model calibration that reasonably reproduces observed hydraulic heads. Given that this was the case for this Site, the project team felt it was important to run simulations for a second conceptual site model scenario to ensure that a wide range of possible outcomes was represented.

The model calibration described in Appendix B achieved a reasonable match to observed hydraulic head data in the Upper Water Bearing Zone (UWBZ) through inclusion of a relatively high permeability vertical communication zone around the city production well, 18M. An alternative interpretation of the observed data would be that two of the wells on the east side of the Site previously interpreted to be screened in the UWBZ are actually completed in lower permeability soils consistent with the upper aquitard (UA). This would explain the significant head difference in that area relative the other UWBZ wells without requiring the high permeability zone around 18M.

In August and September of 2012, CDM Smith obtained from Environeering the Model described in Appendix B. CDM Smith evaluated the model, performed modifications of the model structure based on this alternative interpretation of the boring logs, performed a steady state recalibration of the modified Model using the February 2012 water level data, and performed extraction well and trench capture simulations. In addition, the transport of sulfate potentially produced from in situ chemical oxidation at the facility was simulated with both calibrations in order to determine whether it might detrimentally impact the production well, 18M.

Existing Model Modifications

The initial changes involved modifications to the model framework to avoid extreme aspect ratios on the grid geometry. This was done to minimize potential numerical solution issues when the model is used for transport analysis. These modifications maintained the number of rows and columns within the limits of the graphical user interface. In addition, the aquitard separating the upper and lower aquifers was subdivided into two layers simply to facilitate transport simulations. The properties of the two layers remained identical to each other. Boring logs in the area of interest were evaluated, and the elevations of the top and bottom of the aquifer were modified in the model to conform to this interpretation. Areas outside of the facility area were maintained at their values in the original model. Comparisons of simulated and observed heads used the alternate interpretation of the zone in which the wells were completed

The hydraulic properties in the model were assumed to be uniform within each layer, with the exception of the upper aquifer, where an additional property zone was added in the area near UA-4, UC-5 and CW-13, since the more permeable UWBZ material appears to be absent in this area.

Numerical Groundwater Model Design

The following section describes the Model design including the Model code, grid, boundary conditions, wells, hydraulic parameters, and calibration targets.

Model Code Selection

For consistency, the groundwater flow was simulated using the same code as the original model, the U.S. Geological Survey model code MODFLOW-2005; a standard, widely available open source code model. This 3-dimensional, finite difference, groundwater flow model is capable of simulating all of the processes that are included in the Site conceptual model. MODFLOW-2005 uses a variety of solution techniques that can effectively simulate most natural systems. As in the original Model, the WHS Solver was selected for use. The WHS solver is a proprietary solver developed by Schlumberger that facilitates solving of the flow equations in the model.

Model Grid and Stress Periods

The computational grid for this model is constructed with 325 rows, 365 columns, and 5 layers. The row and column spacing start at 80 feet by 80 feet at the edges of the grid and reduce to 40 ft x 40 ft, 20 ft x 20 ft, 5 ft x 5 ft moving inwards. The row and column spacing was refined to 4 feet by 4 feet over the plant area. The grid represents an area 9,000 ft by 6,700 feet (1,384 acres). The grid size selected was based on maintaining sufficient discretization to obtain a numerical solution that converged and was in mass balance with reasonable execution times. The Model grid in its entirety is shown on Figure 1 and a close up of the plant area is shown in Figure 2.

Layer 1 represents the UWBZ, Layers 2 and 3 represent the upper aquitard and upper City transition zone (UA/UCTZ), Layer 4 represents the Upper City Aquifer (UC), and Layer 5 represents the Bottom City aquifer (BC). CDM Smith interpreted the layer thicknesses and elevations in the plant area from the existing boring logs.

All flow simulations were conducted as steady-state, with no changes in storage, to represent long-term average conditions.

Boundary Conditions

Constant head boundaries were used in the UWBZ, UC, and BC to impose the regional hydraulic gradient on the model. The UWBZ extended from the top of the model (north of the Site) to the Allegany River (south of the Site). The boundary cells for the UWBZ and UC/BC are shown on Figures 3 and 4.

Recharge

Recharge was not changed from the original Model, with a recharge rate of 3.5 in/year applied to the uppermost saturated layer.

Municipal Wells

There are two municipal wells in the model, 18M and 37M/38M, both of which are screened in the bottom 10 feet of the UC. The wells are currently being operated at 615 gallons per minute (gpm) and 609 gpm, respectively. Well 18M is of primary concern as is has the potential to pull in constituents and remediation breakdown products. Well 37M/38M is located south of the Allegany River and has minimal impact on flow at the site. The locations of the municipal wells are shown on Figure 5.

Head Observation Wells

Thirty onsite wells are used as head observation (monitoring) wells in the model. There are 15 monitoring wells in the UWBZ, seven in the UC, and eight in the BC. Table 1 summarizes the head observation wells. The locations of the head observation wells are shown on Figure 6.

Table 1
Head Observation Wells

Well	Unit	Well	Unit
CW-13A	UWBZ	UA-3	UWBZ
RU-1	UWBZ	UA-4	UA/UCTZ
RU-11	UWBZ	UA-5	UWBZ
RU-13R	UWBZ	UC-1	UC
RU-15	UWBZ	UC-2	UC
RU-16	UWBZ	UC-3	UC
RU-17A	UWBZ	UC-4	UC
RU-3	UWBZ	UC-5	UC
RU-4	UWBZ	BC-1	BC
RU-5	UWBZ	BC-2	BC
RU-6	UWBZ	BC-3	BC
RU-7	UA/UCTZ	BC-4	BC
RU-8	UWBZ	BC-5	BC
RU-9	UWBZ	B-1	BC
UA-2	UWBZ	CW-13	BC

Hydraulic Parameters

The properties of hydraulic conductivity were assigned to zones, and a zone was assigned to the entire layer with the exception of the UWBZ which has two hydraulic conductivity zones to account for the area near UA-4, UC-5 and CW-13 since the more permeable upper aquifer material appears to be limited in this area. Table 2 summarizes the initial hydraulic properties. The hydraulic conductivity zones for the UWBZ are shown in Figure 7.

Table 2
Initial Model Hydraulic Properties

Layer(s)	Unit	Kx (cm/sec)	Kz (cm/sec)
1	UWBZ	0.004	0.004
2 and 3	UA/UCTZ	1e-07	1e-07
4	UC	0.6	0.6
5	BC	0.6	0.6

Calibration

Calibration to the supplied steady-state water level data set was done using automated (using the parameter estimation program PEST) and heuristic (manual) methods to determine the final hydraulic conductivity values. A uniform ratio of 10:1 was specified for the horizontal to vertical hydraulic conductivity in all layers. The calibrated hydraulic properties are summarized in Table 3.

Table 3
Calibrated Model Hydraulic Properties

Layer(s)	Unit	Kx (cm/sec)	Kz (cm/sec)
1	UWBZ	0.0057 to 0.0044	0.00057 to 0.00044
2 and 3	UA/UCTZ	5e-05	5e-06
4	UC	0.6	0.6
5	BC	0.6	0.6

Table 4 summarizes the observed, simulated and residual values from the monitoring wells. The model statistics are summarized in Table 5, and the calibration graph of observed versus simulated heads is shown in Figure 8.

Fate and Transport Simulations

CDM Smith performed fate and transport simulations of sulfate (a remediation byproduct) using the code MT3DMS to access the impact of these chemicals on municipal well 18M. The initial sulfate concentration in the source area was 28,000 mg/L based on conceptual sodium persulfate injection concentrations. Sulfate was not considered a constant source. No sorption or degradation was assumed. Peak conditions were reached at 440 days. The constituents in the source area are rapidly transported east towards well 18M. Dilution in the lower aquifer limits the simulated sulfate concentrations detected in well 18M. The peak simulated sulfate concentration at well 18M was approximately 0.18 mg/L. Figure 9 shows the results of the fate and transport simulations.

Capture Scenarios

The purpose of the capture zone analyses is to determine whether the source area can be hydraulically contained to prevent transport of constituents in groundwater associated with the source area near the facility to municipal well 18M. Two capture scenarios were simulated with the calibrated steady state Model; a horizontal recovery trench scenario and an extraction wells scenario. Capture zone analyses were performed by placing a line of particles in Layer 1 (UWBZ) on each side of the trench or wells between the source area and the 18M. The particles were then simulated backwards in time using the program MODPATH, outlining a capture zone. Each case is discussed below.

Table 4
Calibration Statistics

Well	Unit	Observed Head (feet MSL)	Simulated Head (feet MSL)	Residual (feet)
CW-13A	UWBZ	1413.72	1414.807	-1.087
RU-1	UWBZ	1422.22	1420.427	1.793
RU-11	UWBZ	1414.87	1414.726	0.144
RU-13R	UWBZ	1416.51	1417.371	-0.861
RU-15	UWBZ	1414.94	1415.481	-0.541
RU-16	UWBZ	1414.47	1414.986	-0.516
RU-17A	UWBZ	1419.75	1417.98	1.77
RU-3	UWBZ	1412.54	1414.701	-2.161
RU-4	UWBZ	1416.61	1416.875	-0.265
RU-5	UWBZ	1416.57	1416.958	-0.388
RU-6	UWBZ	1416.46	1417.221	-0.761
RU-7	UA/UCTZ	1407.95	1408.655	-0.705
RU-8	UWBZ	1417.97	1415.798	2.172
RU-9	UWBZ	1415.61	1415.627	-0.017
UA-2	UWBZ	1414.56	1415.101	-0.541
UA-3	UWBZ	1414.88	1414.856	0.024
UA-4	UA/UCTZ	1406.69	1408.81	-2.12
UA-5	UWBZ	1416.57	1417.573	-1.003
UC-1	UC	1406.59	1406.842	-0.252
UC-2	UC	1406.77	1407.048	-0.278
UC-3	UC	1406.59	1406.783	-0.193
UC-4	UC	1406.42	1406.482	-0.062
UC-5	UC	1406.28	1406.241	0.039
BC-1	BC	1419.8	1417.431	2.369
BC-2	BC	1406.63	1406.847	0.217
BC-3	BC	1406.61	1406.872	0.262
BC-4	BC	1406.59	1406.791	0.201
BC-5	BC	1406.39	1406.466	0.076
B-1	BC	1406.28	1406.239	0.041
CW-13	BC	1406.26	1406.371	0.111

Table 5
Calibration Statistics

Minimum Residual (feet)	-2.16
Maximum Residual (feet)	2.17
Residual Mean (feet)	-0.27
Absolute Residual Mean (feet)	0.58
Standard Deviation (feet)	0.86
Sum of Squares (feet)	21.29
Number of Observations	27
Range (feet)	4.33
% Error (abs res mean/range x 100)	13.44

Horizontal Recovery Trench Scenario
Drain-type boundary cells were introduced into Layer 1 (UWBZ) of the Model to simulate the trench scenario. The trench trends southwest to northeast. The drain is confined in Layer 1 (UWBZ) and the elevation varies from 1,412.8 ft MSL to 1,414.7 ft MSL and the conductance varies from 408 ft/day to 1,293 ft/day. The total flow rate from the trench is 2.3 gpm. A capture zone was estimated using reverse particle tracking and demonstrates the trench effectively captures the source area. Figure 10 illustrates the particle tracking analysis for the recovery trench scenario.

Extraction Wells Scenario
Well boundary cells were introduced into Layer 1 (UWBZ) of the Model to simulate the extraction wells scenario. The wells are position in a line oriented southwest to northeast, as was the recovery trench. The wells are screened in Layer 1 (UWBZ). The extraction wells' pumping rates are summarized in Table 6. The pumping rates were determined by using the maximum extraction rate in each well that would not generate dry cells in Layer 1. A capture zone was estimated using reverse particle tracking and demonstrates the trench effective captures the source area. Figure 11 illustrates the particle tracking analysis for the extraction wells scenario.

Table 6
Extraction Well Pumping Rates

Well Name	Pumping Rate (gpm)
PW-1	0.75
PW-2	0.5
PW-3	0.25
PW-4	0.12

Well Name	Pumping Rate (gpm)
PW-5	0.12
PW-6	0.12
PW-7	0.25
PW-8	0.5

Summary and Conclusions

CDM Smith modified and recalibrated the Olean steady state groundwater model. Two capture scenarios were simulated using the calibrated, steady state model to assess the ability to contain dissolved constituents in groundwater near the facility such that they would not impact municipal well 18M; a horizontal recovery trench and a linear, extraction well barrier. Particle tracking was performed to assess the capture effectiveness of each scenario. The simulated flow from the recovery trench scenario is 2.3 gpm. The simulated combined flow from the extraction wells is 2.6 gpm. The simulated capture zones from each scenario appear to be similar. Generally, a horizontal recovery trench has greater effectiveness in intercepting contamination than an extraction well barrier, but both appear to meet the objective of hydraulic containment. Further field testing would be required to determine actual sustainable flow rates.

In addition, the recalibrated model was used to simulate the potential remediation byproduct of in situ chemical oxidation, sulfate, to determine whether it might detrimentally impact 18M. The simulation indicated a peak sulfate concentration in the well of just 0.18 mg/L, even with no attenuation of sulfate in the system. This small increase would not pose a concern of exceeding the secondary maximum contaminant level for sulfate of 250 mg/L.

cc: Tim White – Environeering, Inc.

Appendix C

Data Evaluation for ISCO Pilot Study

555 17th Street, Suite 1100
Denver, Colorado 80202
tel: 303-383-2300
fax: 303-308-3003

October 4, 2012

Mr. Robert Prezbindowski
Alcoa, Inc.
2300 North Wright Road
Alcoa, Tennessee 37701

Subject: Data Evaluation for the In-Situ Chemical Oxidation Pilot Study, Alcas Cutlery Corporation Facility, Olean, New York

Dear Mr. Prezbindowski:

CDM Smith Inc. (CDM Smith) conducted an In-Situ Chemical Oxidation Pilot Study at the former Alcas Cutlery Corporation Facility in Olean, New York in support of the focused feasibility study. The pilot study was completed in accordance with the approved In-Situ Chemical Oxidation Pilot Study Work Plan dated March 29, 2012 (CDM Smith 2012a). The purpose of the pilot study was to evaluate the potential for chemical oxidation using activated sodium persulfate to reduce concentrations of trichloroethene (TCE) near a source area at the manufacturing building on site. Prior bench-scale tests completed by CDM Smith (CDM Smith 2012b) indicated that sodium persulfate activated using high pH (sodium hydroxide) at a concentration of 5% by weight was effective at reducing TCE mass and concentration in groundwater.

The pilot study injection of activated persulfate was completed between April 18 and April 20, 2012. Following the injection, performance groundwater monitoring events were completed on May 2 and May 24, 2012. These data were summarized in the Preliminary Data Evaluation report for the pilot study activities dated June 22, 2012 (CDM Smith 2012c). This letter report presents the results of groundwater monitoring completed at the site on June 27 – 29, 2012 and September 6, 2012, and presents conclusions from the pilot study and an evaluation of the feasibility of activated persulfate as a remedial technology for the site.

June Sampling Results

The field activities associated with implementation of the activated persulfate injection pilot study at the Cutco facility prior to May 24, 2012 were summarized in the Preliminary Data Evaluation report (CDM Smith 2012c). Following completion of the preliminary data evaluation, two subsequent groundwater sampling events have been completed in order to evaluate whether concentrations of TCE had rebounded to an equilibrium concentration following exhaustion of the oxidant from the initial activated persulfate injection during the pilot study. As described in the preliminary data summary report, it is likely that the baseline groundwater sample collected from RU-4 contained an artificially low concentration of TCE (44 mg/L) when compared to historical values, which ranged from 130 milligrams per liter (mg/L) to over 300 mg/L. Most importantly, the sample collected during November 2011 contained TCE at 150 mg/L. At the time of the preliminary data evaluation report, TCE concentrations were exhibiting an increase at well RU-4 following exhaustion of the oxidant from the pilot study, and a recommendation was made to complete additional sampling to evaluate when TCE concentrations at RU-4 reached an equilibrium, at which time a determination could be made whether additional injection of persulfate would be necessary to complete the evaluation of in-situ chemical oxidation as a potential remediation technology for the site.

The groundwater monitoring event between June 27 and 29, 2012 was completed approximately ten weeks after completion of injection activities. This event included monitoring at a total of eight wells on the Alcas property, and included sampling of wells outside of the pilot study cell to evaluate whether impacts occurred in the surrounding aquifer. Of greatest interest for this report were the results from wells RU-4, RU-22A, and RU-22B within the pilot study cell. Attachment A presents the data from these three monitoring wells throughout the pilot study, and presents volatile organic compounds (VOCs) in both mass and molar concentrations. All analytical data collected during the pilot study are presented in Tables 1 and 2.

The TCE concentration at RU-4 increased from 56 mg/L on May 24, 2012 to 74 mg/L on June 27, 2012, and the trend at this well had exhibited a nearly linear increase between May 2 and June 27, 2012. The results indicated that an equilibrium concentration had not yet been reached at that location. Concentrations of cis-1,2-dichloroethene (cis-DCE) and vinyl chloride (VC) increased at this location as well. Given that RU-4 appears to be located in close proximity to residual nonaqueous TCE based on high historical concentrations, a rebounding trend was expected to occur following depletion of the oxidant. The increasing trend in VOCs coincided with an increase in chloride concentrations. The increase in chloride from 271 mg/L to 1250 mg/L observed in RU-4 on May 24 may be the result of destruction of chlorinated VOCs by the activated persulfate. Chloride remained elevated in June, at a concentration of 949 mg/L. Sulfate concentrations, however, decreased significantly from 841 mg/L on May 24 to 209 mg/L on June 27. This result indicates that sulfate decreased to below the secondary MCL of 250 mg/L approximately 10 weeks after injection, even in a well directly impacted during activated persulfate injection. Due to the continued increase in VOC concentrations in RU-4 during the sampling event in June 2012, an additional groundwater sampling event was recommended to evaluate equilibrium concentrations following injection activities.

At RU-22B, the previously observed decreasing trend in VOC concentrations continued during the June 2012 sampling event, with TCE decreasing from 10 mg/L to 5.7 mg/L, a decrease of about 87% compared to the baseline concentration of 43 mg/L at this location. This result is encouraging, as it appears that TCE concentrations were significantly reduced by the injected oxidant at this location, and that reduced concentrations continued to persist (and even drop further) more than two months after injection. The relative concentrations of cis-DCE and VC increased during the June sampling event. These data are likely indicative of reductive biological degradation of TCE, which has been observed on the fringes of chemical oxidation injections at other sites. This is typically attributed to increased dissolved organic carbon in groundwater that results from the partial oxidation of natural organic matter. The decrease in overall chlorinated VOC concentrations at this well is accompanied by a slight increasing trend in chloride concentrations, which provides another line of evidence that chlorinated VOCs have been destroyed in the vicinity of this well.

VOC concentrations at well RU-22A, screened between 10 and 15 feet bgs, have exhibited lower VOC concentrations throughout the pilot study when compared to RU-22B and RU-4. RU-22A has also exhibited higher molar concentrations of cis-DCE and VC compared to TCE, which differs from the other pilot study monitoring wells, suggesting that different geochemical conditions existed at this location from the outset. At RU-22A, an increase in TCE concentration from 2.8 mg/L to 4.6 mg/L was observed during the June sampling event; however, the overall molar concentrations of chlorinated VOCs remained relatively unchanged. As described in the preliminary data summary report, little influence from the persulfate injection was observed at well RU-22A.

One of the objectives of the pilot study was to evaluate the potential for adverse secondary impacts to groundwater quality due to the activated persulfate injection activities. The constituents evaluated as having potential to affect water quality were dissolved metals, hexavalent chromium, and bromate. Additionally, sulfate concentrations are being evaluated due to potential to exceed secondary MCLs due to utilization of the sodium persulfate oxidant. Table 2 presents the data for metals, hexavalent chromium, and bromate during the pilot study. At RU-4, which was directly impacted by the persulfate injection, several dissolved metals, notably aluminum, arsenic, total chromium, and vanadium, increased during the monitoring event two weeks after injection. Additionally, sodium increased significantly from 154 mg/L to 3,590 mg/L at two weeks post-injection; this result was expected due to breakdown of the sodium persulfate oxidant. However, concentrations of these metals decreased during sampling five weeks post-injection, and had returned to approximately baseline concentrations by ten weeks post-injection. These results indicate that within the treatment zone, a temporary increase in dissolved metals can be expected immediately following oxidant injection, but that the effects are short-lived and the metals are likely to attenuate following depletion of the oxidant. Bromate was not detected at any wells at the site during either baseline sampling or 10 months post-injection. Hexavalent chromium was not detected at concentrations above 0.01 mg/L during any monitoring events. While hexavalent chromium was detected in four samples during sampling in June 2012, all concentrations were barely above the detection limit. These results indicate that there is minimal potential for detrimental water quality impacts resulting from chemical oxidation byproducts at the site.

September Sampling Results

As described above, an additional groundwater sampling event was determined to be necessary to evaluate whether an equilibrium concentration of VOCs had been re-established, and the magnitude of the new equilibrium. The proposed sampling program was presented in a letter to EPA dated August 27, 2012. The additional sampling was approved during a project conference call with EPA on August 30, 2012. Wells RU-4 and RU-22B were sampled for VOCs and anions (sulfate and chloride) on September 6, 2012.

At RU-4, the TCE concentration decreased from 74 mg/L in June 2012 to 59 mg/L, and other VOC concentrations decreased in a similar manner as indicated in the attached charts. The total molar concentration of chlorinated VOCs decreased slightly from June to September. This result, approximately four months after the oxidant from the pilot study was exhausted, likely indicates that a new equilibrium TCE concentration has been established, and is at least 50% lower than historical concentrations. This result is very encouraging, as it appears to indicate that the oxidant destroyed a portion of the residual nonaqueous TCE present near RU-4, thereby decreasing the equilibrium TCE concentration in groundwater. Sulfate and chloride concentrations have also continued to decrease, with sulfate decreasing from 209 mg/L to 139 mg/L, and chloride decreasing from 949 mg/L to 797 mg/L.

The analytical results from RU-22B indicated an increase in TCE concentration, from 5.7 mg/L to 9.1 mg/L, while other chlorinated VOC concentrations decreased. Although TCE increased during the September sampling event, the total molar concentration of chlorinated VOCs actually decreased slightly, down more than 70% from the peak concentration measured on May 2, 2012. This result is also encouraging, as the decrease in VOC concentrations since the baseline sampling event appears to be sustained four months after the oxidant has been exhausted, and the September concentrations represent a decrease in total VOCs of 70% at this location.

Summary and Conclusions

The analytical results described above were discussed in a project conference call on September 21, 2012. The lower equilibrium concentration observed at RU-4, approximately 50 percent below historical concentrations, along with the significant reduction of total VOCs at RU-22B indicate that activated persulfate can be effective for destroying TCE at the site. However, it is important to note that implementation of this technology at full-scale in the source areas at the site will not result in reduction of groundwater concentrations to below MCLs. What it appears the technology can do is dramatically reduce the mass of VOCs in the shallow groundwater, which will significantly reduce their flux into the Upper City Aquifer from the site.

The effectiveness of in situ chemical oxidation will be controlled by the ability to distribute the injected oxidant into the heterogeneous subsurface at the site, which includes the variable presence of low-permeability soils in the vicinity of the source area. The challenge this presents was demonstrated during the pilot study, as little to no effect of activated persulfate injection was observed at well RU-22A, located roughly the same distance from the injection well as RU-22B, but screened in the upper 5 feet of the 10-ft injection zone rather than the lower 5 feet. During remedial design, options would be evaluated to better distribute oxidant throughout the treatment area (e.g., recirculation during injection, additional injection points) to more effectively treat VOC mass. Additionally, it is likely that sequential oxidant injections will result in a smaller reduction in VOC concentrations, leading to a point of diminishing returns for subsequent injection activities. It is important to set realistic objectives for performance of in situ chemical oxidation as a remedy for the site, such as a target percentage (e.g., 70 to 80 percent) reduction in VOC mass within the source area, rather than expecting this technology to reduce concentrations to MCLs in groundwater in the upper water-bearing zone at the Alcas facility.

While the September 2012 sampling results show promise for chemical oxidation as a potential remediation technology for high TCE concentrations in groundwater near the facility, it is important to note that numerical modeling will need to be completed to evaluate the potential for transport of sulfate from injection activities toward the municipal supply well. This evaluation will be included in the focused feasibility study document that presents the remediation technologies considered for the site.

Please feel free to contact us if you have any questions regarding this report at 303-383-2300, or at smithnl@cdmsmith.com or sorensonks@cdmsmith.com.

Sincerely,

Neil L. Smith, P.E.
Environmental Engineer
CDM Smith Inc.

Kent S. Sorenson, Jr., PhD, P.E.
Senior Vice President
CDM Smith Inc.

cc: Mr. Timothy White (ENI, LLC)
Mr. Michael Walters (U.S. Environmental Protection Agency)

Attachment A – VOC Mass and Molar Charts
Attachment B – References

		VOC - Mass Concentrations							Redox Conditions				General Chemistry					
Well ID	Sample Date	PCE	TCE	cis-1,2-DCE	trans-1,2-DCE	Vinyl Chloride	1,1-DCE	Total Organic Carbon	Dissolved Oxygen	ORP	Sulfate	Hexavalent Chromium	pH	Conductivity	Temperature	Turbidity	Chloride	Alkalinity
	Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mV	mg/L	mg/L	s.u.	uS/cm	deg C	NTU	mg/L	mg/L
D2	4/12/2012	0.0041	4.1	0.091	0.0026	0.0041	0.0023	0.74	8.78	-49	9.4	<0.005	11.98	1325	11.67	23	NS	420
	6/28/2012	<0.036	16	0.34	<0.09	<0.09	<0.029	0.46	6.85	-12.4	35.7	<0.005	10.81	498	14.04	10.3	NS	180
RU22A	4/13/2012	0.012	1.4	2.4	0.026	4.2	<0.0058	13.8	7.51	340.7	5.4	<0.005	6.44	4990	14.04	4.15	203	220
	5/2/2012	<0.014	3.4	3.1	<0.036	3.7	<0.012	NS	0	232.2	7.6	NS	7.69	4628	14.6	6.5	195	280
	5/24/2012	0.027	2.8	2.7	<0.036	3.6	<0.012	NS	3.77	86	65.3	NS	6.52	4750	13.09	9.7	2020	260
	6/27/2012	0.029	4.6	3.2	<0.036	3.4	<0.012	4.4	1.23	70.4	51	<0.005	6.58	4898	18.61	10.1	1770	500
RU22B	4/18/2012	0.072	43	14	0.088	4.4	0.041	10.2	6.48	146.6	65	<0.005	6.97	3020	14.79	2.8	1000	460
	5/2/2012	<0.14	23	24	<0.36	17	<0.12	NS	0	180.8	2.8	NS	6.77	3515	16.47	4.12	25.9	460
	5/24/2012	<0.045	10	9.4	<0.11	7.7	<0.036	NS	1.46	37.4	112	NS	6.61	3589	13.69	3.28	1240	540
	6/27/2012	<0.045	5.7	12	<0.11	9.1	<0.036	7.3	1.21	52.1	73.8	0.0051	6.67	3857	17.07	7.7	1310	500
	9/6/2012	0.085	9.1	6.4	0.048	2.9	0.015	NS	1.12	57.3	99.4	NS	6.41	4268	21.91	6.3	832	NS
RU4	4/13/2012	0.083	44	5.5	0.13	1.1	0.078	2.8	0.56	90.9	42.2	<0.005	7.09	1320	13.64	31	271	300
	5/2/2012	0.77	41	6.8	<0.72	1.5	<0.23	NS	0	-6.9	3570	NS	11.06	9795	16.01	9.51	790	390
	5/24/2012	0.55	56	13	<0.72	5.5	<0.23	NS	0.7	77.6	841	NS	9.7	4336	13.42	4.38	1250	440
	6/27/2012	<0.29	74	9	<0.72	1.9	<0.23	4.1	9.06	154.4	209	0.0059	7.8	3361	19.14	1.24	949	480
	9/6/2012	<0.29	59	9.3	0.1	2.9	0.037	NS	0.82	131.3	139	NS	6.69	2991	22.05	3.5	797	NS
RU5	4/13/2012	0.12	65	0.2	0.0094	0.003	0.012	0.68	1.26	344.7	30.6	<0.005	7.17	629	16.85	33.4	94.8	260
	6/29/2012	<0.09	19	<0.2	<0.23	<0.23	<0.073	0.45	0.51	17.9	29	0.0091	7.26	749	17.15	9.2	NS	220
RU8	11/17/2011	0.00052	0.28	0.012	<0.0009	0.0017	<0.00029	0.5	0.1	2	42.7	NS	7.52	566	11.34	58.8	10.5	391
	5/2/2012	<0.00036	0.077	0.003	<0.0009	<0.0009	<0.00029	0.67	1.42	72.2	38.1	NS	7.4	461	11.28	8.2	12.2	380
RW1	4/12/2012	0.047	17	0.39	0.0038	0.23	0.0038	11	0.58	153.7	48.6	<0.005	6.29	740	10.77	4.81	NS	220
	6/28/2012	<0.072	29	0.28	<0.18	0.34	<0.058	5.8	0.74	109.1	46.7	0.0051	6.39	803	14.51	9.1	NS	260
UC4	4/13/2012	<0.00036	0.056	0.0051	<0.0009	<0.0009	<0.00029	0.84	1.21	329.7	35.4	<0.005	7.23	714	15.79	51.6	148	220
	6/29/2012	<0.00036	0.048	0.0023	<0.0009	<0.0009	<0.00029	<0.43	2.21	67.1	37.9	<0.005	7.5	929	22.5	10.2	NS	220
UC5	4/11/2012	<0.00072	0.19	0.0019	<0.0018	<0.0018	<0.00058	0.53	1.54	83.2	36.9	<0.005	7.59	597	12.76	81.2	NS	240
	6/28/2012	<0.00072	0.16	0.0023	<0.0018	<0.0018	<0.00058	<0.43	0.46	44.9	38.7	<0.005	7.47	640	13.36	10.1	NS	240

Notes:
NS - not sampled
< - indicates compound not detected at greater than the detection limit shown

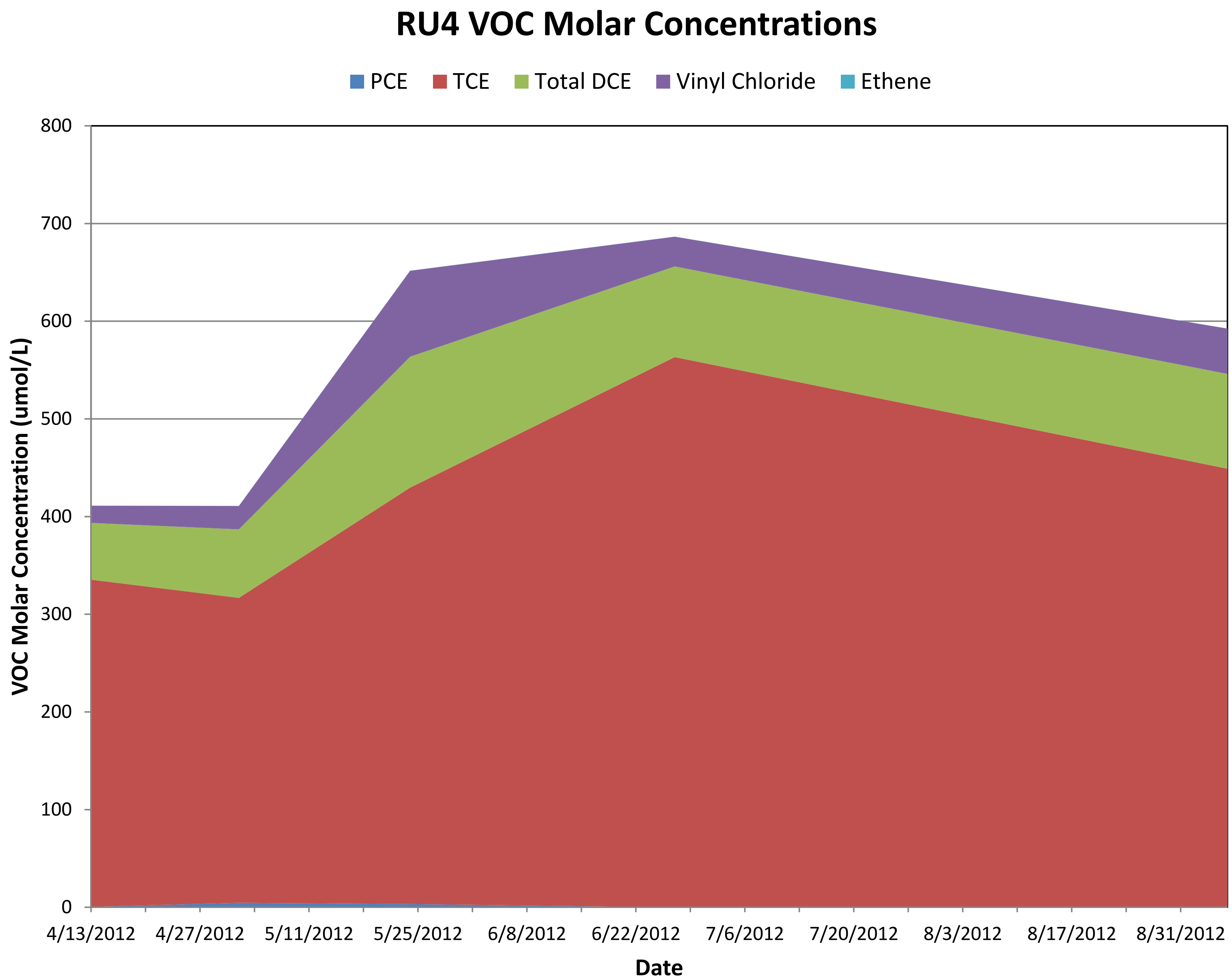
Table 1 - Interim Monitoring Results
ISCO Pilot Study
Alcas Cutlery Corporation, Olean, New York

		Dissolved Metals																								
Well ID	Sample Date	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Mercury (total)	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc
	Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
D2	4/12/2012	0.24	<0.0068	<0.0056	0.11	<0.0003	<0.0005	156	0.003	<0.00063	0.0028	<0.019	0.0079	0.77	<0.0004	<0.00012	<0.0013	7	<0.0087	<0.0017	27.2	<0.01	<0.0015	<0.0015
	6/28/2012	<0.06	<0.0068	<0.0056	0.17	<0.0003	<0.0005	58.2	<0.001	<0.00063	<0.0016	<0.019	<0.003	29.1	0.012	<0.00012	0.003	2.8	<0.0087	<0.0017	52.8	<0.01	<0.0015	0.0023
RU22A	4/13/2012	<0.06	<0.0068	<0.0056	0.64	<0.0003	<0.0005	468	0.0025	0.0096	0.006	<0.019	0.0058	82.9	28.3	<0.00012	0.25	8	0.012	<0.0017	838	0.015	<0.0075	0.01
	5/2/2012	<0.06	<0.0068	<0.0056	0.64	<0.0003	0.0007	521	0.0018	0.0037	0.0045	<0.019	<0.003	93.9	9.1	<0.00012	0.17	12	<0.0087	<0.0017	721	0.013	<0.0015	0.0042
	5/24/2012	<0.06	<0.0068	<0.0056	0.74	<0.0003	0.0011	484	0.0046	0.0053	0.0062	<0.019	0.0039	92	17.5	<0.00012	0.2	12.1	<0.0087	<0.0017	874	0.015	0.014	0.0036
	6/27/2012	<0.06	<0.0068	<0.0056	0.57	<0.0003	0.00077	449	<0.001	0.0031	0.0039	0.029	<0.003	81.1	10.6	<0.00012	0.15	8.9	<0.0087	<0.0017	736	<0.01	0.0025	0.0049
RU22B	4/18/2012	<0.06	<0.0068	<0.0056	0.5	<0.0003	<0.0005	306	0.0015	0.0061	0.0063	<0.019	<0.003	54.8	1.3	<0.00012	0.099	5.2	<0.0087	<0.0017	493	<0.01	<0.0015	0.0084
	5/2/2012	<0.06	<0.0068	<0.0056	0.38	<0.0003	<0.0005	386	<0.001	0.0042	0.0053	<0.019	<0.003	66.6	0.99	<0.00012	0.11	5.1	<0.0087	<0.0017	535	<0.01	<0.0015	0.008
	5/24/2012	<0.06	<0.0068	<0.0056	0.53	<0.0003	<0.0005	377	0.0013	0.0041	0.0057	<0.019	<0.003	71.3	1.2	<0.00012	0.12	5.3	<0.0087	<0.0017	563	<0.01	<0.0015	0.0037
	6/27/2012	<0.06	<0.0068	<0.0056	0.43	<0.0003	<0.0005	350	<0.001	0.0079	0.0047	0.069	<0.003	64.2	2.4	<0.00012	0.18	4.9	<0.0087	<0.0017	643	<0.01	0.002	0.0052
	9/6/2012	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
RU4	4/13/2012	<0.06	<0.0068	<0.0056	0.24	<0.0003	<0.0005	124	<0.001	0.0025	<0.0016	<0.019	<0.003	20.3	1.2	<0.00012	0.017	3	<0.0087	<0.0017	154	<0.01	<0.0015	<0.0015
	5/2/2012	3.3	<0.0068	0.35	0.18	<0.0003	<0.0005	44.3	0.16	0.002	0.0039	<0.019	<0.003	1.3	0.00067	<0.00012	0.053	5.4	<0.0087	<0.0017	3590	<0.01	0.088	0.0061
	5/24/2012	0.38	<0.0068	0.032	0.073	<0.0003	<0.0005	31	0.021	0.0073	0.007	<0.019	<0.003	5.3	0.076	<0.00012	0.15	2.7	<0.0087	<0.0017	1470	<0.01	0.0079	<0.0015
	6/27/2012	<0.06	<0.0068	<0.0056	0.29	<0.0003	<0.0005	196	0.0044	0.0061	0.0061	0.06	<0.003	42.1	0.49	<0.00012	0.14	5.2	<0.0087	<0.0017	742	<0.01	<0.0015	0.0024
	9/6/2012	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
RU5	4/13/2012	<0.06	<0.0068	<0.0056	0.12	<0.0003	<0.0005	101	<0.001	<0.00063	<0.0016	<0.019	<0.003	15.3	0.066	<0.00012	<0.0013	1.8	<0.0087	<0.0017	29.7	<0.01	<0.0015	<0.0015
	6/29/2012	<0.06	<0.0068	<0.0056	0.12	<0.0003	<0.0005	104	<0.001	<0.00063	<0.0016	<0.019	<0.003	16	0.079	<0.00012	<0.0013	2.1	<0.0087	<0.0017	37.8	<0.01	<0.0015	0.0018
RU8	11/17/2011	<0.06	<0.0068	<0.0056	0.11	<0.0003	<0.00033	104	<0.00087	<0.00063	0.0019	<0.019	<0.003	21.5	0.28	<0.00012	<0.0013	1.7	<0.0087	<0.0017	17.6	<0.01	<0.0011	0.0058
	5/2/2012	<0.06	<0.0068	<0.0056	0.13	<0.0003	<0.0005	117	<0.001	<0.00063	0.0017	<0.019	<0.003	22.5	0.48	<0.00012	<0.0013	1.8	<0.0087	<0.0017	12.7	<0.01	<0.0015	0.0086
RW1	4/12/2012	<0.06	<0.0068	<0.0056	0.12	<0.0003	<0.0005	97.5	0.0019	0.0042	0.0048	<0.019	<0.003	12.9	5.5	<0.00012	0.018	5.8	<0.0087	<0.0017	90.1	<0.01	<0.0015	0.005
	6/28/2012	<0.06	<0.0068	<0.0056	0.11	<0.0003	<0.0005	96	<0.001	0.0042	0.0092	0.079	<0.003	13.6	6.4	<0.00012	0.021	5.2	<0.0087	<0.0017	79.7	<0.01	<0.0015	0.034
UC4	4/13/2012	<0.06	<0.0068	<0.0056	0.17	<0.0003	<0.0005	91.9	0.0025	<0.00063	0.0022	0.08	<0.003	14.1	1.1	<0.00012	0.0015	2.8	<0.0087	<0.0017	64.2	<0.01	<0.0015	<0.0015
	6/29/2012	<0.06	<0.0068	<0.0056	0.2	<0.0003	<0.0005	106	<0.001	<0.00063	<0.0016	<0.019	<0.003	16.5	1.3	<0.00012	<0.0013	2.6	<0.0087	<0.0017	59.1	<0.01	<0.0015	0.0035
UC5	4/11/2012	<0.06	<0.0068	<0.0056	0.14	0.00032	<0.0005	96	<0.001	<0.00063	0.0018	0.2	<0.003	16.6	0.63	<0.00012	<0.0013	2	<0.0087	<0.0017	27.7	<0.01	<0.0015	0.0016
	6/28/2012	<0.06	<0.0068	<0.0056	0.2	<0.0003	<0.0005	106	<0.001	<0.00063	<0.0016	<0.019	<0.003	18	0.57	<0.00012	<0.0013	2.1	<0.0087	<0.0017	28.9	<0.01	<0.0015	0.0026

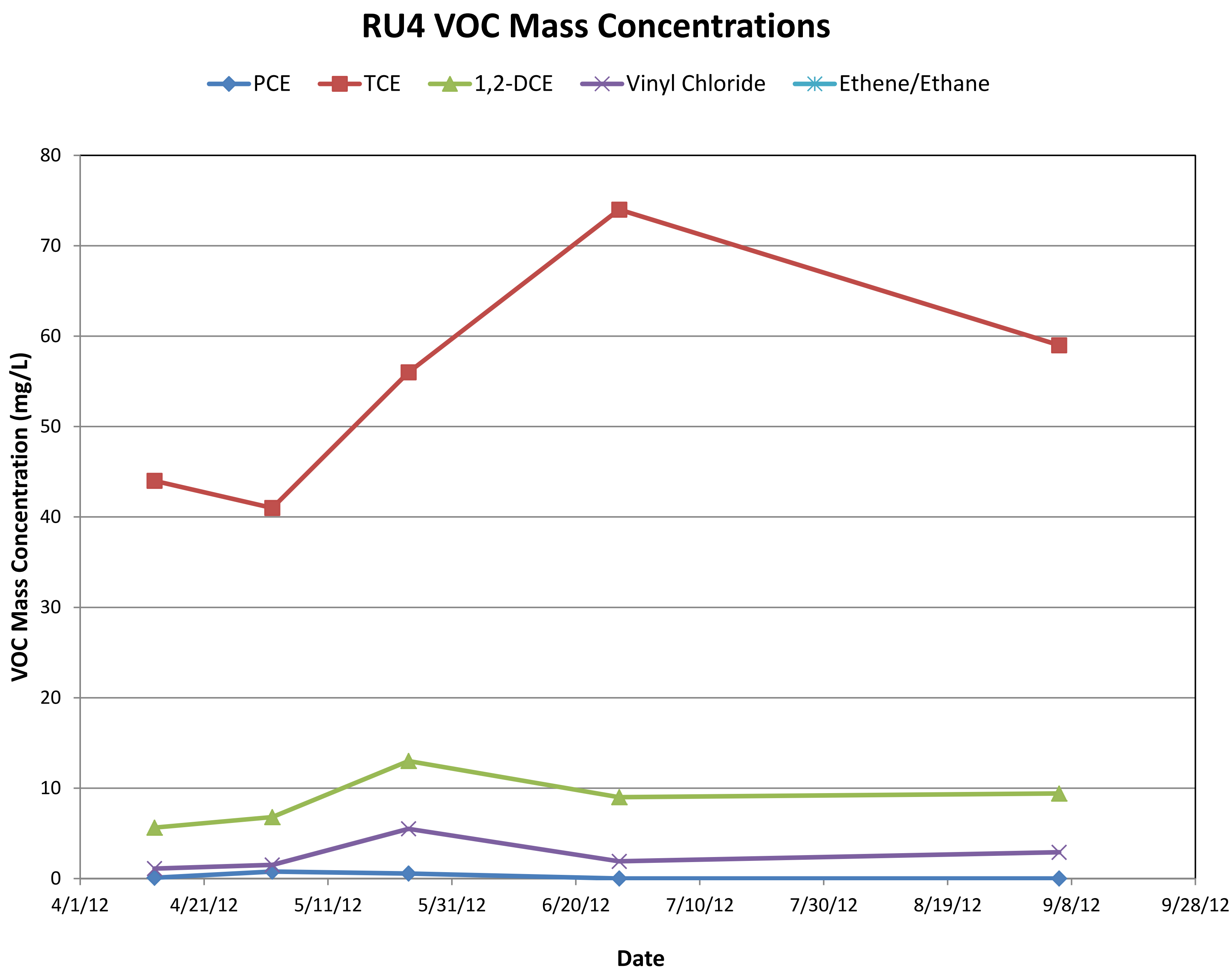
Notes:
NS - not sampled
< - indicates compound not detected at greater than the detection limit shown

Table 2 - Interim Monitoring Results
ISCO Pilot Study
Alcas Cutlery Corporation, Olean, New York

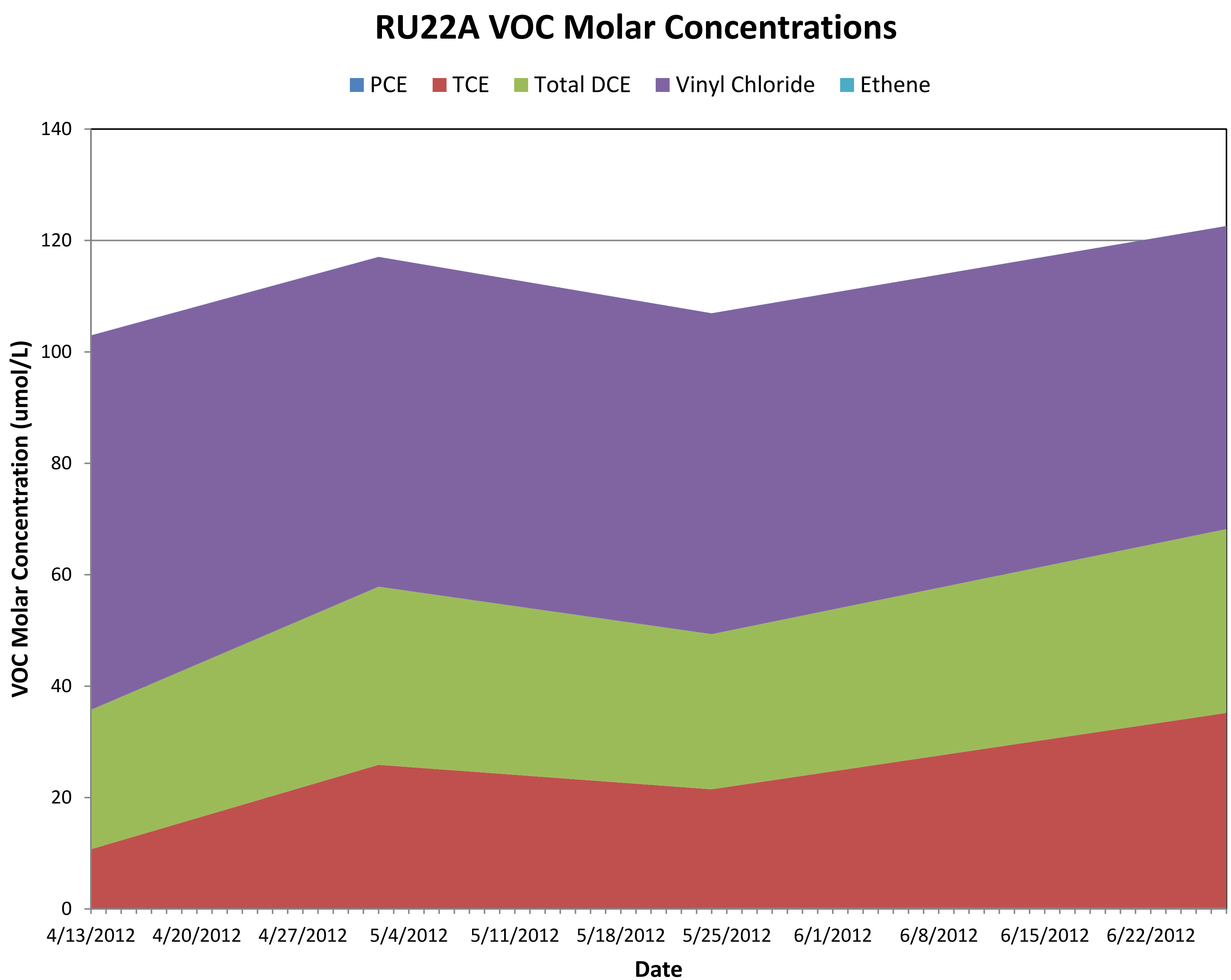
Attachment A
VOC Mass and Molar Charts



ISCO Pilot Study
Alcas Cutlery Corporation, Olean, New York

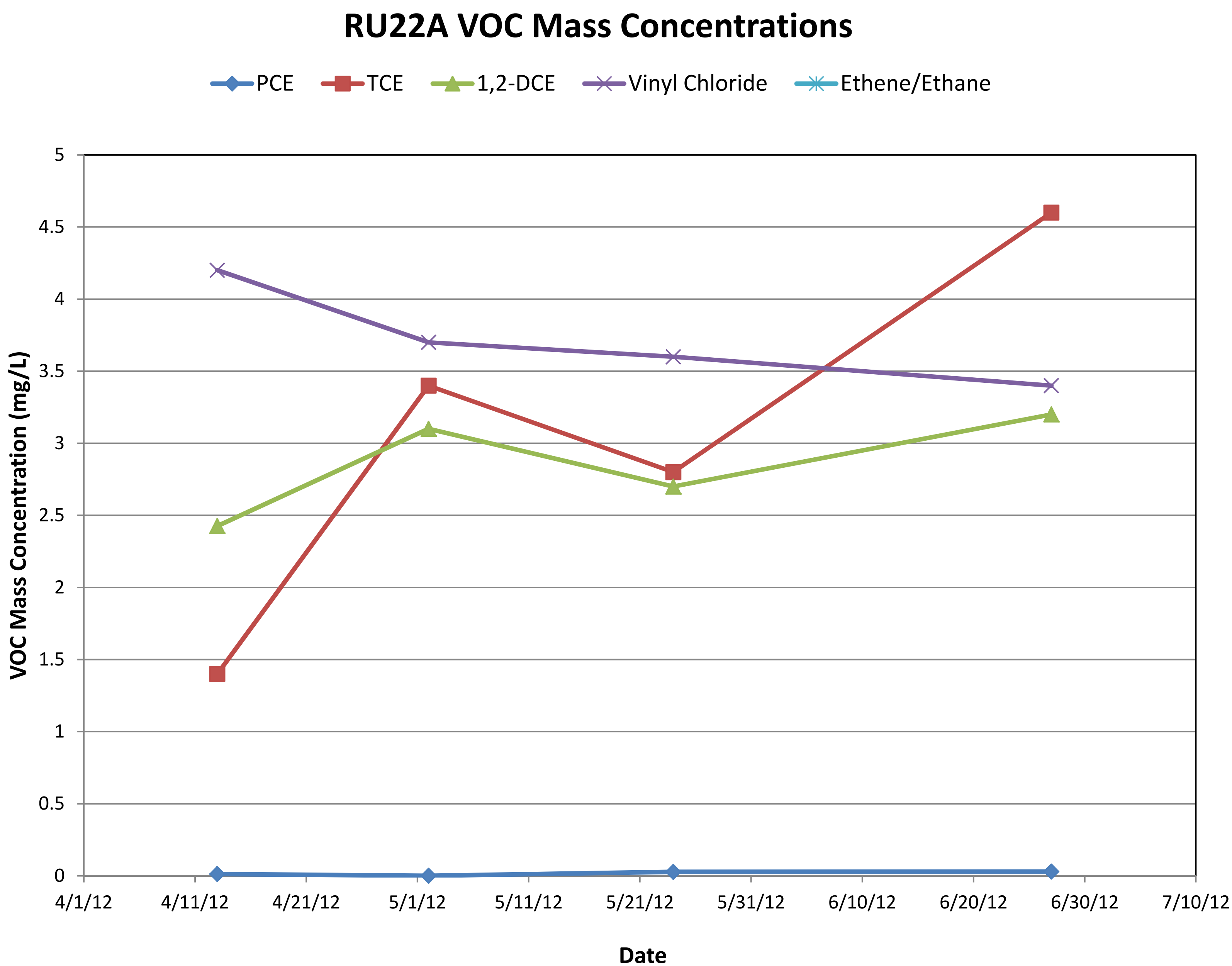


ISCO Pilot Study
Alcas Cutlery Corporation, Olean, New York



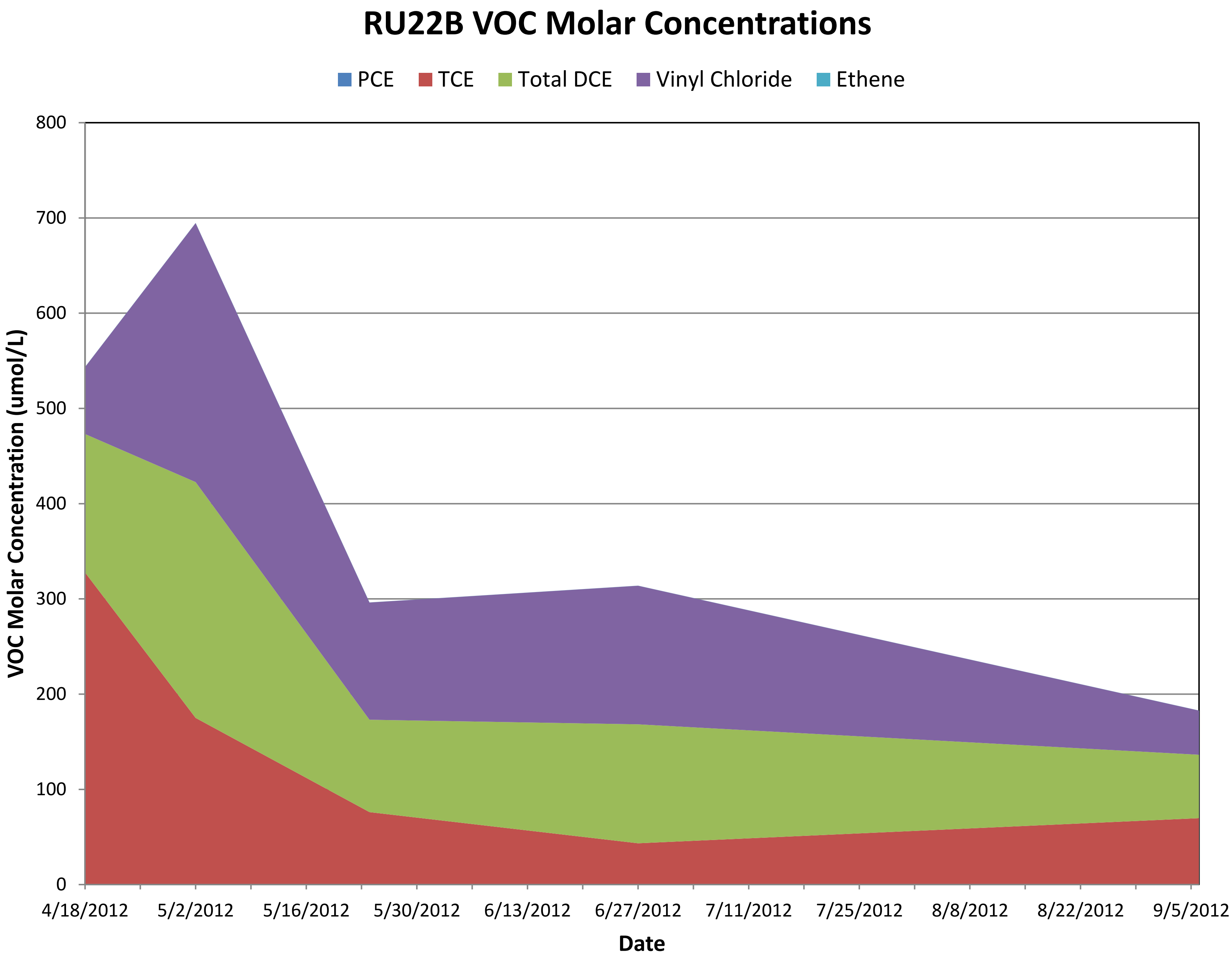
CDM

ISCO Pilot Study
Alcas Cutlery Corporation, Olean, New York

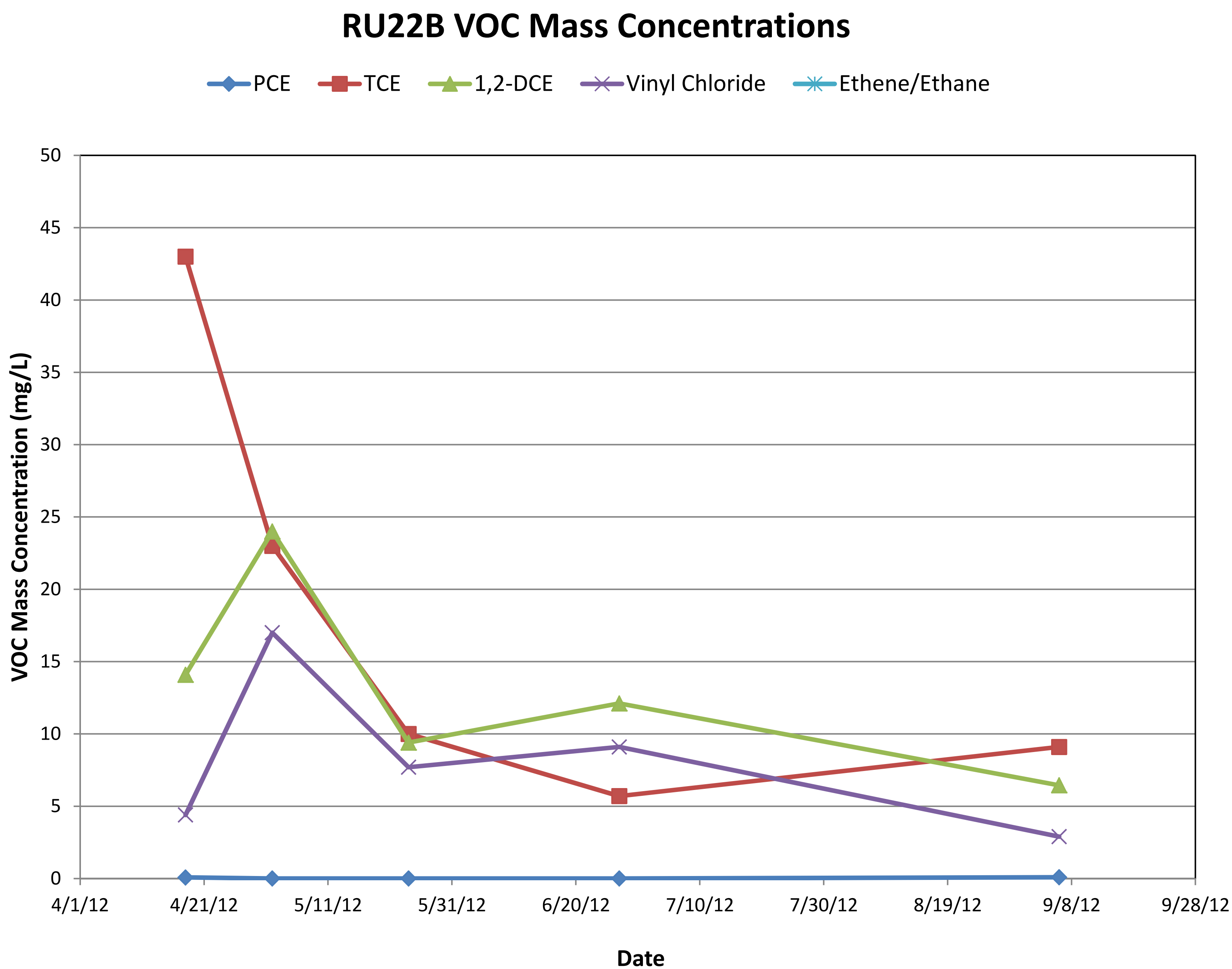


CDM

ISCO Pilot Study
Alcas Cutlery Corporation, Olean, New York



ISCO Pilot Study
Alcas Cutlery Corporation, Olean, New York



ISCO Pilot Study
Alcas Cutlery Corporation, Olean, New York

Attachment B - References

CDM Smith Inc. (CDM Smith). 2012a. In-Situ Chemical Oxidation Pilot Study Work Plan, Alcas Cutlery Corporation Facility, Olean, New York. March.

CDM Smith. 2012b. Draft Bench-Scale Test Summary Report, Alcas Cutlery Corporation Facility, Olean, New York. February.

CDM Smith. 2012c. Preliminary Data Evaluation for the In Situ Chemical Oxidation Pilot Study, Alcas Cutlery Corporation Facility, Olean, New York. June.

Appendix D

Bench-Scale Test Summary Report

CDM Smith
555 17th Street Suite 1100
Denver, Colorado 80202
tel: 303 383-2300
fax: 303 308-3003

February 8, 2012

Mr. Michael Walters
U.S. Environmental Protection Agency, Region II
290 Broadway, 20th Floor
New York, New York 10007

Subject: Draft Bench-Scale Test Summary Report
Alcas Cutlery Corporation Facility, Olean, New York

Dear Mr. Walters:

On behalf of Alcoa, CDM Smith is pleased to submit this Draft Bench-Scale Test Summary Report for the Alcas Cutlery Corporation Facility in Olean, New York. The bench-scale studies were completed as part of the Focused Feasibility Study for the site to evaluate the effectiveness of *in-situ* chemical oxidation at remediating chlorinated organic compounds present in groundwater beneath and near the manufacturing building on the site.

The results of the bench-scale studies indicated that sodium persulfate, activated using sodium hydroxide, was most effective at degrading chlorinated constituents while reducing likelihood for generation of by-products. In order to validate the results of the bench-scale tests and to evaluate the ability to implement the technology on a larger scale at the site, a small-scale pilot study using activated persulfate may be necessary at a location adjacent to the manufacturing building on site.

We look forward to receiving your feedback regarding this report. Should you have any questions, please do not hesitate to contact Robert Prezbindowski with Alcoa at 865-977-3811 or myself at 303-383-2300.

Very truly yours,

Kent Sorenson

Kent S. Sorenson, Jr., Ph.D., P.E.
Senior Vice President
CDM Smith Inc.

Enclosure

cc: Mr. Vivek Nattanmai, NYDEC (4 copies)
Mr. Eric W. Wohlers, Cattaraugus County Health Department (1 copy)
Mr. Robert Prezbindowski, Alcoa (no enclosure)

DRAFT BENCH-SCALE TEST SUMMARY REPORT

Alcas Cutlery Corporation Facility
Olean, New York

Prepared by:

CDM Smith Inc.
555 17th Street, Suite 1100
Denver, Colorado 80202

Prepared for:

ALCOA INC.
2300 North Wright Rd.
Alcoa TN, 37701

Attn: Mr. Robert Prezbindowski

February 2012

Table of Contents

Section 1 –Introduction

Section 2 –Methods

Section 3–Results

Section 4–Conclusions and Recommendations

Section 5–References

Figures

Tables

Acronyms

µg/L	micrograms per liter
CASLabs	Columbia Analytical Services
ETL	Environmental Treatability Laboratory
g	grams
ISCO	In situ chemical oxidation
kg	kilograms
L	liter
M	molar
mg/L	milligrams per liter
mL	milliliters
Site	Alcas Cutlery Corporation Facility Site
SOD	soil oxidant demand
TCE	trichloroethene
TOD	total oxidant demand
VOCs	volatile organic compounds

THIS PAGE INTENTIONALLY LEFT BLANK

Section 1
Introduction

1.1 Project Background

In situ chemical oxidation (ISCO) is being considered as part of a Focused Feasibility Study to screen potential remedial options for the Alcas Cutlery Corporation Facility Site (Site) located in Olean, Cattaraugus County, New York. The primary constituents of concern at the Site are chlorinated organic compounds consisting primarily of trichloroethene (TCE). Elevated levels of chlorinated organic compounds are located underneath the main building and have persisted in shallow groundwater at the site. The remedial effort objective is to control or reduce mass flux of chlorinated organic compounds from the shallow aquifer to the deeper City Aquifer.

As ISCO is a technology that requires site-specific consideration, a bench-scale treatability study was conducted at the CDM Smith Environmental Treatability Laboratory (ETL) located in Bellevue, Washington, to assess the feasibility of this treatment technology for this site. ISCO technology involves injecting chemical oxidant into the subsurface to oxidize organic compounds. As the oxidation process is not selective, sufficient oxidant must be provided to overcome the oxidant demand of soils and groundwater as well in order to oxidize the constituents of concern, thus reducing their mass. Oxidants generally used in ISCO for remediation of soil and groundwater include permanganate, persulfate, hydrogen peroxide, and ozone. Hydrogen peroxide generates significant quantities of gas during the oxidation process. This proved difficult to manage during initial bench-scale testing, and could create problems in a field application occurring underneath a structure. Similarly, the injection of ozone gas beneath the manufacturing facility at the Site could prove problematic both because of the highly heterogeneous soils that would prevent uniform distribution of the gas, and because of the potential for stripping VOCs from groundwater into the unsaturated soils under the building foundation. Therefore, persulfate with bicarbonate and persulfate with sodium hydroxide were determined to be most applicable to the Site and were the focus of this treatability study.

1.2 Chemistry of Persulfate ($S_2O_8^{2-}$)

Persulfate is available as ammonium persulfate [$(NH_4)_2 S_2O_8$], sodium persulfate ($Na_2S_2O_8$), and potassium persulfate ($K_2S_2O_8$). Use of potassium persulfate in ISCO applications is less common because of its low solubility. Injection of ammonium persulfate may lead to an undesirably elevated concentration of ammonia in groundwater. As a result, sodium persulfate was selected for use in this study.

In the pH range of 3 to 7, the half-reaction equation of persulfate is:

$$S_2O_8^{2-} + 2H_2O \rightarrow 2H^+ + 2SO_4^{2-} + H_2O_2 \text{ (Standard potential = 2.1 volts)}$$

Generation of H+ can lead to significant pH reductions and metals mobilization when persulfate is used. The use of alkaline activation or a buffer such as bicarbonate is sometimes used with persulfate. While persulfate is reactive by itself, its reactivity is greatly enhanced by activation and the resultant production of free radicals (Interstate Technology & Regulatory Council 2005). Activated persulfate forms a more powerful oxidant in the form of a sulfate radical ($SO_4{\cdot}^-$). The sulfate radical has a 2.6 V oxidation potential which is greater than the persulfate at 2.1 V and can degrade a wider range of compounds at faster rates by initiating a series of radical propagation and termination chain reactions. Heat, high pH, ferrous or chelated iron, and hydrogen peroxide are common persulfate activators. Sodium hydroxide (high pH) was chosen as the persulfate activator for this treatability study.

Not all of the oxidation potential will be available for degradation of the constituents of concern. Total oxidant demand (TOD) is defined as the amount of oxidant consumed by soil, groundwater, and the target constituents. The majority of the TOD required for ISCO is associated with the soil oxidant demand (SOD). Thus, the oxidant dose requirements can depend strongly on SOD.

As with all oxidants, metals mobilization may occur due to changed oxidation states as well as lowered pH. Therefore, metals mobilization is a concern even when alkaline activation or buffering is used with persulfate. Furthermore, oxidized byproducts such as bromate and hexavalent chromium can be formed. It is important to assess the potential for formation of these products, particularly where drinking water aquifers or supply wells may be impacted.

1.3 Study Objectives

The objectives of this bench-scale study are to:

1. Evaluate degradation of the constituents of concern by persulfate and activated persulfate, using Site soil and groundwater as the test matrix.

2. Evaluate the rate of breakdown of the persulfate and activated persulfate during the treatment test.

3. Evaluate the potential formation of any undesirable byproducts of the *in situ* treatments, such as oxidized metals, that could negatively impact the City Aquifer and 18M municipal supply well.

4. Determine if persulfate with or without activation is applicable for Site source treatment, and if any additional testing (e.g., a small scale, short-term pilot test near the Site source area) is needed to confirm feasibility.

Section 2
Methods

2.1 Groundwater and Soil Samples Receipt

Approximately 2.5 kilograms (kg) of Site soil from borehole RU4 were collected on 4 August 2011 and received at CDM Smith's ETL on 5 August 2011. Five liters of groundwater were collected from RU4 on 10 October 2011 and received at the ETL on 11 October 2011. Upon receipt by CDM Smith, all samples were recorded on CDM Smith's electronic inventory system and kept in a cold room at 4 degrees Celsius until setup. The treatability study sample information is summarized in **Table 2-1**. Prior to use, the soil was sieved through a #4 sieve.

Table 2-1 Sample Log

Sample ID	Sample Date	Sampled From	Received Date	Amount Received
Site soil	8/4/11	RU4	8/5/11	2.5 kg
Site groundwater	10/10/11	RU5	10/11/11	5 L

Notes:

kg – kilogram
L – liter

2.2 Titration of Soil, Groundwater, and Persulfate

Prior to experimental setup, mixtures of soil and groundwater with varying concentrations of persulfate were titrated to pH 11 with sodium hydroxide. The results of the titration test were used to calculate the volume of sodium hydroxide to use during the experimental setup. The mixtures were allowed to equilibrate overnight, then titrated back up to pH 11. The total volumes of sodium hydroxide necessary to titrate the mixtures are shown in **Table 2-2**.

Table 2-2 Persulfate Titration Test—Hydroxide Needed to Titrate to pH 11

Soil (g)	Groundwater (mL)	Persulfate Concentration	NaOH used (µL of 1.0 M)
30	150	0%	1900
		1%	2450
		5%	3050
		10%	3300

Notes:

g – gram
mL – milliliters
µL – microliters
M – molar

2.3 Experimental Setup

The bench-scale study tested the use of unactivated persulfate with bicarbonate buffer (Test A) and activated persulfate with sodium hydroxide (Test B). Each of these tests included four oxidant concentrations (i.e., 0 percent, 1 percent, 3 percent, and 10 percent on a volume basis). The test bottles were designated A1 through A4 and B1 through B4, as shown in **Table 2-3**.

Table 2-3 Test Conditions and Setup

Test Condition Code	Target persulfate concentration (%)	Soil (g)	Ground-water (mL)	Deionized water (mL)	Persulfate solution (400 g persulfate/L; mL)	Bicarbonate (as NaHCO3; g)	NaOH (1.0 M; µL)
A1	0	60	220	80.0	0	0	--
A2	1	60	220	72.5	7.5	2.6	--
A3	5	60	220	42.5	37.5	13.1	--
A4	10	60	220	5.0	75.0	26.3	--
B1	0	60	220	80.0	0	--	0
B2	1	60	220	70.1	7.5	--	2450
B3	5	60	220	39.5	37.5	--	3050
B4	10	60	220	1.7	75.0	--	3300

Notes:

g – grams
mL – milliliter
µL – microliter
M – molar

Reaction vessels were 1 liter (L) media bottles with a teflon-coated septum held in place by an open-top lid. To prevent excess pressure in the event of gas production, the reaction vessels were connected to a 1-L Tedlar bag as an expansion chamber. The bag was connected to a needle via a Luer-Lok/barb adapter and Tygon tubing; the needle was secured in place in the septum of the reaction vessel throughout the experiment.

For each condition, 60 grams (g) of Site soil and 220 milliliters (mL) of groundwater were added to the bottle. Persulfate, buffer or activator, and deionized water were added to each condition as indicated in Table 2-3. Deionized water was added to equalize the total liquid volume to 300 mL in each condition; the deionized water volume depended on the volumes of persulfate and sodium hydroxide. The amounts of bicarbonate added in Test A (persulfate with bicarbonate) were determined as the stoichiometric amount of buffer needed to neutralize the acidity generated by persulfate decomposition. The amounts of 1 molar (M) sodium hydroxide added in Test B (persulfate with sodium hydroxide) were based on the titration test described in Section 2.2. Materials were added to the bottles in the following order: soil, bicarbonate (if any), distilled water, groundwater, persulfate, and sodium hydroxide (if any). This order was chosen to minimize the time that the persulfate and sodium hydroxide were reacting with the soil and groundwater prior to the first sampling event. The bottles were capped immediately after the final addition, and analyses began immediately after capping.

Groundwater from each bottle was sampled as indicated in **Table 2-4**. Analyses of VOCs, pH, and sulfate were conducted by ETL at several time points for all the experimental bottles. In addition, samples from bottles A1, A4, B1, and B4 were sent to Columbia Analytical Services (CASLabs) for analyses of bromate, hexavalent chromium, and dissolved metals. Bottles A1 and B1 were selected for analysis as negative controls, while A4 and B4 had the highest oxidant loadings and could be assumed to present the greatest probability of forming undesirable byproducts.

Table 2-4 Analytical Methods and Sampling Frequencies

Analyte	Method	Time Points Sampled (hours from test initiation)[1]	Test Conditions Sampled	Laboratory
VOCs	EPA 8260-M	0, 12, 23, 41, 46	All	ETL
pH	Standard method 4500	0, 12, 23, 41, 46	All	ETL
Sulfate	HACH 8051	0, 12, 23, 41, 46	All	ETL
Bromate	EPA 300.1 / BrO3	46	A1, A4, B1, B4	CASLabs
Hexavalent chromium	EPA 7199	46	A1, A4, B1, B4	CASLabs
Dissolved metals	6010B LL / Metals 7470A / Hg	46	A1, A4, B1, B4	CASLabs

Notes:

VOCs – Volatile organic compounds
EPA – U.S. Environmental Protection Agency
ETL – CDM Smith's Environmental Treatability Laboratory
CASLabs – Columbia Analytical Services Laboratory
[1]: The time point shown was the time of sampling; Due to instrument limitations the GC-MS analysis occurred 2-9 hours after sampling.

THIS PAGE INTENTIONALLY LEFT BLANK

Section 3
Results

3.1 VOC Oxidation

3.1.1 Unactivated Persulfate with Sodium Bicarbonate (Test A)

The graphs in **Figure 3-1** show the removal of PCE, TCE, cis-1,2-DCE, and VC using 1 percent, 5 percent, and 10 percent concentrations of unactivated persulfate with bicarbonate buffer. VOC levels declined in the controls in both this test and in Test B. The average percent reductions in the VOCs for the two controls were PCE: 66 percent; TCE: 29 percent; cis-1,2-DCE: 28 percent, and VC: 69 percent. The 1 percent dosage in this test showed little improvement compared to the control. The 5 percent and 10 percent dosages performed similarly to each other and better than the control, with the 10 percent dosage generally facilitating slightly faster and more thorough VOC removal than the 5 percent dosage. In the 2.5-day period of the experiment, VOC removal was not complete even in the 10 percent dosage. In this dosage, PCE was reduced by 79 percent, TCE by 84 percent, cis-1,2-DCE by 78 percent, and VC by 98 percent. The VOC data for these tests are presented in Appendix A.

3.1.2 Activated Persulfate with Sodium Hydroxide (Test B)

The graphs in **Figure 3-2** show the removal of PCE, TCE, *cis*-1,2-DCE, and VC using 1 percent, 5 percent, and 10 percent concentrations of persulfate activated with sodium hydroxide. Similarly to persulfate with bicarbonate, persulfate with hydroxide performed better at the 5 percent and 10 percent dosages than at 1 percent. In contrast to test A, the 1 percent dosage in test B did perform better than the control. Furthermore, the 5 percent and 10 percent dosages with hydroxide performed substantially better than the corresponding doses in test A. In the 10 percent dosage, PCE was reduced by 90 percent, TCE by 96 percent, *cis*-1,2-DCE by 98 percent, and VC by 99 percent. The VOC data for these tests are also presented in Appendix A.

3.2 pH, Dissolved Metals, and Oxidized Byproducts

Addition of strong oxidizers often results in decreased pH values, potentially leading to increases in dissolved metals such as cadmium, chromium, and lead. Furthermore, the oxidizers can lead to the formation of undesirable byproducts such as bromate and hexavalent chromium. Thus, the pH of all test conditions was monitored throughout the experiment, and analyses of dissolved metals along with bromate and hexavalent chromium were performed on samples from selected conditions by Columbia Analytical Services. Detailed results of these analyses are presented in Appendix B. It should be noted that a low matrix-spike recovery for bromate indicated possible matrix interference and the chromatograms for samples A1, B1, and B4 indicated non-target background components, resulting in an elevated reporting limit of 100 micrograms per liter (µg/L).

Figure 3-1 Concentrations of PCE , TCE, cis-1,2-DCE & VC in Persulfate + Bicarbonate Treatments

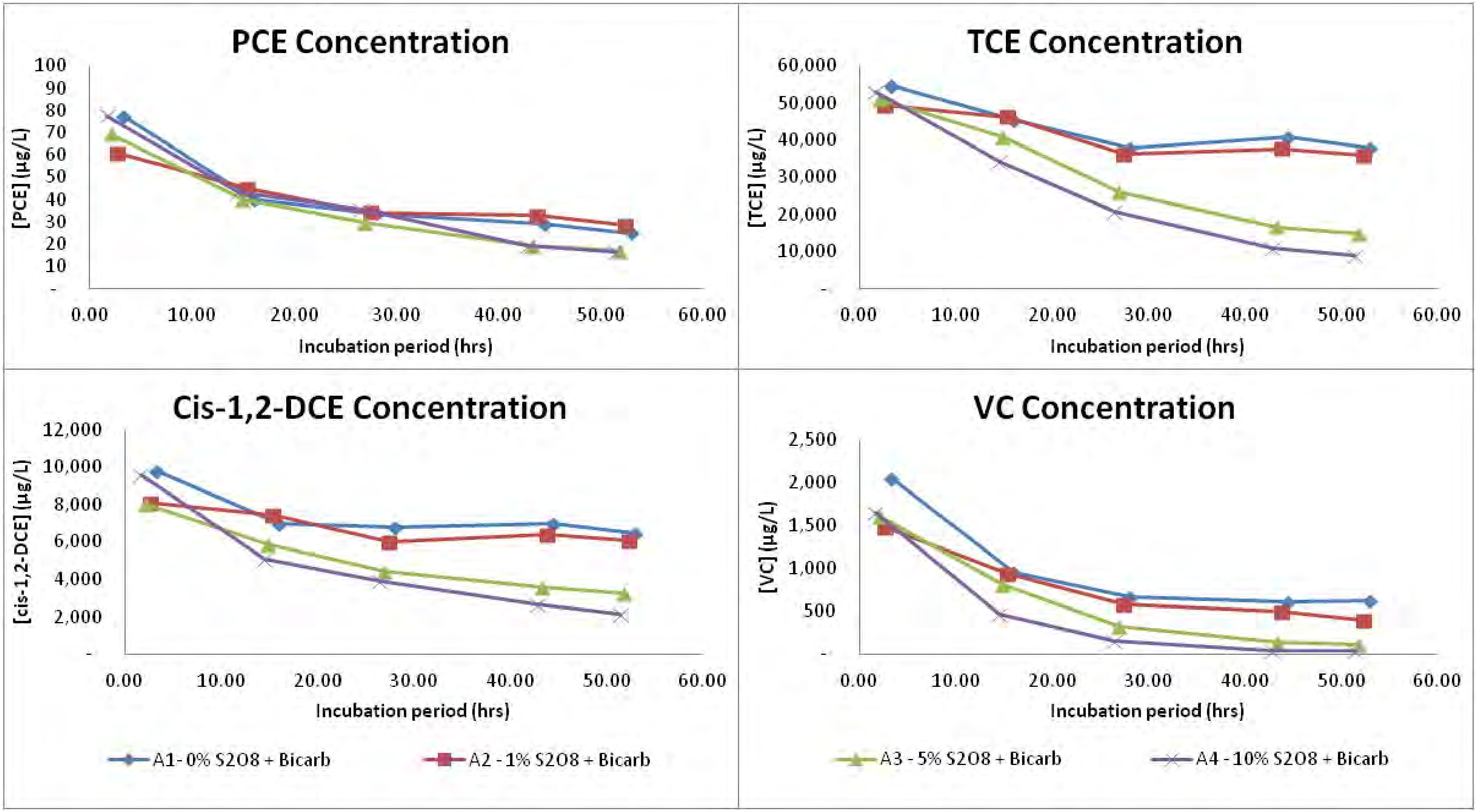
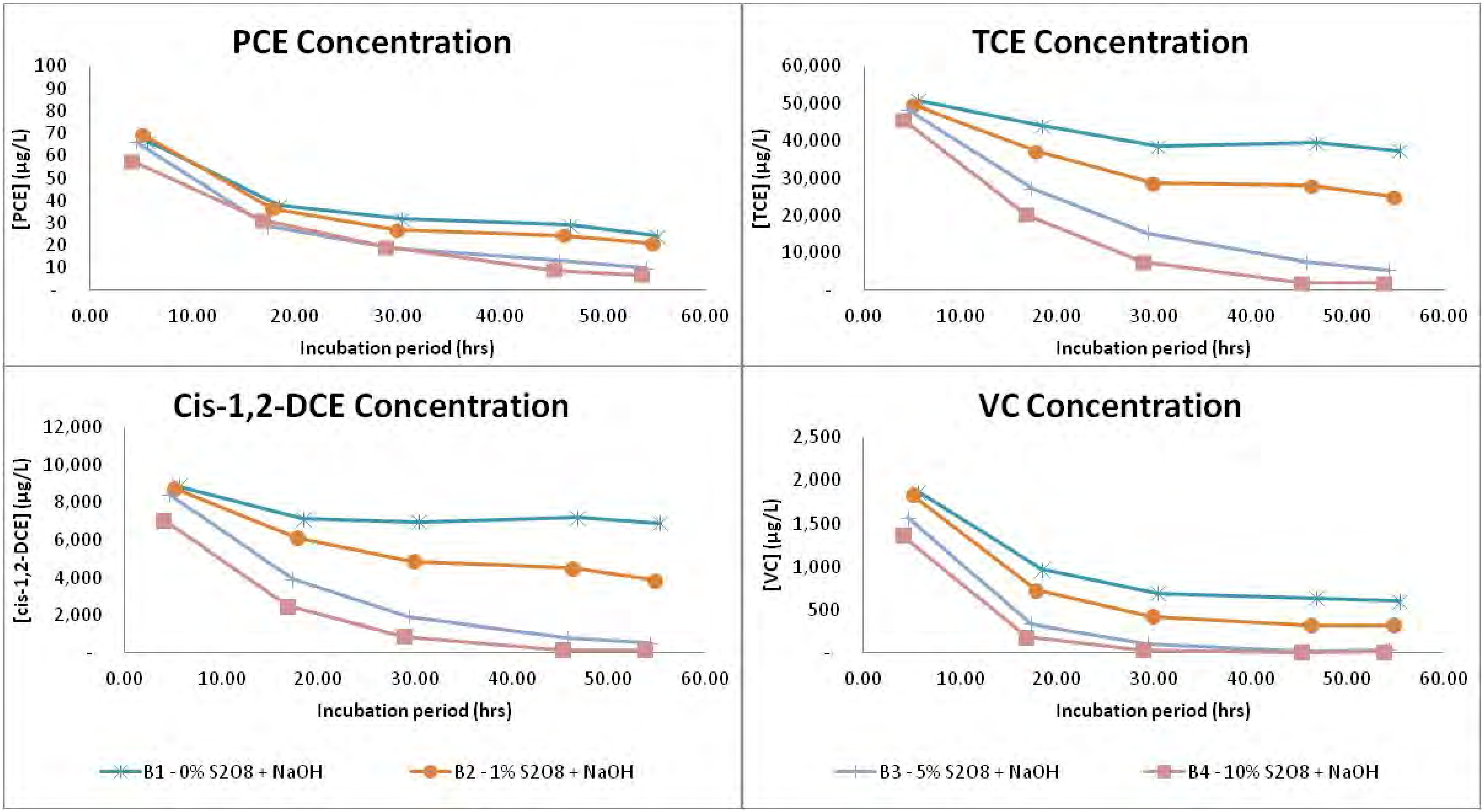


Figure 3-2 Concentrations of PCE, TCE, cis-1,2-DCE & VC in Persulfate + Hydroxide Treatments



3.2.1 Unactivated Persulfate with Bicarbonate

As shown in **Figure 3-3**, bicarbonate effectively maintained the pH of the test conditions at slightly above neutral for all persulfate dosages. Despite the near-neutral pH, many of the dissolved metals concentrations were elevated in test A4 (10 percent persulfate) compared to the control, as shown in **Figure 3-4**. The relative difference was greatest for iron (elevated by a factor of 430x compared to the control), sodium (260x), total chromium (110x), copper (30x), vanadium (30x), aluminum (20x), arsenic (20x), and cobalt (10x). Several metals were elevated to levels several times greater than the New York state groundwater or drinking-water quality standards, including aluminum, arsenic, cobalt, iron, sodium, and vanadium (based on Part 703 summary tables, http://www.dec.ny.gov/regs/4590.html). Barium and total chromium also exceeded the standards, though not by as great a factor. The hexavalent chromium concentration did not measurably increase in test A4 compared to the control. However, the bromate concentration was higher in test A4 by a factor of more than 400x, at approximately 43,000 µg/L. The EPA drinking water standard is 10 µg/L. These results indicate that this treatment could have multiple adverse impacts on the quality of the shallow groundwater.

3.2.2 Activated Persulfate with Sodium Hydroxide

Figure 3-5 shows that pH was initially elevated to approximately 10.5 in test conditions with persulfate and sodium hydroxide. The pH declined to less than 9 within the first 12 hours of the test, but remained above neutral for the full duration. **Figure 3-6** shows that most metals concentrations did not increase substantially in test B4 compared to the control. The greatest increases occurred for sodium (150x), total chromium (100x), and potassium (5x). Neither bromate nor hexavalent chromium were measurably elevated in test B4 compared to the control. A few metals were elevated to levels above the New York state groundwater or drinking-water quality standards, including total chromium, selenium, and sodium. However, chromium and selenium did not exceed the standards by much (chromium: 63 µg/L vs. 50 µg/L; selenium 12.8 µg/L vs. 10 µg/L), suggesting that the impact of this treatment on the shallow groundwater would be far less than the impact of persulfate with bicarbonate.

3.3 Total Oxidant Demand

The sulfate production for both test A and test B are shown in **Figure 3-7**; detailed results of these are in Appendix C. In test B, increased persulfate dosages resulted in higher sulfate concentrations, although the relationship was not linear. The sulfate results in test A do not follow this trend. Sulfate concentrations were highest in A2 (1 percent persulfate with bicarbonate), while the higher persulfate dosages did not generally produce any more sulfate than the control. However, the VOC-removal data indicate that oxidation was occurring in conditions A3 and A4. This suggests an interference to the sulfate assay at the higher dosages of persulfate with bicarbonate. None of the known interfering substances were present in the samples at concentrations of concern, but other interferences may exist. Because of the destructive nature of the analyses, re-analysis of the samples to identify or avoid the interference was not possible.

TOD values calculated from sulfate production in test B ranged from 1.2 to 6.8 g/kg; these values are shown in **Table 3-1**. The oxidant demand increased with increasing persulfate dosages, indicating that the measured oxidant demand is dependent on the dose applied, which is consistent with observations reported by Huling and Pivetz (2006). Also, the sulfate concentration was still increasing at the completion of the test period, suggesting that the calculated TOD would be higher with a longer period of observation.

Table 3-1 Total Oxidant Demand for Persulfate Activated with Hydroxide

Condition	Soil Mass (g)	Total Water Volume (mL)	Control Sulfate Concentration (mg/L)	Final Sulfate Concentration (mg/L)	Oxidant Consumed (mg/L)	Total Oxidant Demand (g/kg)
B1 (1%)	60	300	40	280	240	1.2
B2 (5%)	60	300	40	750	710	3.5
B3 (10%)	60	300	40	1400	1360	6.8

Notes: Total oxidant demand (in g/kg) is equal to the oxidant consumed (in mg/L), times the total water volume (in L), divided by the sum of the soil mass (in g) and the water volume (in mL; assumes a density of 1g/mL).
g – gram
mL - milliliter
mg/L – milligrams per liter
g/kg – grams per kilogram

Figure 3-3 pH in Persulfate + Bicarbonate Treatments

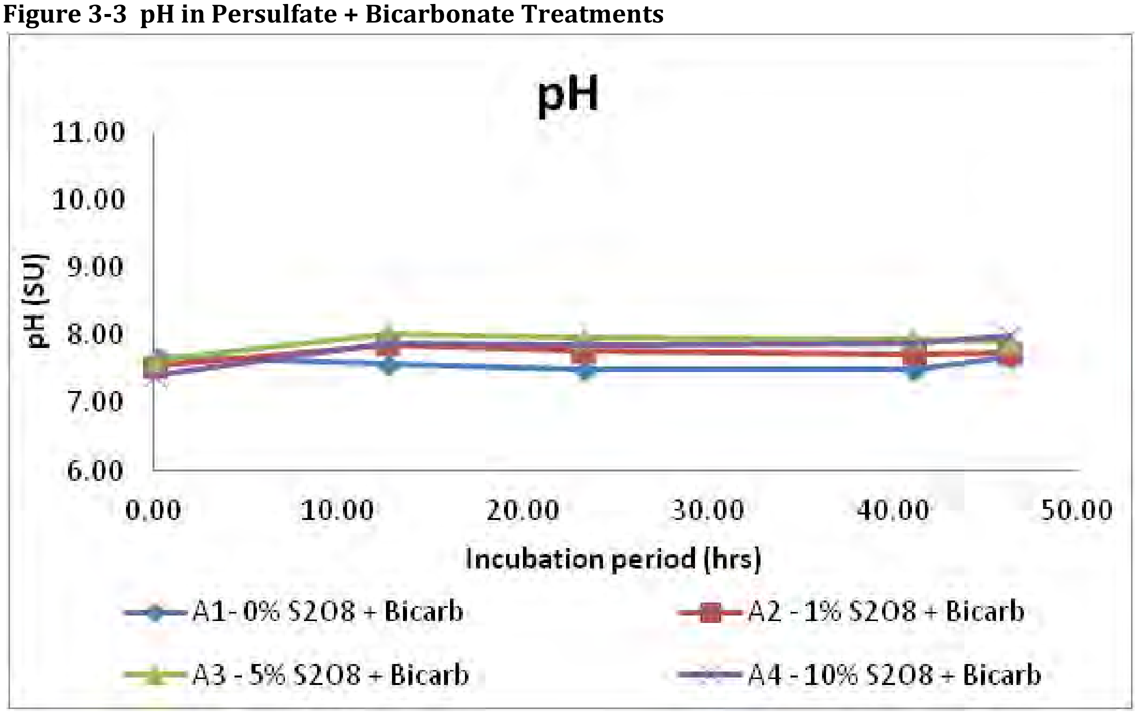
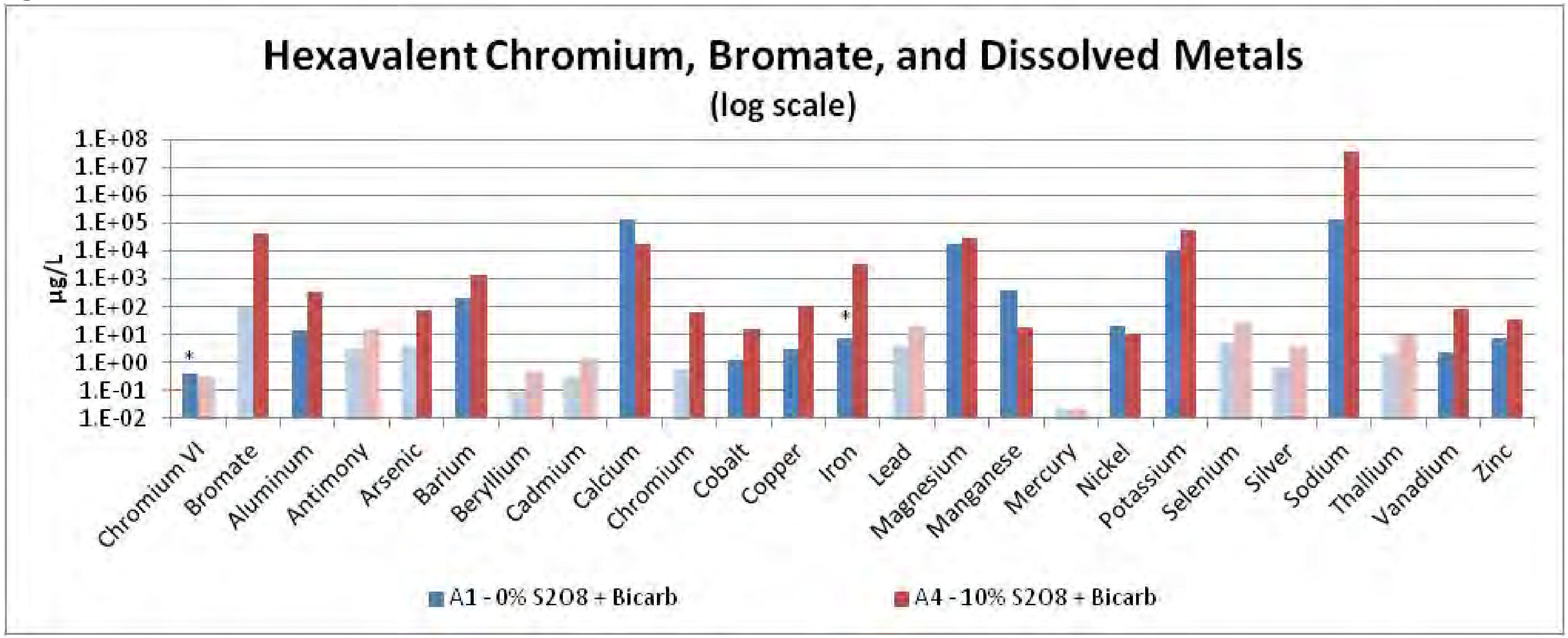


Figure 3-4 Final Concentrations of Hexavalent Chromium, Bromate, and Dissolved Metals in Persulfate + Bicarbonate Treatments



Notes:

The method detection limit (MDL) and method reporting limit (MRL) were higher in A4 than A1 because dilution was necessary for analysis of A4.

Lighter color indicates the MDL in non-detect samples.

An asterisk indicates an estimated value between the MDL and MRL.

Figure 3-5 pH in Persulfate + Hydroxide Treatments

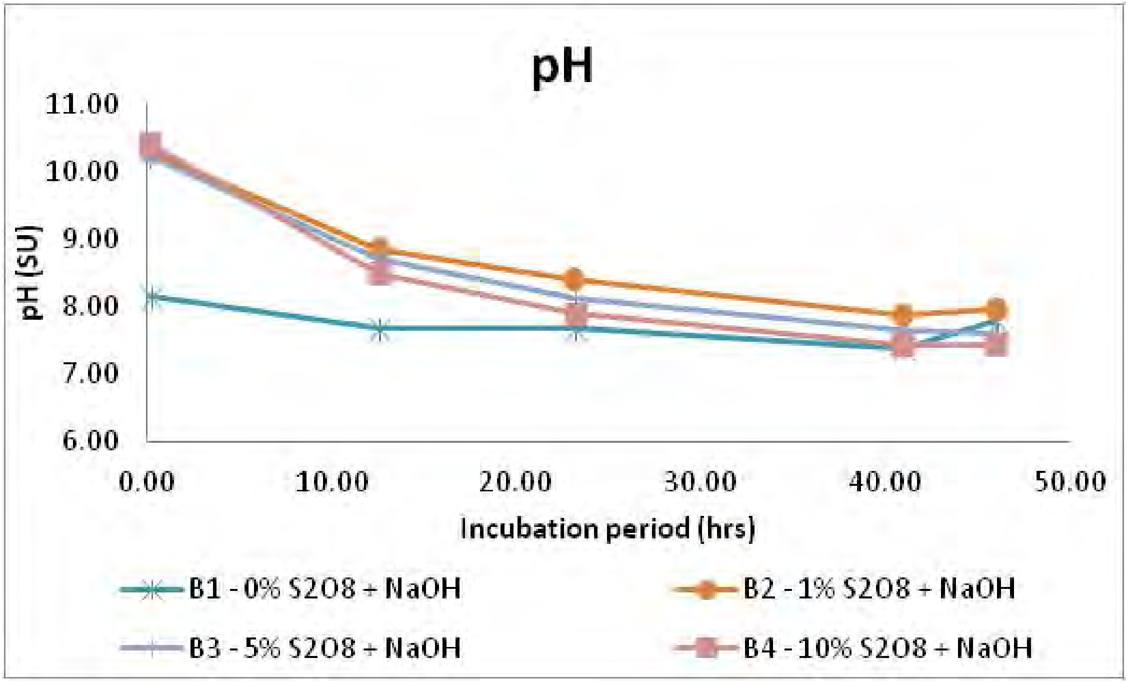
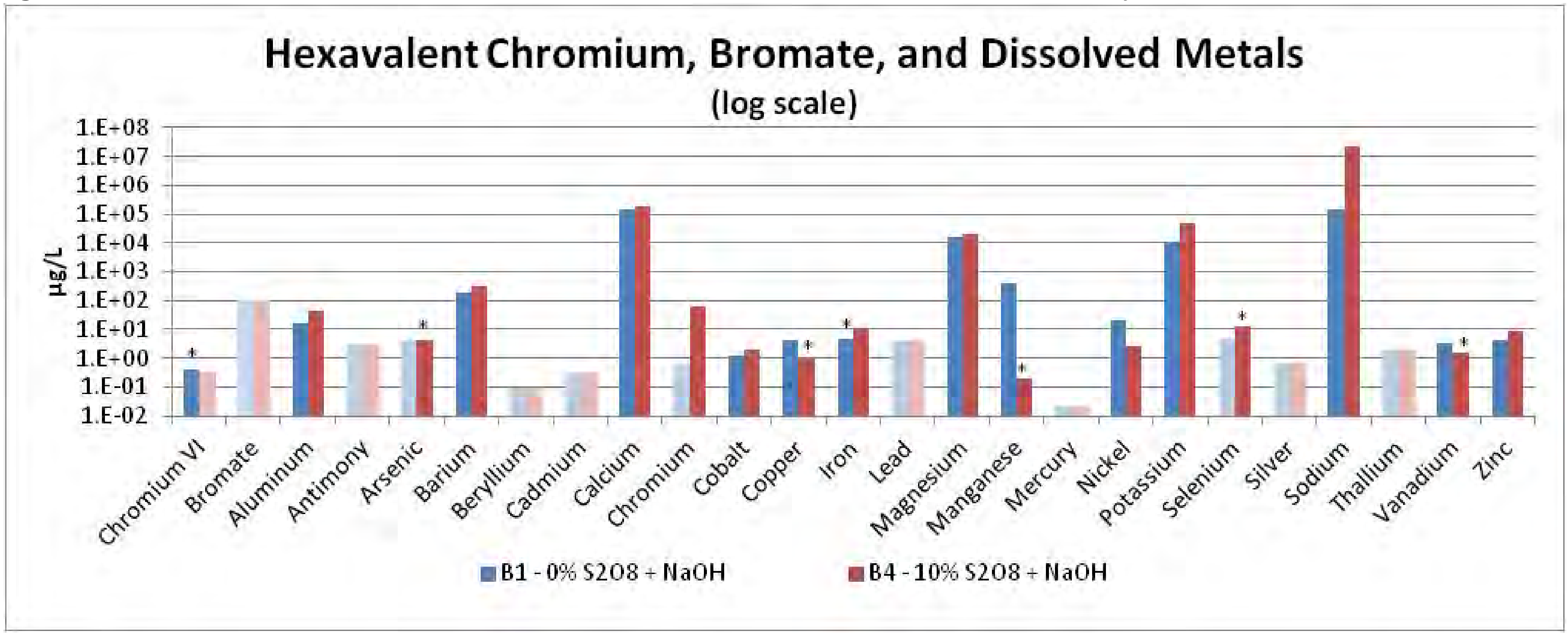


Figure 3-6 Final Concentrations of Hexavalent Chromium, Bromate, and Dissolved Metals in Persulfate + Hydroxide Treatments

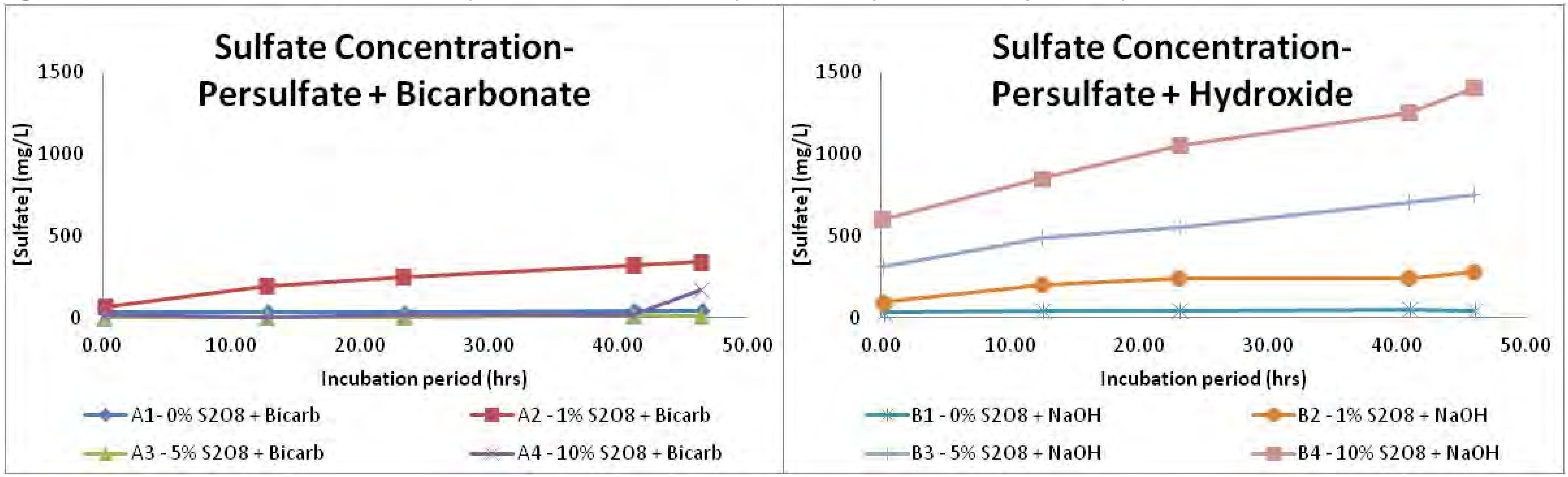


Notes:

Lighter color indicates the method detection limit (MDL) in non-detect samples.

An asterisk indicates an estimated value between the MDL and method reporting limit (MRL).

Figure 3-7 Sulfate Concentrations in Test A (Persulfate + Bicarbonate) and Test B (Persulfate + Hydroxide)



THIS PAGE INTENTIONALLY LEFT BLANK

Section 4 Conclusions and Discussion

4.1 Conclusions

The results from this treatability study suggest the following conclusions:

- Both unactivated persulfate buffered with bicarbonate and persulfate activated with hydroxide were capable of substantially oxidizing TCE, *cis*-1,2-DCE, and VC when applied at 5 percent and 10 percent dosages.
- For both unactivated and activated persulfate, the 10 percent dosage was more effective than the 5 percent. Unactivated persulfate had little or no effect at a 1 percent dosage, while activated persulfate was somewhat effective at this dosage.
- For each of the dosages tested, hydroxide-activated persulfate provided better removal of VOCs than unactivated persulfate.
- The bicarbonate dosage rates chosen were sufficient to maintain a slightly alkaline pH. However, substantial increases in the dissolved metals concentrations occurred and bromate reached a concentration of 43 milligrams per liter (mg/L) with the 10 percent dosage.
- Activated persulfate dosed at 10 percent had much less impact on dissolved metals concentrations than did unactivated persulfate, and it did not lead to measurable increases in the hexavalent chromium or bromate concentrations.
- Activated persulfate did cause an immediate increase in the pH to 10.5, but this impact diminished over time.
- The calculated TOD values for activated persulfate indicate a dependence of TOD on the oxidant dosage applied. The TOD could not be calculated for unactivated persulfate, due to presumed analytical interference.

4.2 Discussion of Findings

The performance of activated persulfate was superior to unactivated persulfate in this study for two reasons:

1. For each dosage tested, the activated persulfate more effectively oxidized the VOCs.
2. At the highest dosage, the unactivated persulfate resulted in high concentrations of the byproduct bromate, whereas activated persulfate did not.

For activated persulfate, a 1 percent dosage provided some removal of the VOCs, but less than 60 percent of the high-concentration TCE and *cis*-1,2-DCE. The 10 percent dosage provided 90 – 99 percent removal of the four VOCs tested, and initial removal rates were faster than in the 5 percent dosage. However, the VOC removal in the 5 percent dosage approached that of the 10 percent dosage by the end of the test, ranging from 85 to 98 percent. Furthermore, it appears that removal was still occurring at that time for both TCE and *cis*-1,2-DCE. Thus it appears that a dosage of activated persulfate of approximately 5 percent will provide the optimum balance between effective VOC removal and cost, without the formation of undesirable oxidized byproducts.

The applicability of ISCO via alkaline-activated persulfate at the Site depends on the treatment goals. The bench-scale results demonstrate that substantial mass removal can be achieved with this technology under the ideal mixing conditions of the laboratory; however, even in those conditions, final VOC concentrations were above federal drinking water standards. This suggests that in a field application at a heterogeneous site where significant VOC mass is likely to be located in low permeability soil lenses, treatment to drinking water standards would not be possible even with multiple oxidant applications. If, on the other hand, the treatment goal were to achieve a specified mass removal in a specific area, this technology appears promising.

Section 5
References

Huling, S. G., and Pivetz, B. Z, 2006. *In-Situ Chemical Oxidation* . United States Environmental Protection Agency (EPA). Engineering Issue. EPA 600-R-06-072, 2006.

Interstate Technology & Regulatory Council. 2005. *Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Soil and Groundwater*. Second Edition. January 2005.

THIS PAGE INTENTIONALLY LEFT BLANK

Appendix A

Appendix A: Summary of VOC Results

Test	Condition	Persulfate Concentration	Time (hours)	PCE (ug/L)	TCE (ug/L)	cis-1,2-DCE (ug/L)	VC (ug/L)
Persulfate + Bicarbonate	A1	0	3.28	78	54,691	9,807	2,049
			16.08	40	45,512	6,975	952
			28.10	34	37,976	6,775	664
			44.48	29	40,896	6,968	610
			53.03	25	37,808	6,440	628
	A2	0.01	2.65	61	49,364	8,064	1,485
			15.45	45	46,267	7,428	935
			27.47	34	36,206	5,998	586
			43.85	33	37,688	6,408	493
			52.4	29	36,002	6,076	392
	A3	0.05	2.13	70	51,097	7,995	1,615
			14.93	40	40,936	5,840	808
			26.95	30	26,115	4,410	330
			43.33	19	16,655	3,603	140
			51.88	17	14,896	3,265	119
	A4	0.1	1.68	78	53,128	9,565	1,647
			14.48	43	34,184	5,109	464
			26.5	36	20,660	3,937	157
			42.88	19	10,877	2,696	36
			51.43	16	8,955	2,125	46
Persulfate + Hydroxide	B1	0	5.62	67	50,881	8,853	1,868
			18.42	38	44,199	7,138	970
			30.43	32	38,632	6,961	693
			46.82	29	39,488	7,178	633
			55.38	24	37,412	6,903	602
	B2	0.01	5.05	70	49,665	8,774	1,834
			17.85	37	37,136	6,122	729
			29.87	27	28,573	4,870	425
			46.25	25	27,995	4,529	322
			54.82	21	25,094	3,857	323
	B3	0.05	4.53	66	48,451	8,417	1,568
			17.33	29	27,357	3,911	334
			29.35	19	15,333	1,929	112
			45.73	13	7,601	833	25
			54.3	10	5,467	513	39
	B4	0.1	4.02	58	45,917	7,064	1,363
			16.82	32	20,270	2,487	183
			28.83	19	7,671	882	40
			45.22	9	1,964	177	8
			53.78	7	2,010	159	13

Appendix B

Appendix B: Summary of Metals and Bromate Results

	Persulfate + Bicarbonate				Persulfate + Hydroxide			
	A1		A4		B1		B2	
Analyte	ug/L		ug/L		ug/L		ug/L	
Chromium VI	0.4	J	0.3	U	0.4	J	0.3	U
Bromate	100	iU	42800		100	iU	100	iU
Aluminum	14.6		325		16.5		45.5	
Antimony	3	U	15	iU	3	U	3	U
Arsenic	4	U	72		4	U	4.3	J
Barium	209		1460		183		329	
Beryllium	0.09	U	0.45	iU	0.09	U	0.09	U
Cadmium	0.3	U	1.5	iU	0.3	U	0.3	U
Calcium	143000		16800		141000		191000	
Chromium	0.6	U	65		0.6	U	62.6	
Cobalt	1.3		15		1.3		2	
Copper	3.1		102		4		1	J
Iron	7.8	J	3330		5	J	11.8	
Lead	4	U	20	iU	4	U	4	U
Magnesium	17100		28500		16200		21500	
Manganese	390		19		405		0.2	J
Mercury	0.02	U	0.02	iU	0.02	U	0.02	U
Nickel	19.6		11		21.3		2.6	
Potassium	10800		56600		10700		50700	
Selenium	5	U	25	iU	5	U	12.8	J
Silver	0.7	U	3.5	iU	0.7	U	0.7	U
Sodium	142000		37100000		148000		22200000	
Thallium	2	U	10	iU	2	U	2	U
Vanadium	2.5		85		3.3		1.6	J
Zinc	7.2		35		4		9.1	

Flags:

J	The result is an estimated value
U	Non-detect at or above the MRL/MDL
i	The MRL/MDL is elevated due to a matrix interference or necessary sample dilution.

Note: All samples taken at end of experimental period

LABORATORY REPORT

November 16, 2011

Diane Nelson
Camp Dresser & McKee, Incorporated (CDM)
14432 SE Eastgate Way, Suite 100
Bellevue, WA 98007

RE: Olean / 88146.TSK2.Bench

Dear Diane:

Enclosed are the results of the samples submitted to our laboratory on November 11, 2011. For your reference, these analyses have been assigned our service request number P1104402.

All analyses were performed according to our laboratory's NELAP and DoD-ELAP-approved quality assurance program. The test results meet requirements of the current NELAP and DoD-ELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP and DoD-ELAP-accredited analytes, refer to the certifications section at www.caslab.com. Results are intended to be considered in their entirety and apply only to the samples analyzed and reported herein.

Columbia Analytical Services, Inc. is certified by the California Department of Health Services, NELAP Laboratory Certificate No. 02115CA; Arizona Department of Health Services, Certificate No. AZ0694; Florida Department of Health, NELAP Certification E871020; New Jersey Department of Environmental Protection, NELAP Laboratory Certification ID #CA009; New York State Department of Health, NELAP NY Lab ID No: 11221; Oregon Environmental Laboratory Accreditation Program, NELAP ID: CA20007; The American Industrial Hygiene Association, Laboratory #101661; United States Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP), Certificate No. L10-3-R2; Pennsylvania Registration No. 68-03307; TX Commission of Environmental Quality, NELAP ID T104704413-11-2; Minnesota Department of Health, NELAP Certificate No. 219474; Washington State Department of Ecology, ELAP Lab ID: C946. Each of the certifications listed above have an explicit Scope of Accreditation that applies to specific matrices/methods/analytes; therefore, please contact me for information corresponding to a particular certification.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

Columbia Analytical Services, Inc.

Sue Anderson

Digitally Signed By Sue Anderson at 1:56 pm, Nov 16, 2011

Sue Anderson
Project Manager

Client:	Camp Dresser & McKee, Incorporated (CDM)	CAS Project No:	P1104402
Project:	Olean / 88146.TSK2.Bench		

CASE NARRATIVE

The samples were received intact under chain of custody on November 11, 2011 and were stored in accordance with the analytical method requirements. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the samples at the time of sample receipt.

Hexavalent Chromium Analysis

The samples were analyzed for hexavalent chromium in accordance with EPA Method 7199 and analyzed by Ion Chromatography.

Due to limited sample volume submitted the samples were diluted prior to analysis; therefore, the reporting limits have been elevated accordingly.

The results of analyses are given in the attached laboratory report. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for utilization of less than the complete report.

Use of Columbia Analytical Services, Inc. (CAS) Name. Client shall not use CAS's name or trademark in any marketing or reporting materials, press releases or in any other manner ("Materials") whatsoever and shall not attribute to CAS any test result, tolerance or specification derived from CAS's data ("Attribution") without CAS's prior written consent, which may be withheld by CAS for any reason in its sole discretion. To request CAS's consent, Client shall provide copies of the proposed Materials or Attribution and describe in writing Client's proposed use of such Materials or Attribution. If CAS has not provided written approval of the Materials or Attribution within ten (10) days of receipt from Client, Client's request to use CAS's name or trademark in any Materials or Attribution shall be deemed denied. CAS may, in its discretion, reasonably charge Client for its time in reviewing Materials or Attribution requests. Client acknowledges and agrees that the unauthorized use of CAS's name or trademark may cause CAS to incur irreparable harm for which the recovery of money damages will be inadequate. Accordingly, Client acknowledges and agrees that a violation shall justify preliminary injunctive relief. For questions contact the laboratory.

DETAIL SUMMARY REPORT

Client: Camp Dresser & McKee, Incorporated (CDM) Service Request: P1104402
Project ID: Olean / 88146.TSK2.Bench

Date Received: 11/11/2011
Time Received: 08:00

Client Sample ID	Lab Code	Matrix	Date Collected	Time Collected	7199 - Cr6
A1	P1104402-001	Water	11/10/2011	15:33	X
B1	P1104402-002	Water	11/10/2011	15:15	X
A4	P1104402-003	Water	11/10/2011	15:30	X
B4	P1104402-004	Water	11/10/2011	15:22	X

Columbia Analytical Services

2655 Park Center Drive, Suite A
Simi Valley, California 93065
Phone (805) 526-7161
Fax (805) 526-7270

Air - Chain of Custody Record & Analytical Service Request

Page 1 of 1

Requested Turnaround Time in Business Days (Surcharges) please circle
1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day-Standard

CAS Project No. P1104402

CAS Contact:

Company Name & Address (Reporting Information): CDM, 14432 SE Eastgate Way Ste100, Bellevue WA 98007

Project Manager: Pat Evans

Phone: 425-519-8300

Fax:

Email Address for Result Reporting: nelsenda@cdm.com

Project Name: Olean

Project Number: 88146. TSK2. Bench

P.O. # / Billing Information: PO: 20111110 ~~DAH~~ DAN

Sampler (Print & Sign): Diane Nelsen Diane Nelsen

Analysis Method: 7199 CrVI

Client Sample ID	Laboratory ID Number	Date Collected	Time Collected	Canister ID (Bar code # - AC, SC, etc.)	Flow Controller ID (Bar code # - FC #)	Canister Start Pressure "Hg	Canister End Pressure "Hg/psig	Sample Volume	7199 CrVI		Comments e.g. Actual Preservative or specific instructions
A1	N/A	11/10/11	1533					10mL	X		filtered/
B1	↓	↓	1515					↓	X		not buffered
A4	↓	↓	1530					↓	X		↓
B4	↓	↓	1522					↓	X		↓

Report Tier Levels - please select
Tier I - Results (Default if not specified) ____
Tier II (Results + QC Summaries) X
Tier III (Results + QC & Calibration Summaries) ____
Tier IV (Data Validation Package) 10% Surcharge ____

EDD required Yes / No
Type: ____

Project Requirements (MRLs, QAPP)

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:	
Diane Nelsen	11/10/11	15:47	[signature]	11/11/11	0800	belTre
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:	Cooler / Blank Temperature 5.0°C

COC AIR REV 3-11

Columbia Analytical Services INC 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 | 805.526.7161 | www.caslab.com

Sample Acceptance Check Form

Client: Camp Dresser & McKee, Incorporated (CDM) Work order: P1104402

Project: Olean / 88146.TSK2.Bench

Sample(s) received on: 11/11/11 Date opened: 11/11/11 by: MZAMORA

Note: This form is used for all samples received by CAS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client and/or as required by the method/SOP.

#	Question	Yes	No	N/A
1	Were **sample containers** properly marked with client sample ID?	☒	☐	☐
2	Container(s) **supplied by CAS**?	☒	☐	☐
3	Did **sample containers** arrive in good condition?	☒	☐	☐
4	Were **chain-of-custody** papers used and filled out?	☒	☐	☐
5	Did **sample container labels** and/or tags agree with custody papers?	☒	☐	☐
6	Was **sample volume** received adequate for analysis?	☒	☐	☐
7	Are samples within specified holding times?	☒	☐	☐
8	Was proper **temperature** (thermal preservation) of cooler at receipt adhered to?	☒	☐	☐
	Cooler Temperature: ° C Blank Temperature: 5° C **Gel Packs**			
9	Was a **trip blank** received?	☐	☐	☒
10	Were **custody seals** on outside of cooler/Box?	☒	☐	☐
	Location of seal(s)? Top of cooler, down the front. Sealing Lid?	☒	☐	☐
	Were signature and date included?	☒	☐	☐
	Were seals intact?	☒	☐	☐
	Were custody seals on outside of sample container?	☐	☒	☐
	Location of seal(s)? Sealing Lid?	☐	☐	☒
	Were signature and date included?	☐	☐	☒
	Were seals intact?	☐	☐	☒
11	Do containers have appropriate **preservation**, according to method/SOP or Client specified information?	☒	☐	☐
	Is there a client indication that the submitted samples are **pH** preserved?	☐	☐	☒
	Were **VOA vials** checked for presence/absence of air bubbles?	☐	☐	☒
	Does the client/method/SOP require that the analyst check the sample pH and if necessary alter it?	☐	☐	☒
12	**Tubes:** Are the tubes capped and intact?	☐	☐	☒
	Do they contain moisture?	☐	☐	☒
13	**Badges:** Are the badges properly capped and intact?	☐	☐	☒
	Are dual bed badges separated and individually capped and intact?	☐	☐	☒

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P1104402-001.01	125mL Plastic NP					
P1104402-002.01	125mL Plastic NP					
P1104402-003.01	125mL Plastic NP					
P1104402-004.01	125mL Plastic NP					

Explain any discrepancies: (include lab sample ID numbers):

Each bottle contains very limited sample volume.

RSK - MEEPP, HCL (pH<2); RSK - CO2, (pH 5-8); Sulfur (pH>4)

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client : Camp Dresser & McKee, Incorporated (CDM)
Project Name : Olean
Project Number : 88146.TSK2.Bench
Sample Matrix : WATER

Service Request : P1104402
Date Collected : 11/10/11
Date Received : 11/11/11

Chromium, Hexavalent

Prep Method : None
Analysis Method : 7199
Test Notes :

Units : ug/L (ppb)
Basis : NA

Sample Name	Lab Code	PQL	MDL	Dilution Factor	Date Extracted	Date/Time Analyzed	Result	Result Notes
A1	P1104402-001	1.0	0.3	10	NA	11/11/11 13:50	0.4	J
B1	P1104402-002	1.0	0.3	10	NA	11/11/11 14:03	0.4	J
A4	P1104402-003	1.0	0.3	10	NA	11/11/11 14:17	ND	
B4	P1104402-004	1.0	0.3	10	NA	11/11/11 14:30	ND	
Method Blank	P1104402-MB	0.10	0.03	1	NA	11/11/11 12:57	ND	

J Estimated concentration. The result is less than the PQL but greater than the MDL.

Approved By Karen Ryan Date : 11/15/11

Report By:SAnderson

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client : Camp Dresser & McKee, Incorporated (CDM)
Project Name : Olean
LCS Matrix : WATER

Service Request : P1104402
Date Collected : NA
Date Received : NA
Date Extracted : NA
Date Analyzed : 11/11/11

Laboratory Control Sample/Duplicate Laboratory Control Sample Summary
Inorganic Parameters

Sample Name : Duplicate Laboratory Control Sample
Lab Code : P1104402-LCS P1104402-DLCS

Basis : NA

Analyte	Units	Analysis Method	True Value LCS	True Value DLCS	Result LCS	Result DLCS	LCS	DLCS	CAS Acceptance Limits	Relative Percent Difference	Result Notes
Chromium, Hexavalent	ug/L (ppb)	7199	2.00	2.00	2.01	2.01	101	101	90-110	<1	

Approved By Kare Ryan Date : 11/15/11

Report By:SAnderson

Columbia Analytical Services INC

1317 S. 13th Avenue, Kelso, WA 98626 360.577.7222 360.636.1068 (fax) www.caslab.com

December 22, 2011

Analytical Report for Service Request No: K1111126
Revised Service Request No: K1111126.01

Diane Nelsen
CDM
14432 SE Eastgate Way
Suite 100
Poulsbo, WA 98370

RE: Olean/88146.TSK2.Bench

Dear Diane:

Enclosed are the revised report pages for the samples submitted to our laboratory on November 15, 2011. For your reference, these analyses have been assigned our service request number K1111126.

The Metals report has been revised to the MDL per your request.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.caslab.com. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please call if you have any questions. My extension is 3275. You may also contact me via Email at CLeaf@caslab.com.

Respectfully submitted,

Columbia Analytical Services, Inc.

C Leaf

Chris Leaf
Project Chemist

CL/lb

SR# K1111126

Columbia Analytical Services

27407 CHAIN OF CUSTODY

COC Set____of____

Page 1 OF 1 COC#________

1317 South 13th Ave, Kelso, WA 98626 | 360.577.7222 | 800.695.7222 | 360.636.1068 (fax)

Project Name: Olean
Project Number: 88146.TSK2. Bench
Project Manager: Pat Evans
Company Name: CDM
Comany Address: 14432 SE Eastgate Way Ste 100
City/State/Zip: Bellevue WA 98007
E-Mail Address: nelsenda@cdm.com
Phone #: 425-519-8300 FAX #:
Sampler Signature: Diane Nelsen

	Sample ID	Date	Time	Lab ID	Matrix	Number of Containers	300.1 / BrO3	7470A / Hg T (28D)	SM 5310 C / TOC D	6010B LL / Metals T (180D)				Remarks
1	A1	11/10/11	15:33	N/A	Water	2	X	X		X				Metals samples
2	B1	↓	15:15	↓	↓	2	X	X		X				have been filtered
3	A4	↓	15:30	↓	↓	2	X	X		X				↓
4	B4	↓	15:22	↓	↓	2	X	X		X				↓
5														
6														
7														
8														
9														
10														
11														

Report Requirements

___ I. Routine Report: Method Blank, Surrogate, as required
X II. Report Dup., MS, MSD as required
___ III. Data Validation Report (includes all raw data)
___ IV. CLP Deliverable Report
X V. EDD

Invoice Information

P.O.# 20111110 DAN
Bill To: CDM Attn Robert
14432 SE Eastgate Way Ste 100
Bellevue WA 98007

Turnaround Requirements

___ 24 hr. ___ 48 hr.
___ 5 Day
X Standard (10-15 working days)
___ Provide Fax Results

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other____(Circle One)

☐ Sample Shipment contains USDA regulated soil samples (check box if applicable)

Relinquished By:		Received By:		Relinquished By:		Received By:	
Signature: Diane Nelsen	Date/Time: 11/14/11/1600	Signature: Brad Tobin	Date/Time: 11/15/11 920	Signature:	Date/Time:	Signature:	Date/Time:
Printed Name: Diane Nelsen	Firm: CDM	Printed Name: Brad Tobin	Firm: CAS	Printed Name:	Firm:	Printed Name:	Firm:

PC CV

Columbia Analytical Services, Inc.
Cooler Receipt and Preservation Form

Client / Project: CDM Service Request K11 11124

Received: 11/15/11 Opened: 11/15/11 By: BT Unloaded: 11/15/11 By: BT

1. Samples were received via? *Mail* ***Fed Ex*** *UPS* *DHL* *PDX* *Courier* *Hand Delivered*
2. Samples were received in: (circle) ***Cooler*** *Box* *Envelope* *Other* ______ *NA*
3. Were custody seals on coolers? NA **Y** N If yes, how many and where? 1F 1B

   If present, were custody seals intact? **Y** N If present, were they signed and dated? **Y** N

Cooler Temp °C	Temp Blank °C	Thermometer ID	Cooler/COC ID NA	Tracking Number NA	Filed
2.6	4.5	318			✓

7. Packing material used. *Inserts* *Baggies* ***Bubble Wrap*** ***Gel Packs*** *Wet Ice* *Sleeves* *Other* ______
8. Were custody papers properly filled out (ink, signed, etc.)? NA **Y** N
9. Did all bottles arrive in good condition (unbroken)? *Indicate in the table below.* NA **Y** N
10. Were all sample labels complete (i.e analysis, preservation, etc.)? NA **Y** N
11. Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* NA **Y** N
12. Were appropriate bottles/containers and volumes received for the tests indicated? NA **Y** N
13. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* NA Y **N**
14. Were VOA vials received without headspace? *Indicate in the table below.* **NA** Y N
15. Was C12/Res negative? **NA** Y N

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time
A4	250 mL				X	HNO3	.5mL	RE1-18-0	BT	12:25

Notes, Discrepancies, & Resolutions: ______

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client:	CDM Federal Programs Corporation	Service Request:	K1111126
Project No.:	88146.TSK2.Bench	Date Collected:	11/10/11
Project Name:	Olean	Date Received:	11/15/11
Matrix:	WATER	Units:	ug/L
		Basis:	NA

Sample Name: A1 Lab Code: K1111126-001DISS

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6010B	2.00	0.50	1.0	11/21/11	12/01/11	14.6		X
Antimony	6010B	10.0	3.0	1.0	11/21/11	11/30/11	3.0	U	
Arsenic	6010B	10.0	4.0	1.0	11/21/11	11/30/11	4.0	U	
Barium	6010B	2.0	0.4	1.0	11/21/11	11/30/11	209		
Beryllium	6010B	0.20	0.09	1.0	11/21/11	11/30/11	0.09	U	
Cadmium	6010B	0.5	0.3	1.0	11/21/11	11/30/11	0.3	U	
Calcium	6010B	50.0	6.0	1.0	11/21/11	11/30/11	143000		
Chromium	6010B	2.0	0.6	1.0	11/21/11	11/30/11	0.6	U	
Cobalt	6010B	1.0	0.4	1.0	11/21/11	11/30/11	1.3		
Copper	6010B	2.0	0.8	1.0	11/21/11	11/30/11	3.1		
Iron	6010B	10.0	3.0	1.0	11/21/11	12/01/11	7.8	J	
Lead	6010B	10.0	4.0	1.0	11/21/11	11/30/11	4.0	U	
Magnesium	6010B	20.0	2.0	1.0	11/21/11	11/30/11	17100		
Manganese	6010B	0.6	0.2	1.0	11/21/11	11/30/11	390		
Mercury	7470A	0.20	0.02	1.0	11/16/11	11/17/11	0.02	U	
Nickel	6010B	2.0	0.7	1.0	11/21/11	11/30/11	19.6		
Potassium	6010B	100	50.0	1.0	11/21/11	11/30/11	10800		
Selenium	6010B	20.0	5.0	1.0	11/21/11	11/30/11	5.0	U	
Silver	6010B	2.0	0.7	1.0	11/21/11	11/30/11	0.7	U	
Sodium	6010B	200	20.0	1.0	11/21/11	11/30/11	142000		
Thallium	6010B	10.0	2.0	1.0	11/21/11	11/30/11	2.0	U	
Vanadium	6010B	2.0	1.0	1.0	11/21/11	11/30/11	2.5		
Zinc	6010B	2.00	0.70	1.0	11/21/11	11/30/11	7.20		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client:	CDM Federal Programs Corporation	**Service Request:**	K1111126
Project No.:	88146.TSK2.Bench	**Date Collected:**	11/10/11
Project Name:	Olean	**Date Received:**	11/15/11
Matrix:	WATER	**Units:**	ug/L
		Basis:	NA

Sample Name: B1 **Lab Code:** K1111126-002DISS

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6010B	2.00	0.50	1.0	11/21/11	12/01/11	16.5		X
Antimony	6010B	10.0	3.0	1.0	11/21/11	11/30/11	3.0	U	
Arsenic	6010B	10.0	4.0	1.0	11/21/11	11/30/11	4.0	U	
Barium	6010B	2.0	0.4	1.0	11/21/11	11/30/11	183		
Beryllium	6010B	0.20	0.09	1.0	11/21/11	11/30/11	0.09	U	
Cadmium	6010B	0.5	0.3	1.0	11/21/11	11/30/11	0.3	U	
Calcium	6010B	50.0	6.0	1.0	11/21/11	11/30/11	141000		
Chromium	6010B	2.0	0.6	1.0	11/21/11	11/30/11	0.6	U	
Cobalt	6010B	1.0	0.4	1.0	11/21/11	11/30/11	1.3		
Copper	6010B	2.0	0.8	1.0	11/21/11	11/30/11	4.0		
Iron	6010B	10.0	3.0	1.0	11/21/11	12/01/11	5.0	J	
Lead	6010B	10.0	4.0	1.0	11/21/11	11/30/11	4.0	U	
Magnesium	6010B	20.0	2.0	1.0	11/21/11	11/30/11	16200		
Manganese	6010B	0.6	0.2	1.0	11/21/11	11/30/11	405		
Mercury	7470A	0.20	0.02	1.0	11/16/11	11/17/11	0.02	U	
Nickel	6010B	2.0	0.7	1.0	11/21/11	11/30/11	21.3		
Potassium	6010B	100	50.0	1.0	11/21/11	11/30/11	10700		
Selenium	6010B	20.0	5.0	1.0	11/21/11	11/30/11	5.0	U	
Silver	6010B	2.0	0.7	1.0	11/21/11	11/30/11	0.7	U	
Sodium	6010B	200	20.0	1.0	11/21/11	11/30/11	148000		
Thallium	6010B	10.0	2.0	1.0	11/21/11	11/30/11	2.0	U	
Vanadium	6010B	2.0	1.0	1.0	11/21/11	11/30/11	3.3		
Zinc	6010B	2.00	0.70	1.0	11/21/11	11/30/11	4.00		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client:	CDM Federal Programs Corporation	Service Request:	K1111126
Project No.:	88146.TSK2.Bench	Date Collected:	11/10/11
Project Name:	Olean	Date Received:	11/15/11
Matrix:	WATER	Units:	ug/L
		Basis:	NA

Sample Name: A4 Lab Code: K1111126-003DISS

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6010B	8.96	2.24	1.0	11/21/11	12/01/11	325		
Antimony	6010B	50.0	15.0	1.0	11/21/11	11/30/11	15.0	U	
Arsenic	6010B	50.0	20.0	1.0	11/21/11	11/30/11	72.0		
Barium	6010B	10.0	2.0	1.0	11/21/11	11/30/11	1460		
Beryllium	6010B	1.00	0.45	1.0	11/21/11	11/30/11	0.45	U	
Cadmium	6010B	2.5	1.5	1.0	11/21/11	11/30/11	1.5	U	
Calcium	6010B	250	30.0	1.0	11/21/11	11/30/11	16800		
Chromium	6010B	10.0	3.0	1.0	11/21/11	11/30/11	65.0		
Cobalt	6010B	5.0	2.0	1.0	11/21/11	11/30/11	15.0		
Copper	6010B	10.0	4.0	1.0	11/21/11	11/30/11	102		
Iron	6010B	44.8	13.4	1.0	11/21/11	12/01/11	3330		
Lead	6010B	50.0	20.0	1.0	11/21/11	11/30/11	20.0	U	
Magnesium	6010B	100	10.0	1.0	11/21/11	11/30/11	28500		
Manganese	6010B	3.0	1.0	1.0	11/21/11	11/30/11	19.0		
Mercury	7470A	0.20	0.02	1.0	11/16/11	11/17/11	0.02	U	
Nickel	6010B	10.0	3.5	1.0	11/21/11	11/30/11	11.0		
Potassium	6010B	500	250	1.0	11/21/11	11/30/11	56600		
Selenium	6010B	100	25.0	1.0	11/21/11	11/30/11	25.0	U	
Silver	6010B	10.0	3.5	1.0	11/21/11	11/30/11	3.5	U	
Sodium	6010B	100000	10000	100.0	11/21/11	11/30/11	37100000		
Thallium	6010B	50.0	10.0	1.0	11/21/11	11/30/11	10.0	U	
Vanadium	6010B	10.0	5.0	1.0	11/21/11	11/30/11	85.0		
Zinc	6010B	10.0	3.50	1.0	11/21/11	11/30/11	35.0		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client:	CDM Federal Programs Corporation	Service Request:	K1111126
Project No.:	88146.TSK2.Bench	Date Collected:	11/10/11
Project Name:	Olean	Date Received:	11/15/11
Matrix:	WATER	Units:	ug/L
		Basis:	NA

Sample Name: B4 Lab Code: K1111126-004DISS

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6010B	2.00	0.50	1.0	11/21/11	12/01/11	45.5		X
Antimony	6010B	10.0	3.0	1.0	11/21/11	11/30/11	3.0	U	
Arsenic	6010B	10.0	4.0	1.0	11/21/11	11/30/11	4.3	J	
Barium	6010B	2.0	0.4	1.0	11/21/11	11/30/11	329		
Beryllium	6010B	0.20	0.09	1.0	11/21/11	11/30/11	0.09	U	
Cadmium	6010B	0.5	0.3	1.0	11/21/11	11/30/11	0.3	U	
Calcium	6010B	50.0	6.0	1.0	11/21/11	11/30/11	191000		
Chromium	6010B	2.0	0.6	1.0	11/21/11	11/30/11	62.6		
Cobalt	6010B	1.0	0.4	1.0	11/21/11	11/30/11	2.0		
Copper	6010B	2.0	0.8	1.0	11/21/11	11/30/11	1.0	J	
Iron	6010B	10.0	3.0	1.0	11/21/11	12/01/11	11.8		
Lead	6010B	10.0	4.0	1.0	11/21/11	11/30/11	4.0	U	
Magnesium	6010B	20.0	2.0	1.0	11/21/11	11/30/11	21500		
Manganese	6010B	0.6	0.2	1.0	11/21/11	11/30/11	0.2	J	
Mercury	7470A	0.20	0.02	1.0	11/16/11	11/17/11	0.02	U	
Nickel	6010B	2.0	0.7	1.0	11/21/11	11/30/11	2.6		
Potassium	6010B	100	50.0	1.0	11/21/11	11/30/11	50700		
Selenium	6010B	20.0	5.0	1.0	11/21/11	11/30/11	12.8	J	
Silver	6010B	2.0	0.7	1.0	11/21/11	11/30/11	0.7	U	
Sodium	6010B	20000	2000	100.0	11/21/11	11/30/11	22200000		
Thallium	6010B	10.0	2.0	1.0	11/21/11	11/30/11	2.0	U	
Vanadium	6010B	2.0	1.0	1.0	11/21/11	11/30/11	1.6	J	
Zinc	6010B	2.00	0.70	1.0	11/21/11	11/30/11	9.10		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: CDM Federal Programs Corporation
Service Request: K1111126
Project No.: 88146.TSK2.Bench
Date Collected:
Project Name: Olean
Date Received:
Matrix: WATER
Units: ug/L
Basis: NA

Sample Name: Method Blank 1 **Lab Code:** K1111126-MB1

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6010B	2.00	0.50	1.0	11/21/11	12/01/11	3.70		
Antimony	6010B	10.0	3.0	1.0	11/21/11	11/30/11	3.0	U	
Arsenic	6010B	10.0	4.0	1.0	11/21/11	11/30/11	4.0	U	
Barium	6010B	2.0	0.4	1.0	11/21/11	11/30/11	0.4	U	
Beryllium	6010B	0.20	0.09	1.0	11/21/11	11/30/11	0.09	U	
Cadmium	6010B	0.5	0.3	1.0	11/21/11	11/30/11	0.3	U	
Calcium	6010B	50.0	6.0	1.0	11/21/11	11/30/11	16.2	J	
Chromium	6010B	2.0	0.6	1.0	11/21/11	11/30/11	0.6	U	
Cobalt	6010B	1.0	0.4	1.0	11/21/11	11/30/11	0.4	U	
Copper	6010B	2.0	0.8	1.0	11/21/11	11/30/11	1.9	J	
Iron	6010B	10.0	3.0	1.0	11/21/11	12/01/11	3.0	U	
Lead	6010B	10.0	4.0	1.0	11/21/11	11/30/11	4.0	U	
Magnesium	6010B	20.0	2.0	1.0	11/21/11	11/30/11	2.5	J	
Manganese	6010B	0.6	0.2	1.0	11/21/11	11/30/11	0.2	U	
Mercury	7470A	0.20	0.02	1.0	11/16/11	11/17/11	0.02	U	
Nickel	6010B	2.0	0.7	1.0	11/21/11	11/30/11	0.7	U	
Potassium	6010B	100	50.0	1.0	11/21/11	11/30/11	50.0	U	
Selenium	6010B	20.0	5.0	1.0	11/21/11	11/30/11	5.0	U	
Silver	6010B	2.0	0.7	1.0	11/21/11	11/30/11	0.7	U	
Sodium	6010B	200	20.0	1.0	11/21/11	11/30/11	20.0	U	
Thallium	6010B	10.0	2.0	1.0	11/21/11	11/30/11	2.0	U	
Vanadium	6010B	2.0	1.0	1.0	11/21/11	11/30/11	1.0	U	
Zinc	6010B	2.00	0.70	1.0	11/21/11	11/30/11	0.70	U	

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client:	CDM Federal Programs Corporation	**Service Request:**	K1111126
Project No.:	88146.TSK2.Bench	**Date Collected:**	
Project Name:	Olean	**Date Received:**	
Matrix:	WATER	**Units:**	ug/L
		Basis:	NA

Sample Name: Method Blank 2 **Lab Code:** K1111126-MB2

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6010B	2.00	0.50	1.0	11/21/11	12/01/11	0.90	J	
Antimony	6010B	10.0	3.0	1.0	11/21/11	11/30/11	3.0	U	
Arsenic	6010B	10.0	4.0	1.0	11/21/11	11/30/11	4.0	U	
Barium	6010B	2.0	0.4	1.0	11/21/11	11/30/11	0.4	U	
Beryllium	6010B	0.20	0.09	1.0	11/21/11	11/30/11	0.09	U	
Cadmium	6010B	0.5	0.3	1.0	11/21/11	11/30/11	0.3	U	
Calcium	6010B	50.0	6.0	1.0	11/21/11	11/30/11	9.7	J	
Chromium	6010B	2.0	0.6	1.0	11/21/11	11/30/11	0.6	U	
Cobalt	6010B	1.0	0.4	1.0	11/21/11	11/30/11	0.4	U	
Copper	6010B	2.0	0.8	1.0	11/21/11	11/30/11	1.0	J	
Iron	6010B	10.0	3.0	1.0	11/21/11	12/01/11	3.0	U	
Lead	6010B	10.0	4.0	1.0	11/21/11	11/30/11	4.0	U	
Magnesium	6010B	20.0	2.0	1.0	11/21/11	11/30/11	2.0	J	
Manganese	6010B	0.6	0.2	1.0	11/21/11	11/30/11	0.2	U	
Nickel	6010B	2.0	0.7	1.0	11/21/11	11/30/11	0.7	U	
Potassium	6010B	100	50.0	1.0	11/21/11	11/30/11	50.5	J	
Selenium	6010B	20.0	5.0	1.0	11/21/11	11/30/11	5.0	U	
Silver	6010B	2.0	0.7	1.0	11/21/11	11/30/11	0.7	U	
Sodium	6010B	200	20.0	1.0	11/21/11	11/30/11	103	J	
Thallium	6010B	10.0	2.0	1.0	11/21/11	11/30/11	2.0	U	
Vanadium	6010B	2.0	1.0	1.0	11/21/11	11/30/11	1.0	U	
Zinc	6010B	2.00	0.70	1.0	11/21/11	11/30/11	0.70	U	

Comments:

Metals
- 5A -

SPIKE SAMPLE RECOVERY

Client: CDM Federal Programs Corporation | **Service Request:** K1111126

Project No.: 88146.TSK2.Bench | **Units:** UG/L

Project Name: Olean | **Basis:** NA

Matrix: WATER | **% Solids:** 0.0

Sample Name: A1S | **Lab Code:** K1111126-001DISSS

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Mercury	76 - 126	0.94		0.02	U	1.00	94.0		7470A

An empty field in the Control Limit column indicates the control limit is not applicable

Metals

- 5A -

SPIKE SAMPLE RECOVERY

Client: CDM Federal Programs Corporation **Service Request:** K1111126

Project No.: 88146.TSK2.Bench **Units:** UG/L

Project Name: Olean **Basis:** NA

Matrix: WATER **% Solids:** 0.0

Sample Name: Batch QC1S **Lab Code:** K1111260-001S

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Aluminum	79 - 125	2500		344		2000.00	107.8		6010B
Antimony	86 - 116	485		3.0	U	500.00	97.0		6010B
Arsenic	79 - 121	998		4.0	U	1000.00	99.8		6010B
Barium	80 - 124	2140		16.4		2000.00	106.2		6010B
Beryllium	87 - 114	49.7		0.09	U	50.00	99.4		6010B
Cadmium	71 - 142	51.1		0.3	U	50.00	102.2		6010B
Calcium	75 - 125	13100		2460		10000.00	106.4		6010B
Chromium	89 - 117	215		2.8		200.00	106.1		6010B
Cobalt	88 - 117	493		0.4	U	500.00	98.6		6010B
Copper	86 - 113	251		8.2		250.00	97.1		6010B
Iron	72 - 131	1760		642		1000.00	111.8		6010B
Lead	75 - 130	515		8.8	J	500.00	101.2		6010B
Magnesium	75 - 125	9890		403		10000.00	94.9		6010B
Manganese	77 - 113	549		15.9		500.00	106.6		6010B
Nickel	86 - 120	511		1.1	J	500.00	102.0		6010B
Potassium	75 - 125	10400		282		10000.00	101.2		6010B
Selenium	82 - 119	974		5.0	U	1000.00	97.4		6010B
Silver	79 - 120	49.6		0.7	U	50.00	99.2		6010B
Sodium	75 - 125	12600		2990		10000.00	96.1		6010B
Thallium	75 - 125	977		2.0	U	1000.00	97.7		6010B
Vanadium	89 - 115	558		1.8	J	500.00	111.2		6010B
Zinc	77 - 112	665		168		500.00	99.4		6010B

An empty field in the Control Limit column indicates the control limit is not applicable

Metals

- 6 -

DUPLICATES

Client: CDM Federal Programs Corporation **Service Request:** K1111126

Project No.: 88146.TSK2.Bench **Units:** UG/L

Project Name: Olean **Basis:** NA

Matrix: WATER **% Solids:** 0.0

Sample Name: A1D **Lab Code:** K1111126-001DISSD

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Mercury		0.0	U	0.0	U			7470A

An empty field in the Control Limit column indicates the control limit is not applicable.

Form VI - IN

Metals
- 6 -
DUPLICATES

Client: CDM Federal Programs Corporation | **Service Request:** K1111126

Project No.: 88146.TSK2.Bench | **Units:** UG/L

Project Name: Olean | **Basis:** NA

Matrix: WATER | **% Solids:** 0.0

Sample Name: Batch QC1D | **Lab Code:** K1111260-001D

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Aluminum	20	344		371		7.6		6010B
Antimony		3	U	3	U			6010B
Arsenic		4	U	4	U			6010B
Barium	20	16.4		16.9		3.0		6010B
Beryllium		0.1	U	0.1	U			6010B
Cadmium		0.3	U	0.3	J	200.0		6010B
Calcium	20	2460		2540		3.2		6010B
Chromium		2.8		2.7		3.6		6010B
Cobalt		0.4	U	0.4	U			6010B
Copper		8.2		8.2		0.0		6010B
Iron	20	642		709		9.9		6010B
Lead		9	J	9	J	0.0		6010B
Magnesium	20	403		414		2.7		6010B
Manganese	20	15.9		16.6		4.3		6010B
Nickel		1.1	J	1.2	J	8.7		6010B
Potassium		282		353		22.4		6010B
Selenium		5	U	5	U			6010B
Silver		0.7	U	0.7	U			6010B
Sodium	20	2990		3070		2.6		6010B
Thallium		2	U	2	U			6010B
Vanadium		1.8	J	1.3	J	32.3		6010B
Zinc	20	168		173		2.9		6010B

An empty field in the Control Limit column indicates the control limit is not applicable.

Appendix C

Appendix C: Summary of pH and Sulfate Results

Test	Condition	Persulfate Concentration	Time (hours)	pH	Sulfate (mg/L)
Persulfate + Bicarbonate	A1	0%	3.28	7.70	30
			16.08	7.57	35
			28.10	7.50	30
			44.48	7.49	45
			53.03	7.70	45
	A2	1%	2.65	7.55	65
			15.45	7.87	195
			27.47	7.78	250
			43.85	7.73	320
			52.4	7.74	340
	A3	5%	2.13	7.63	0
			14.93	8.04	5
			26.95	7.97	5
			43.33	7.95	15
			51.88	7.92	10
	A4	10%	1.68	7.42	15
			14.48	7.90	0
			26.5	7.87	15
			42.88	7.88	15
			51.43	8.01	170
Persulfate + Hydroxide	B1	0%	5.62	8.14	30
			18.42	7.67	40
			30.43	7.67	40
			46.82	7.38	50
			55.38	7.78	40
	B2	1%	5.05	10.29	95
			17.85	8.84	200
			29.87	8.41	240
			46.25	7.87	240
			54.82	7.97	280
	B3	5%	4.53	10.22	315
			17.33	8.71	490
			29.35	8.11	550
			45.73	7.65	700
			54.3	7.59	750
	B4	10%	4.02	10.41	600
			16.82	8.48	850
			28.83	7.89	1050
			45.22	7.43	1250
			53.78	7.43	1400

cdmsmith.com

Appendix E

Groundwater Characterization for Evaluation of Natural Attenuation

Groundwater Characterization for Evaluation of Natural Attenuation as a Remedial Alternative

FOR THE

ALCAS CUTLERY CORPORATION FACILITY SITE
OLEAN, NEW YORK

Prepared for

ALCOA, Inc.

Alcoa, Tennessee

January 31, 2013

Prepared by

ENI Engineering, LLC
Houston, Texas

Contents

List of Tables

List of Figures

1.0 Introduction

Groundwater at the Alcas facility has been impacted by historic operations where Trichloroethene ("TCE") and its degradation products, have migrated to the Superfund Site's Upper Aquifer (*hereinafter referred to as the "Upper Aquitard or UA"*) and Lower Aquifer (*hereinafter referred to as the "City Aquifer*"). Targeted daughter, or degradation, products for TCE include cis-1,2-dichloroethene ("*cDCE*") and vinyl chloride ("*VC*"). Tetrachloroethene ("*PCE*"), a parent product for TCE, has also been detected at the Site and is most likely derived from a commercial grade fraction of the TCE solvent.

A site-specific determination was made to analyze natural attenuation as a sufficient remedial technology. Natural attenuation in groundwater results from several attenuation mechanisms that include sorption, dispersion, dilution, volatilization, and biodegradation. As part of the FFS data collection initiative, additional water quality and geochemical samples were collected in December 2011 to better understand the interactions between chlorinated volatile organic compounds, natural existing carbon, and inorganic electron acceptors at the Site. For the purposes of this study, natural attenuation was evaluated for the UWBZ and the Upper City Aquifer.

1.1 Processes of Natural Attenuation

Chlorinated organic compounds may be used as electron acceptors or electron donors during biodegradation. The most common process of biodegradation of highly chlorinated solvents is through reductive dechlorination. During this process, the chlorinated hydrocarbon is used as an electron acceptor and a chlorine atom is removed and replaced with a hydrogen atom sequentially from PCE to TCE to DCE to VC to ethene. An electron donor is required to facilitate this reaction in the form of naturally existing organic carbon or anthropogenic carbon. In this process, the availability of other electron acceptors, DO, Nitrate, Iron (III), and Sulfate plays an important role as they compete with chlorinated organic compounds for reduction. Reductive dechlorination has been demonstrated under nitrate and iron reducing conditions but is most effective under sulfate reducing and methanogenic conditions.

1.2 Study Objectives

The objectives of this natural attenuation evaluation are to:

- Evaluate the water quality of the water bearing units through groundwater sampling and analysis, and
- Determine whether natural attenuation is capable of attaining site-specific remediation objectives in a reasonable time period.

2.0 Methods

Field personnel collected groundwater samples for analysis. Locations of the wells selected for groundwater sampling are shown on Figure 2-1. Any well not sampled within the last 12 months was redeveloped prior to sampling. Otherwise, a groundwater sample was collected using the EPA recommended Low Flow Sampling protocols.

All wells were sampled for TCL VOCs. Fifteen of those wells, (RU-3, RU-4, RU-6, RU-8, RU-9, UA-1, UA-2, UA-3, UA-4, UA-5, UC-1, UC-2, UC-3, UC-4 and UC-5), were also sampled for General Chemistry parameters; ethane, ethene, methane, sulfate, sulfide, chloride, alkalinity, TOC, COD, and nitrate.

2.1 Sample Collection

During the sampling event, each well was gauged from the top of casing with an electronic resistivity probe, which measures the groundwater level. The water levels were measured in all wells before any actions are performed on the well which may affect water levels. Measurements were made to a precision of +/- 0.01 ft. The measuring device was decontaminated prior to use in each well.

The majority of well in the Alcas well network had not been sampled in the prior year. These wells were redeveloped and sampled immediately following development without any additional purging. Procedures for redevelopment of the wells will follow EPA Guidance entitled Monitoring Well Development Guidelines for Superfund Project Managers.

The few monitoring wells that had been sampled in the last 12 months or been recently installed as replacement for existing damaged wells, were sampled using Low Flow Sampling protocols. Low-flow/low-stress monitoring well sampling procedures and protocols were followed as outlined in the USEPA Region II guidance document entitled “Groundwater Sampling Procedure, Low Stress (Low Flow) Purging and Sampling.” Generally, the low-flow/low-stress purging was conducted prior to sampling by evacuating groundwater at a rate of less than 500 milliliters per minute until stabilization of the field parameters occurred. Purging was conducted using a 2-inch submersible pump, which was connected to dedicated tubing in each well.

Immediately prior to sampling, field parameters were collected and recorded in the field notes. The field parameters consisted of Dissolved (“DO”), Oxidation/Reduction Potential (“ORP”), Ferrous Iron, pH, Temperature, specific conductivity (“SC”), nitrate, and turbidity.

Precautions were taken so that sampling materials did not contact the ground or other potentially contaminated surfaces. Contents were retrieved from the sampling location and placed into a clean sample container. Upon completion of the field measurements, samples were collected from the sample location for laboratory analyses, and placed in laboratory-prepared containers appropriate for the analyses. Trip and equipment blanks (not required if dedicated equipment are used), and replicate samples were collected for analyses. Each sample container was labeled with the sample number; the identity of the sampler; the time and date of collection; the preservatives (if any); and the desired analyses. All samples collected were placed into laboratory-prepared containers and preserved.

3.0 Results

Biodegradation of organic compounds brings about measurable changes in the groundwater chemistry. Those changes in COC concentration, TOC, available electron acceptors, and biodegradation indications were measured and analyzed to evaluate natural attenuation at the Site.

3.1 Volatile Organic Compounds

TCE is the predominant chlorinated volatile organic compound at the Site found in the UWBZ, UCTZ, Upper City Aquifer, and Lower City Aquifer. Detected concentrations of TCE, as shown on Figures 3-1 and 3-2, range from approximately 150,000 µg/L at RU-4 next to the Main Building to 0.6 µg/L at RU-15 at the former Bailey property. PCE, a parent product of TCE, is also found across the Site, but at much lower concentrations as shown on Figure 3-3. The presence of PCE is most likely derived from commercial grade fraction of the TCE solvent formerly used as part of the manufacturing process.

Evidence of biodegradatoin is observed with the accumulation of TCE daughter products. The two isomers of DCE were measured and it was found that cis-1,2-DCE was the prevailing intermediate observed across the Site with detected concentrations ranging from 16,000 µg/L at RU-4 to 1.1 µg/L at RU-1, as shown on Figure 3-4. Concentrations of VC were not found as widespread across the Site as compared to TCE or cis-1,2-DCE with detected concentrations ranging from 2,700 µg/L at RU-4 to 3.5 µg/L at RU-12, as shown on Figure 3-5. Volatile organic compound results are reported in Table 3-1

3.2 Total Organic Carbon (TOC)

Reductive dechlorination is described as an electron-donor-limited process. Without an electron donor source reductive dechlorination cannot occur. Total Organic Carbon (TOC) concentrations were measured from 15 locations across the Site. The concentrations ranged from 14.4 mg/L at UA-1 to non-detect (<1 mg/L) at UA-4 in the UWBZ and from 1.1 mg/L in UC-3 to 0.45 mg/L at UC-2 in the Upper City Aquifer. This concentration coincides with the City of Olean's 2011 Consumer Confidence Report that reported TOC concentrations between 0.92 mg/L to 1.7 mg/L from various City Production wells withdrawn from the City Aquifer. TOC concentrations are reported in Table 3-2.

3.3 Electron Acceptors

During biodegradation, organic carbon is used as an electron donor and dissolved oxygen is used first as the primary electron acceptor. After DO is consumed, anaerobic bacteria will utilize nitrate, ferric iron, sulfate, and carbon dioxide, in that order, as additional electron acceptors.

3.3.1 Dissolved Oxygen (DO)

Anaerobic bacteria generally cannot function at dissolved oxygen concentrations greater than 0.5 mg/L and at concentrations greater than 0.5 mg/L reductive dechlorination will not occur. DO concentrations ranged at the Site from 9.4 mg/L at RU-1 to 0.63 mg/L at UA-1 in the UWBZ and from 4.68 mg/L in Alcas D-2 to 0.8 mg/L in UC-4 in the Upper City Aquifer. The majority of

DO concentrations measured were greater than 0.5 mg/L in the UWBZ and the Upper City Aquifer. DO concentrations are reported in Table 3-3.

3.3.2 Nitrate

After DO has been depleted, anaerobic bacteria prefer to use Nitrate an electron acceptor for biodegradation of organic carbon. In order for reductive dechlorination to occur, nitrate concentrations need to be less than 1.0 mg/L. Nitrate concentrations ranged at the Site from 2.5 mg/L at RU-9 to non-detect (<0.1 mg/L) at RU-3 and UA-1 in the UWBZ and from 2.3 mg/L in UC-2 to 0.56 mg/L at UC-5 in the Upper City Aquifer. This concentration coincides with the City of Olean's 2011 Consumer Confidence Report that reported Nitrate concentrations between 0.39 mg/L to 1.32 mg/L from various City Production wells withdrawn from the City Aquifer. The majority of Nitrate concentrations measured were greater than 1.0 mg/L in the UWBZ and the Upper City Aquifer. Nitrate concentrations are reported in Table 3-2.

3.3.3 Sulfate/Sulfide

After DO and Nitrate have been depleted, sulfate will be used as the electron acceptor for anaerobic biodegradation. The process of sulfate reduction will generate sulfide. Unlike DO and Nitrate, reductive dechlorination of chlorinated organic compounds can occur under sulfate reducing conditions, but concentrations of sulfate greater than 20 mg/L may still cause a competitive exclusion to chlorinated dechlorination. Sulfate concentrations ranged at the Site from 56.6 mg/L at RU-4 to 9.3 mg/L at RU-9 in the UWBZ and from 39.9 mg/L in UC-5 to 24.0 mg/L at UC-3 in the Upper City Aquifer. The majority of Sulfate concentrations measured were greater than 20.0 mg/L in the UWBZ and the Upper City Aquifer. The City of Olean's 2011 Consumer Confidence Report reported Sulfate concentrations between 11.3 mg/L to 23.5 mg/L from various City Production wells withdrawn from the City Aquifer. Sulfide was not detected at any well across the site in the UWBZ or Upper City Aquifer. Sulfate and Sulfide concentrations are reported in Table 3-2.

3.3.4 Ferrous Iron

Ferrous Iron or Iron (II) (Fe^{+2}) will be produced when Ferric Iron (Fe^{+3}) is used as an electron acceptor during anaerobic biodegradation. Thus, ferrous Iron can be used as an indicator of biodegradation as a metabolic by-product when the ferrous iron concentration is greater than 1.0 mg/L. Ferrous Iron concentrations ranged at the Site from 1.98 mg/L at RU-12 to non-detect at several location in the UWBZ and from 1.9 mg/L in B-2 to non-detect at UC-1 and Alcas D-2 in the Upper City Aquifer. The majority of Ferrous Iron concentrations measured were less than 1.0 mg/L in the UWBZ and the Upper City Aquifer. Ferrous Iron concentrations are reported in Table 3-3.

3.3.5 Methane

Methanogenesis occurs after oxygen, nitrate, and sulfate have been depleted in the treatment zone. During methanogenesis, carbon dioxide is used as the electron acceptor and is reduced to methane. Therefore, the presence of methane in ground water is indicative of strongly reducing conditions and indicated with methane concentrations exceeding 0.5 mg/L. Methane concentrations were measured from 15 locations across the Site. The concentrations ranged from 0.9 mg/L at RU-4 to non-detect (<0.002 mg/L) at several wells in the UWBZ and from 0.0003 J mg/L at UC-3 to non-detect (<0.002 mg/L) at UC-1 and UC-2 in the Upper City Aquifer. The majority of methane concentrations measured were less than 0.5 mg/L in the UWBZ and the Upper City Aquifer. Methane concentrations are reported in Table 3-2.

3.4 Biodegradation Indicators

Biodegradation of chlorinated organic compounds alters the groundwater chemistry in the affected area. Analysis of these changes allows for a quantitative evaluation of the ongoing natural attenuation at the Site. The following paragraphs analyzes chloride alkalinity, ORP, pH, Temp, and Specific Conductivity as natural attenuation indicators.

3.4.1 Chloride

Biodegradation of chlorinated hydrocarbons releases chloride into the ground water. This results in elevated chloride concentrations in and around the contaminant plume relative to background chloride levels. Chloride concentrations were measured from 15 locations across the Site. The concentrations ranged from 566 mg/L at RU-4 to 3.2 mg/L at UA-1 and UA-3 in the UWBZ and from 165 mg/L at UC-4 to 88.1 mg/L at UC-2 in the Upper City Aquifer. In areas around the contaminant plume, chloride concentrations were observed to be less than 100 mg/L in the UWBZ and Upper City Aquifer. This concentration coincides with the City of Olean's 2011 Consumer Confidence Report that reported chloride concentrations between 35.0 mg/L to 51.2 mg/L from various City Production wells withdrawn from the City Aquifer. Chloride concentrations were observed to be greater than 100 mg/L at RU-4, RU-3, and RU-6 in the UWBZ and at UC-4 and UC-5 in the Upper City Aquifer. As illustrated on Figure 3-6, these areas are located in the heart of the contaminant plume. Chloride concentrations are reported in Table 3-2.

3.4.2 Alkalinity

Similar to chloride, a positive correlation has been noted with biodegradation and increased alkalinity. Alkalinity measured at twice the background concentration is indicative of methanogenic conditions as the generated carbon dioxide increases the alkalinity. Alkalinity concentrations were measured from 15 locations across the Site. The concentrations ranged from 352 mg/L at RU-3 to 61.3 mg/L at UA-2 in the UWBZ and from 293 mg/L at UC-3 to 184 mg/L at UC-2 in the Upper City Aquifer. In areas around the contaminant plume, alkalinity concentrations were observed to be less than 100 mg/L in the UWBZ and between 300 and 200 mg/L in the Upper City Aquifer. Alkalinity concentrations were observed to be greater than 100 mg/L at RU-4, RU-3, RU-6, RU-8, UA-1, UA-4 and UA-5 in the UWBZ. As illustrated on Figure 3-7, these areas are located in the heart of the contaminant plume in the UWBZ. Alkalinity concentrations are reported in Table 3-2.

3.4.3 ORP

The Oxidation-Reduction Potential (ORP) is a measure of electron activity and is an indicator of a solutions preference to accept or transfer electrons. The ORP is influenced by the nature of the biological availability of an electron acceptor. The ORP of groundwater may range from more than 800 mV to less than -400 mV. Generally, ORP measurements less than 50 mV indicate that reductive dechlorination is possible. ORP measurements ranged at the Site from 199.8 mV at RU-6 to -131.5 mV at RU-5 in the UWBZ and from 196.5 mV at UC-5 to 144.4 at Alcas D-2 in the Upper City Aquifer. The majority of ORP measurements were greater than 50 mV in the UWBZ and the Upper City Aquifer. ORP is reported in Table 3-3.

3.4.4 pH, Temp, and Specific Conductivity

Microbes capable of degrading chlorinated organic compounds generally prefer pH values between 6 and 8 standard units. The pH measured across the Site ranged from 7.44 to 4.7 standard units in the UWBZ and from 8.53 to 5.19 standard units in the Upper City Aquifer. The pH was me asured below 6 standard units at RU-14B, RU-16, RU-17B, and UA2 in the UWBZ. The pH was measured below 6 standard units at RU-18 and Alcas D-2 and was measured above 8 standard units at UC-1, UC-3, and UC-4 in the Upper City Aquifer. Groundwater temperature was measured across the site and ranged from 16 ^{o}C to 9 ^{o}C in the UWBZ and the Upper City Aquifer. Conductivity measures a solutions ability to conduct electricity and relates to the concentration of dissolved ions. Specific Conductivity was measured across the site and ranged from 73 µS/cm to 2773 µS/cm in the UWBZ and 375 µS/cm to 1138 µS/cm in the Upper City Aquifer. pH, temperature, and specific conductivity are reported in Table 3-3.

4.0 Conclusions

The results from the natural attenuation evaluation suggest the following conclusions:

- Evidence of biodegradation is observed with the accumulation of TCE daughter products, DCE and VC. Degradation products are observed more readily at high TCE concentration areas but are not as prevalent in areas of low TCE concentration.
- The Site does not contain sufficient electron donors, TOC, to drive dechlorination. The process is Electron donor limiting at the Site.
- The Site has a low Reducing potential based on availability of DO, Nitrate, Sulfate and ORP field measurements.
- Chloride and Alkalinity concentrations confirm that some amount of biodegradation is occurring at high TCE concentration areas.

Tables

Table 3-1
Volatile Organic Constituents
in Groundwater

Alcas Cutlery Corporation
Olean, New York

		Client Sample ID	B-1		B-2		BC-1		BC-2		BC-3		BC-4		BC-5		CW-13		CW-13A		D-2	
		Collection Date	11/29/2011 14:00		11/29/2011 18:00		12/2/2011 18:06		12/2/2011 13:45		12/2/2011 18:30		12/2/2011 12:00		12/2/2011 15:45		12/2/2011 9:10		12/1/2011 11:30		12/2/2011 8:00	
		Analysis Date	12/10/2011 13:40		12/9/2011 11:38		12/13/2011 17:45		12/13/2011 16:58		12/13/2011 18:09		12/13/2011 16:34		12/13/2011 17:22		12/14/2011 20:43		12/13/2011 3:05		12/13/2011 5:02	
		Analysis Method	8260B		8260B		8260B		8260B		8260B		8260B		8260B		8260B		8260B		8260B	
		Dilution Factor	1		20		1		1		1		1		1		1		1		1	
CAS	**Analyte**	**Unit**	**Result**		**Result**		**Result**		**Result**		**Result**		**Result**		**Result**		**Result**		**Result**		**Result**	
71-55-6	1,1,1-Trichloroethane	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	1.2	
79-34-5	1,1,2,2-Tetrachloroethane	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	0.46	J	< 1	U
79-00-5	1,1,2-Trichloroethane	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	2.4	
75-34-3	1,1-Dichloroethane	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
75-35-4	1,1-Dichloroethene	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	6.9	
120-82-1	1,2,4-Trichlorobenzene	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
96-12-8	1,2-Dibromo-3-Chloropropane	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
106-93-4	1,2-Dibromoethane	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
95-50-1	1,2-Dichlorobenzene	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
107-06-2	1,2-Dichloroethane	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
78-87-5	1,2-Dichloropropane	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
541-73-1	1,3-Dichlorobenzene	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
106-46-7	1,4-Dichlorobenzene	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
78-93-3	2-Butanone (MEK)	ug/L	< 10	U	< 200	U	< 10	U	< 10	U	< 10	U	< 10	U	< 10	U	< 10	U	< 10	U	< 10	U
591-78-6	2-Hexanone	ug/L	< 5	U	< 100	U	< 5	U	< 5	U	< 5	U	< 5	U	< 5	U	< 5	U	< 5	U	< 5	U
108-10-1	4-Methyl-2-pentanone (MIBK)	ug/L	< 5	U	< 100	U	< 5	U	< 5	U	< 5	U	< 5	U	< 5	U	< 5	U	< 5	U	< 5	U
67-64-1	Acetone	ug/L	< 10	U	< 200	U	< 10	U	< 10	U	< 10	U	< 10	U	< 10	U	3.2	J	< 10	U	< 10	U
71-43-2	Benzene	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	0.45	J
75-27-4	Bromodichloromethane	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
75-25-2	Bromoform	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
74-83-9	Bromomethane	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
75-15-0	Carbon disulfide	ug/L	< 1	U *	< 20	U *	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	1.7		< 1	U
56-23-5	Carbon tetrachloride	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
108-90-7	Chlorobenzene	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
75-00-3	Chloroethane	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	0.51	J
67-66-3	Chloroform	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	0.77	J
74-87-3	Chloromethane	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
156-59-2	cis-1,2-Dichloroethene	ug/L	< 1	U	190		< 1	U	< 1	U	< 1	U	1.3		< 1	U	< 1	U	2.9		440	D
10061-01-5	cis-1,3-Dichloropropene	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
110-82-7	Cyclohexane	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
124-48-1	Dibromochloromethane	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
75-71-8	Dichlorodifluoromethane	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
100-41-4	Ethylbenzene	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
98-82-8	Isopropylbenzene	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
79-20-9	Methyl acetate	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
1634-04-4	Methyl tert-butyl ether	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
108-87-2	Methylcyclohexane	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
75-09-2	Methylene Chloride	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
100-42-5	Styrene	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
127-18-4	Tetrachloroethene	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	0.83	J	< 1	U	< 1	U	8.7	
108-88-3	Toluene	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
156-60-5	trans-1,2-Dichloroethene	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	8.1	
10061-02-6	trans-1,3-Dichloropropene	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
79-01-6	Trichloroethene	ug/L	< 1	U	2900	D	5.5		0.98	J	< 1	U	14		5		1.5		95		16000	D
75-69-4	Trichlorofluoromethane	ug/L	< 1	U	< 20	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
75-01-4	Vinyl chloride	ug/L	< 1	U	26		< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	51	
1330-20-7	Xylenes, Total	ug/L	< 2	U	< 40	U	< 2	U	< 2	U	< 2	U	< 2	U	< 2	U	< 2	U	< 2	U	< 2	U

U - Analyzed for but not detected.
* - MS, MSD, LCS or LCSD exceeds the control limit.
J - Indicates an estimated value.
D - Result determined from Secondary Dultion Factor.
E - Compound concentration exceeds the upper level of the calibration range of the instrument.

Table 3-1
Volatile Organic Constituents
in Groundwater

Alcas Cutlery Corporation
Olean, New York

		Client Sample ID	P-1	P-2	RU-1	RU-3	RU-4	RU-5	RU-6	RU-7	RU-8	RU-9
		Collection Date	12/1/2011 16:30	12/1/2011 11:30	12/1/2011 15:00	11/30/2011 15:15	11/30/2011 16:30	12/1/2011 17:00	11/30/2011 14:00	12/1/2011 9:00	11/30/2011 9:30	11/30/2011 11:00
		Analysis Date	12/13/2011 0:44	12/13/2011 1:08	12/13/2011 2:41	12/12/2011 14:37	12/10/2011 17:23	12/13/2011 3:51	12/12/2011 14:59	12/13/2011 1:31	12/10/2011 19:14	12/12/2011 13:31
		Analysis Method	8260B	8260B	8260B	8260B	8260B	8260B	8260B	8260B	8260B	8260B
		Dilution Factor	1	1	1	4	1	1	500	1	1	1
CAS	**Analyte**	**Unit**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
71-55-6	1,1,1-Trichloroethane	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	7.3	< 500 U	< 1 U	< 1 U	< 1 U
79-34-5	1,1,2,2-Tetrachloroethane	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	0.83 J	< 500 U	0.4 J	< 1 U	< 1 U
79-00-5	1,1,2-Trichloroethane	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	6.6	< 500 U	< 1 U	< 1 U	< 1 U
75-34-3	1,1-Dichloroethane	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	0.66 J	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
75-35-4	1,1-Dichloroethene	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	100 E	15	< 500 U	< 1 U	< 1 U	< 1 U
120-82-1	1,2,4-Trichlorobenzene	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
96-12-8	1,2-Dibromo-3-Chloropropane	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
106-93-4	1,2-Dibromoethane	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
95-50-1	1,2-Dichlorobenzene	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
107-06-2	1,2-Dichloroethane	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
78-87-5	1,2-Dichloropropane	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
541-73-1	1,3-Dichlorobenzene	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
106-46-7	1,4-Dichlorobenzene	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
78-93-3	2-Butanone (MEK)	ug/L	< 10 U	< 10 U	< 10 U	< 40 U	< 10 U	< 10 U	< 5000 U	< 10 U	< 10 U	< 10 U
591-78-6	2-Hexanone	ug/L	< 5 U	< 5 U	< 5 U	< 20 U	< 5 U	< 5 U	< 2500 U	< 5 U	< 5 U	< 5 U
108-10-1	4-Methyl-2-pentanone (MIBK)	ug/L	< 5 U	< 5 U	< 5 U	< 20 U	< 5 U	< 5 U	< 2500 U	< 5 U	< 5 U	< 5 U
67-64-1	Acetone	ug/L	< 10 U	< 10 U	< 10 U	< 40 U	< 10 U	< 10 U	< 5000 U	< 10 U	< 10 U	< 10 U
71-43-2	Benzene	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	4.9	0.54 J	< 500 U	< 1 U	< 1 U	< 1 U
75-27-4	Bromodichloromethane	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
75-25-2	Bromoform	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
74-83-9	Bromomethane	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
75-15-0	Carbon disulfide	ug/L	< 1 U	< 1 U	< 1 U	< 4 U *	< 1 U *	< 1 U	< 500 U *	< 1 U	< 1 U *	< 1 U *
56-23-5	Carbon tetrachloride	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	1.7	< 500 U	< 1 U	< 1 U	< 1 U
108-90-7	Chlorobenzene	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
75-00-3	Chloroethane	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	11	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
67-66-3	Chloroform	ug/L	< 1 U	< 1 U	< 1 U	2.1 J	0.98 J	2.1	< 500 U	< 1 U	< 1 U	< 1 U
74-87-3	Chloromethane	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
156-59-2	cis-1,2-Dichloroethene	ug/L	11	< 1 U	1.1	31	16000 D	270 E	< 500 U	< 1 U	5.7	< 1 U
10061-01-5	cis-1,3-Dichloropropene	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
110-82-7	Cyclohexane	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
124-48-1	Dibromochloromethane	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
75-71-8	Dichlorodifluoromethane	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
100-41-4	Ethylbenzene	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
98-82-8	Isopropylbenzene	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
79-20-9	Methyl acetate	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
1634-04-4	Methyl tert-butyl ether	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
108-87-2	Methylcyclohexane	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
75-09-2	Methylene Chloride	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	9.9	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
100-42-5	Styrene	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
127-18-4	Tetrachloroethene	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	140 E	100 E	< 500 U	< 1 U	< 1 U	< 1 U
108-88-3	Toluene	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	14	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
156-60-5	trans-1,2-Dichloroethene	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	200 E	11	< 500 U	< 1 U	< 1 U	< 1 U
10061-02-6	trans-1,3-Dichloropropene	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
79-01-6	Trichloroethene	ug/L	17	1.6	8.8	210	13000 E	80000 D	31000	9.4	120 D	0.87 J
75-69-4	Trichlorofluoromethane	ug/L	< 1 U	< 1 U	< 1 U	< 4 U	< 1 U	< 1 U	< 500 U	< 1 U	< 1 U	< 1 U
75-01-4	Vinyl chloride	ug/L	2.5	< 1 U	< 1 U	13	2700 D	13	< 500 U	< 1 U	< 1 U	< 1 U
1330-20-7	Xylenes, Total	ug/L	< 2 U	< 2 U	< 2 U	< 8 U	3.1	< 2 U	< 1000 U	< 2 U	< 2 U	< 2 U

U - Analyzed for but not detected.
* - MS, MSD, LCS or LCSD exceeds the control limit.
J - Indicates an estimated value.
D - Result determined from Secondary Dultion Factor.
E - Compound concentration exceeds the upper level of the ca

Table 3-1
Volatile Organic Constituents
in Groundwater

Alcas Cutlery Corporation
Olean, New York

		Client Sample ID	RU-11		RU-12		RU-13		RU-14A		RU-14B		RU-15		RU-16		RU-17A		RU-17B		RU-17C	
		Collection Date	11/29/2011 14:11		11/29/2011 17:00		12/2/2011 9:55		12/1/2011 12:30		12/2/2011 11:40		11/29/2011 15:52		12/1/2011 13:45		12/1/2011 13:30		12/2/2011 13:33		11/29/2011 16:35	
		Analysis Date	12/10/2011 14:47		12/10/2011 15:09		12/14/2011 19:55		12/13/2011 2:18		12/13/2011 15:24		12/10/2011 15:32		12/13/2011 3:28		12/13/2011 1:54		12/13/2011 15:47		12/10/2011 14:03	
		Analysis Method	8260B		8260B		8260B		8260B		8260B		8260B		8260B		8260B		8260B		8260B	
		Dilution Factor	1		1		1		1		5		1		1		1		4		1	
CAS	**Analyte**	**Unit**	**Result**		**Result**		**Result**		**Result**		**Result**		**Result**		**Result**		**Result**		**Result**		**Result**	
71-55-6	1,1,1-Trichloroethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
79-34-5	1,1,2,2-Tetrachloroethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
79-00-5	1,1,2-Trichloroethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
75-34-3	1,1-Dichloroethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
75-35-4	1,1-Dichloroethene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
120-82-1	1,2,4-Trichlorobenzene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
96-12-8	1,2-Dibromo-3-Chloropropane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
106-93-4	1,2-Dibromoethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
95-50-1	1,2-Dichlorobenzene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
107-06-2	1,2-Dichloroethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
78-87-5	1,2-Dichloropropane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
541-73-1	1,3-Dichlorobenzene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
106-46-7	1,4-Dichlorobenzene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
78-93-3	2-Butanone (MEK)	ug/L	< 10	U	< 10	U	< 10	U	< 10	U	< 50	U	< 10	U	< 10	U	< 10	U	< 40	U	< 10	U
591-78-6	2-Hexanone	ug/L	< 5	U	< 5	U	< 5	U	< 5	U	< 25	U	< 5	U	< 5	U	< 5	U	< 20	U	< 5	U
108-10-1	4-Methyl-2-pentanone (MIBK)	ug/L	< 5	U	< 5	U	< 5	U	< 5	U	< 25	U	< 5	U	< 5	U	< 5	U	< 20	U	< 5	U
67-64-1	Acetone	ug/L	< 10	U	< 10	U	< 10	U	< 10	U	< 50	U	< 10	U	3.7	J	< 10	U	< 40	U	< 10	U
71-43-2	Benzene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
75-27-4	Bromodichloromethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
75-25-2	Bromoform	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
74-83-9	Bromomethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
75-15-0	Carbon disulfide	ug/L	< 1	U *	< 1	U *	< 1	U	< 1	U	< 5	U	< 1	U *	0.57	J	< 1	U	< 4	U	< 1	U *
56-23-5	Carbon tetrachloride	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
108-90-7	Chlorobenzene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
75-00-3	Chloroethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
67-66-3	Chloroform	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
74-87-3	Chloromethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
156-59-2	cis-1,2-Dichloroethene	ug/L	1.4		3.5		< 1	U	< 1	U	46		< 1	U	11		< 1	U	49		< 1	U
10061-01-5	cis-1,3-Dichloropropene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
110-82-7	Cyclohexane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
124-48-1	Dibromochloromethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
75-71-8	Dichlorodifluoromethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
100-41-4	Ethylbenzene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
98-82-8	Isopropylbenzene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
79-20-9	Methyl acetate	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
1634-04-4	Methyl tert-butyl ether	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
108-87-2	Methylcyclohexane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
75-09-2	Methylene Chloride	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
100-42-5	Styrene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
127-18-4	Tetrachloroethene	ug/L	< 1	U	< 1	U	< 1	U	1.7		< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
108-88-3	Toluene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
156-60-5	trans-1,2-Dichloroethene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
10061-02-6	trans-1,3-Dichloropropene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
79-01-6	Trichloroethene	ug/L	< 1	U	1.5		6.2		0.55	J	330		0.6	J	43		< 1	U	330		< 1	U
75-69-4	Trichlorofluoromethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 5	U	< 1	U	< 1	U	< 1	U	< 4	U	< 1	U
75-01-4	Vinyl chloride	ug/L	1.1		3.5		< 1	U	< 1	U	18		< 1	U	< 1	U	< 1	U	3.7	J	< 1	U
1330-20-7	Xylenes, Total	ug/L	< 2	U	< 2	U	< 2	U	< 2	U	< 10	U	< 2	U	< 2	U	< 2	U	< 8	U	< 2	U

U - Analyzed for but not detected.
* - MS, MSD, LCS or LCSD exceeds the control limit.
J - Indicates an estimated value.
D - Result determined from Secondary Dultion Factor.
E - Compound concentration exceeds the upper level of the ca

Table 3-1
Volatile Organic Constituents
in Groundwater

Alcas Cutlery Corporation
Olean, New York

		Client Sample ID	RU-18		UA-1		UA-2		UA-3		UA-4		UA5		UC-1		UC-2		UC-3	
		Collection Date	12/2/2011 8:30		11/30/2011 17:11		11/30/2011 15:30		11/30/2011 13:45		11/30/2011 11:35		11/30/2011 9:15		11/30/2011 18:00		11/30/2011 10:00		11/30/2011 16:35	
		Analysis Date	12/13/2011 4:38		12/12/2011 13:52		12/10/2011 20:20		12/10/2011 19:58		12/10/2011 15:54		12/9/2011 12:00		12/10/2011 17:00		12/12/2011 13:08		12/10/2011 16:38	
		Analysis Method	8260B		8260B		8260B		8260B		8260B		8260B		8260B		8260B		8260B	
		Dilution Factor	1		1		1		1		1		1		1		1		1	
CAS	**Analyte**	**Unit**	**Result**		**Result**		**Result**		**Result**		**Result**		**Result**		**Result**		**Result**		**Result**	
71-55-6	1,1,1-Trichloroethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
79-34-5	1,1,2,2-Tetrachloroethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
79-00-5	1,1,2-Trichloroethane	ug/L	0.77	J	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
75-34-3	1,1-Dichloroethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
75-35-4	1,1-Dichloroethene	ug/L	5.8		< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
120-82-1	1,2,4-Trichlorobenzene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
96-12-8	1,2-Dibromo-3-Chloropropane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
106-93-4	1,2-Dibromoethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
95-50-1	1,2-Dichlorobenzene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
107-06-2	1,2-Dichloroethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
78-87-5	1,2-Dichloropropane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
541-73-1	1,3-Dichlorobenzene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
106-46-7	1,4-Dichlorobenzene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
78-93-3	2-Butanone (MEK)	ug/L	< 10	U	< 10	U	< 10	U	< 10	U	< 10	U	< 10	U	< 10	U	< 10	U	< 10	U
591-78-6	2-Hexanone	ug/L	< 5	U	< 5	U	< 5	U	< 5	U	< 5	U	< 5	U	< 5	U	< 5	U	< 5	U
108-10-1	4-Methyl-2-pentanone (MIBK)	ug/L	< 5	U	< 5	U	< 5	U	< 5	U	< 5	U	< 5	U	< 5	U	< 5	U	< 5	U
67-64-1	Acetone	ug/L	< 10	U	< 10	U	< 10	U	< 10	U	< 10	U	< 10	U	< 10	U	< 10	U	< 10	U
71-43-2	Benzene	ug/L	0.41	J	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
75-27-4	Bromodichloromethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
75-25-2	Bromoform	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
74-83-9	Bromomethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
75-15-0	Carbon disulfide	ug/L	0.98	J	< 1	U *	< 1	U *	< 1	U *	< 1	U *	< 1	U *	< 1	U *	< 1	U *	< 1	U *
56-23-5	Carbon tetrachloride	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
108-90-7	Chlorobenzene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
75-00-3	Chloroethane	ug/L	0.51	J	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
67-66-3	Chloroform	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
74-87-3	Chloromethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
156-59-2	cis-1,2-Dichloroethene	ug/L	1700	D	49		9.3		3.1		< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
10061-01-5	cis-1,3-Dichloropropene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
110-82-7	Cyclohexane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
124-48-1	Dibromochloromethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
75-71-8	Dichlorodifluoromethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
100-41-4	Ethylbenzene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
98-82-8	Isopropylbenzene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
79-20-9	Methyl acetate	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
1634-04-4	Methyl tert-butyl ether	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
108-87-2	Methylcyclohexane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
75-09-2	Methylene Chloride	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
100-42-5	Styrene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
127-18-4	Tetrachloroethene	ug/L	2.9		< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
108-88-3	Toluene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
156-60-5	trans-1,2-Dichloroethene	ug/L	9.3		< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
10061-02-6	trans-1,3-Dichloropropene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
79-01-6	Trichloroethene	ug/L	4600	D	0.91	J	13		29		5.6		18		13		< 1	U	7.2	
75-69-4	Trichlorofluoromethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
75-01-4	Vinyl chloride	ug/L	43		8.3		< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U	< 1	U
1330-20-7	Xylenes, Total	ug/L	< 2	U	< 2	U	< 2	U	< 2	U	< 2	U	< 2	U	< 2	U	< 2	U	< 2	U

U - Analyzed for but not detected.
* - MS, MSD, LCS or LCSD exceeds the control limit.
J - Indicates an estimated value.
D - Result determined from Secondary Dultion Factor.
E - Compound concentration exceeds the upper level of the ca

Table 3-1
Volatile Organic Constituents
in Groundwater

Alcas Cutlery Corporation
Olean, New York

		Client Sample ID	UC-4		UC-5		EQUIP BLANK		TRIP BLANK	
		Collection Date	11/30/2011 14:30		11/30/2011 12:30		12/3/2011 8:00		12/3/2011 8:00	
		Analysis Date	12/10/2011 16:16		12/12/2011 12:46		12/13/2011 18:32		12/13/2011 18:56	
		Analysis Method	8260B		8260B		8260B		8260B	
		Dilution Factor	1		1		1		1	
CAS	**Analyte**	**Unit**	**Result**		**Result**		**Result**		**Result**	
71-55-6	1,1,1-Trichloroethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
79-34-5	1,1,2,2-Tetrachloroethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
79-00-5	1,1,2-Trichloroethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
75-34-3	1,1-Dichloroethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
75-35-4	1,1-Dichloroethene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
120-82-1	1,2,4-Trichlorobenzene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
96-12-8	1,2-Dibromo-3-Chloropropane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
106-93-4	1,2-Dibromoethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
95-50-1	1,2-Dichlorobenzene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
107-06-2	1,2-Dichloroethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
78-87-5	1,2-Dichloropropane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
541-73-1	1,3-Dichlorobenzene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
106-46-7	1,4-Dichlorobenzene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
78-93-3	2-Butanone (MEK)	ug/L	< 10	U	< 10	U	< 10	U	< 10	U
591-78-6	2-Hexanone	ug/L	< 5	U	< 5	U	< 5	U	< 5	U
108-10-1	4-Methyl-2-pentanone (MIBK)	ug/L	< 5	U	< 5	U	< 5	U	< 5	U
67-64-1	Acetone	ug/L	< 10	U	< 10	U	6.6	J	6.9	J
71-43-2	Benzene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
75-27-4	Bromodichloromethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
75-25-2	Bromoform	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
74-83-9	Bromomethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
75-15-0	Carbon disulfide	ug/L	< 1	U *	< 1	U *	< 1	U	< 1	U
56-23-5	Carbon tetrachloride	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
108-90-7	Chlorobenzene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
75-00-3	Chloroethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
67-66-3	Chloroform	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
74-87-3	Chloromethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
156-59-2	cis-1,2-Dichloroethene	ug/L	1.8		0.93	J	< 1	U	< 1	U
10061-01-5	cis-1,3-Dichloropropene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
110-82-7	Cyclohexane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
124-48-1	Dibromochloromethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
75-71-8	Dichlorodifluoromethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
100-41-4	Ethylbenzene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
98-82-8	Isopropylbenzene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
79-20-9	Methyl acetate	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
1634-04-4	Methyl tert-butyl ether	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
108-87-2	Methylcyclohexane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
75-09-2	Methylene Chloride	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
100-42-5	Styrene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
127-18-4	Tetrachloroethene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
108-88-3	Toluene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
156-60-5	trans-1,2-Dichloroethene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
10061-02-6	trans-1,3-Dichloropropene	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
79-01-6	Trichloroethene	ug/L	55		95		< 1	U	< 1	U
75-69-4	Trichlorofluoromethane	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
75-01-4	Vinyl chloride	ug/L	< 1	U	< 1	U	< 1	U	< 1	U
1330-20-7	Xylenes, Total	ug/L	< 2	U	< 2	U	< 2	U	< 2	U

U - Analyzed for but not detected.
* - MS, MSD, LCS or LCSD exceeds the control limit.
J - Indicates an estimated value.
D - Result determined from Secondary Dultion Factor.
E - Compound concentration exceeds the upper level of the ca

Table 3-2
General Chemistry Parameters in Groundwater

Alcas Cutlery Corporation
Olean, New York

		Client Sample ID	Reporting Limit	RU-3	RU-4	RU-6	RU-8	RU-9	UA-1	UA-2	UA-3	UA-4
		Collection Date		11/30/2011	11/30/2011	11/30/2011	11/30/2011	11/30/2011	11/30/2011	11/30/2011	11/30/2011	11/30/2011
		Analysis Date		12/12/2011	12/10/2011	12/12/2011	12/10/2011	12/12/2011	12/12/2011	12/10/2011	12/10/2011	12/10/2011
CAS	**Analyte**	**Unit**										
74-84-0	Ethane	mg/L	0.003	0.0068	0.2	U	0.00091 J	U	0.0005 J	U	U	U
74-85-1	Ethene	mg/L	0.004	0.013	0.27 J	U	0.00076 J	U	U	U	U	U
74-82-8	Methane	mg/L	0.002	0.14	0.9	0.0041	0.013	U	0.11	U	0.00049 J	U
16887-00-6	Chloride	mg/L	1	244	566	140	11.7	9.1	3.2	11.1	3.2	50.9
14808-79-8	Sulfate	mg/L	2	46	56.6	31.7	39.4	9.3	47.6	27.9	13.8	29.8
14797-55-8	Nitrate as N	mg/L	0.1	U	0.025 J	1.3	0.36	2.5	U	1.8	0.88	2.4
	COD	mg/L	10	U	41.8	6.7 J	U	21.2	34.8	14.9	U	U
	Alkalinity	mg/L	5	352	342	227	352	75.1	163	61.3	89.4	251
18496-25-8	Sulfide	mg/L	1	U	U	U	U	U	U	U	U	U
7440-44-0	TOC	mg/L	1	3.4	5.8	1.2	1.2	1.5	14.4	5.7	10.8	U

U - Analyzed for but not detected.
J - Indicates an estimated value.

Table 3-2
General Chemistry Parameters in Groundwater

Alcas Cutlery Corporation
Olean, New York

		Client Sample ID	Reporting Limit	UA-5	UC-1	UC-2	UC-3	UC-4	UC-5
		Collection Date		11/30/2011	11/30/2011	11/30/2011	11/30/2011	11/30/2011	11/30/2011
		Analysis Date		12/9/2011	12/10/2011	12/12/2011	12/10/2011	12/10/2011	12/12/2011
CAS	**Analyte**	**Unit**							
74-84-0	Ethane	mg/L	0.003	U	U	U	U	U	U
74-85-1	Ethene	mg/L	0.004	U	U	U	U	U	U
74-82-8	Methane	mg/L	0.002	U	U	U	0.0003 J	0.00023 J	0.00023 J
16887-00-6	Chloride	mg/L	1	59.7	97.4	88.1	90.3	165	109
14808-79-8	Sulfate	mg/L	2	30	24.6	32.3	24	38.9	39.9
14797-55-8	Nitrate as N	mg/L	0.1	2.4	1.7	2.3	1.3	1.4	0.056 J
	COD	mg/L	10	U	U	U	U	U	U
	Alkalinity	mg/L	5	238	244	184	293	221	205
18496-25-8	Sulfide	mg/L	1	U	U	U	U	U	U
7440-44-0	TOC	mg/L	1	0.64 J	0.84 J	0.45 J	1.1	0.47 J	0.56 J

U - Analyzed for but not detected.
J - Indicates an estimated value.

Table 3-3
General Chemistry in Groundwater (Field Parameters)

Alcas Cutlery Corporation
Olean, New York

Well ID	Dissolved Oxygen	Ferrous Iron	ORP	pH	Temp	SC
	mg/L	mg/L	mV	SU	°C	µS/cm
RU-1	9.4	0	156.3	6.82	12.4	837
RU-3	3.63	0	164.8	6.16	13.9	1264
RU-4	3.47	0.06	154.2	6.39	14.5	2116
RU-5	3.07	0	-131.5	6.49	16.6	618
RU-6	5.06	0	199.8	7.13	12.3	152
RU-7	3.46	0.23	193.2	7.12	10.3	669
RU-8	0.97	0.05	-17	7.02	9.4	419
RU-9	0.97	0.06	23.6	6.84	16.3	73
RU-10	ND	ND	ND	ND	ND	ND
RU-11	ND	0.51	ND	7.35	13.9	424
RU-12	ND	1.98	ND	6.08	13.1	448
RU-13	1.28	0.41	152.3	6.1	15.9	781
RU-14A	7.23	0.16	169.2	7.23	13.7	634
RU-14B	2.11	0	144	5.39	15.0	1464
RU-15	ND	0.58	ND	6.15	12.9	137
RU-16	2.66	0.1	-106.6	4.7	11.5	187
RU-17A	9.27	0.09	154.7	6.6	15.5	2773
RU-17B	1.8	0	136.2	5.43	13.8	2647
UA-1	0.63	0.81	-30.7	6.18	11.4	291
UA-2	0.9	0	42.5	5.93	9.8	141
UA-3	0.69	0.03	20.3	6.38	10.9	111
UA-4	3.56	0.18	127.5	7.44	12.2	583
UA-5	4.71	0.16	162	7.43	14.8	546
B-1	3.92	1.9	165.2	5.97	15.1	1540
P-1	5.07	ND	130.9	7.4	10.4	511
P-2	6.02	0.42	171.6	6.79	13.3	539
CW-13A	3.57	1.49	-72	6.39	9.4	406
RU-2	ND	ND	ND	ND	ND	ND
RU-17C	2.86	0.02	194.3	7.07	14.0	782
RU-18	2.65	0.24	144.7	5.93	12.0	692
UC-1	1.64	0	175.3	8.14	10.8	698
UC-2	3.68	0.14	188.6	7.39	10.9	605
UC-3	1.17	0.2	160.7	8.09	10.7	734
UC-4	0.8	0.01	161.5	8.53	14.4	870
UC-5	2.5	0.07	196.5	7.28	9.0	375
B-2	3.01	1.9	168.4	6.54	14.9	1138
Alcas D2	4.68	0	144.4	5.19	9.1	807
BC-1	3.58	0.1	-62.9	8.14	9.9	0.507
BC-2	3.46	0.12	-53.3	8.31	10.9	0.422
BC-3	0.32	ND	168.6	10.27	8.1	0.672

Table 3-3

General Chemistry in Groundwater (Field Parameters)

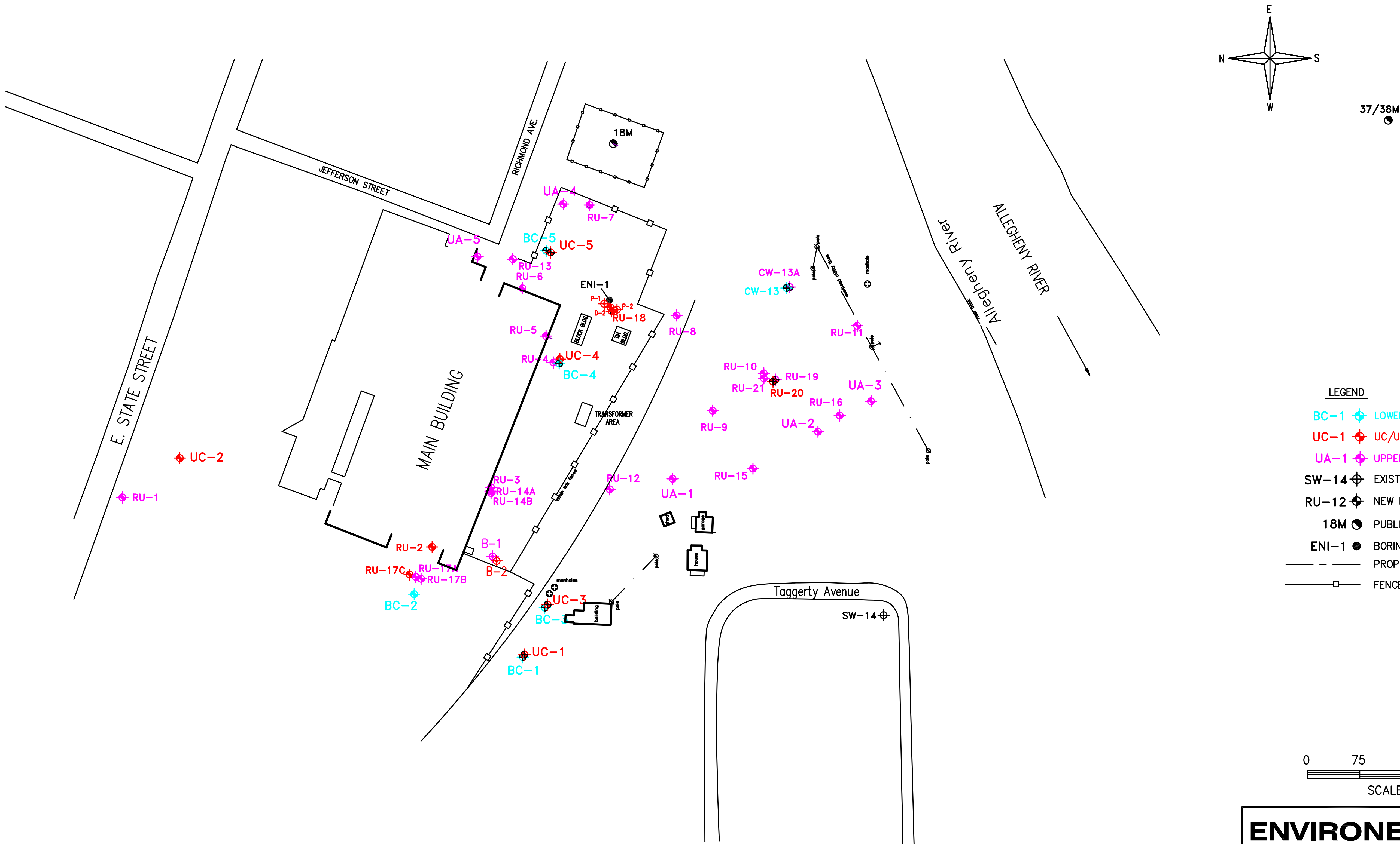
Alcas Cutlery Corporation

Olean, New York

Well ID	Dissolved Oxygen	Ferrous Iron	ORP	pH	Temp	SC
	mg/L	mg/L	mV	SU	^{o}C	µS/cm
BC-4	0.516	0	-43.8	8.39	11.4	0.45
BC-5	ND	0.19	ND	8.65	10.4	0.403
CW-13	6.4	0	170.6	7.98	7.9	0.472

ND- Parameter Not determined.

Figures



LEGEND

BC-1	LOWER (BOTTOM) CITY AQUIFER WELLS
UC-1	UC/UCTZ AQUIFER WELLS
UA-1	UPPER AQUITARD WELLS
SW-14	EXISTING MONITORING WELLS
RU-12	NEW MONITORING WELLS
18M	PUBLIC WATER WELL
ENI-1	BORING
	PROPERTY BOUNDARY
	FENCE

0 75 150 300

SCALE IN FEET

Notes:

This plat was completed on Jan. 2012

D. Michael Canada P.L.S. No. 49245

Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

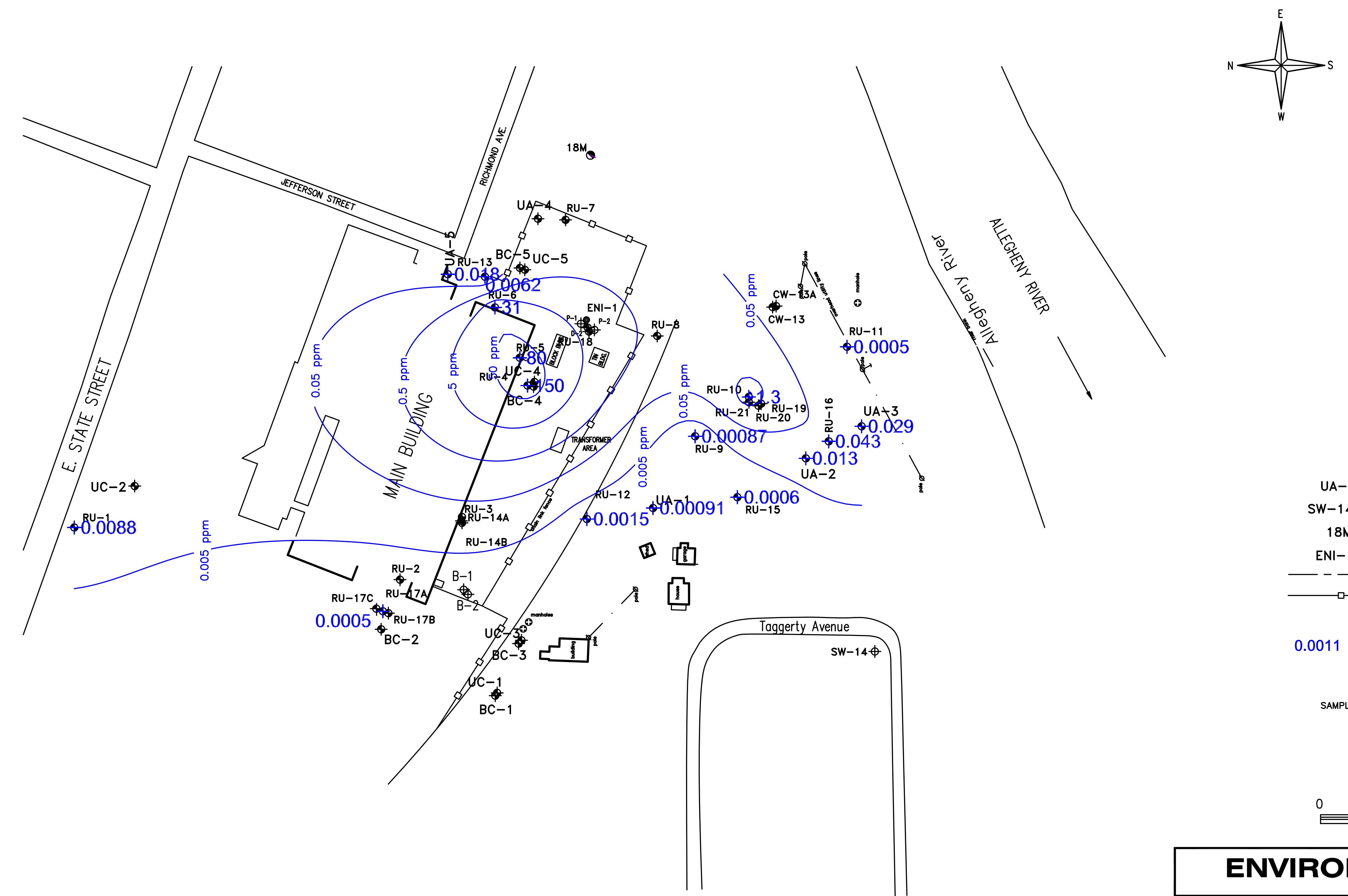
ENVIRONEERING, INC.

FIGURE 2-1

WELL LOCATIN MAP

ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.



LEGEND

UA-1 ALCAS MONITORING WELLS

SW-14 EXISTING MONITORING WELLS

18M PUBLIC WATER WELL

ENI-1 BORING

PROPERTY BOUNDARY

FENCE

0.0011 TCE CONCENTRATION IN THE UPPER WATER BEARING ZONE mg/L

SAMPLES COLLECTED IN DECEMBER 2011

0 75 150 300

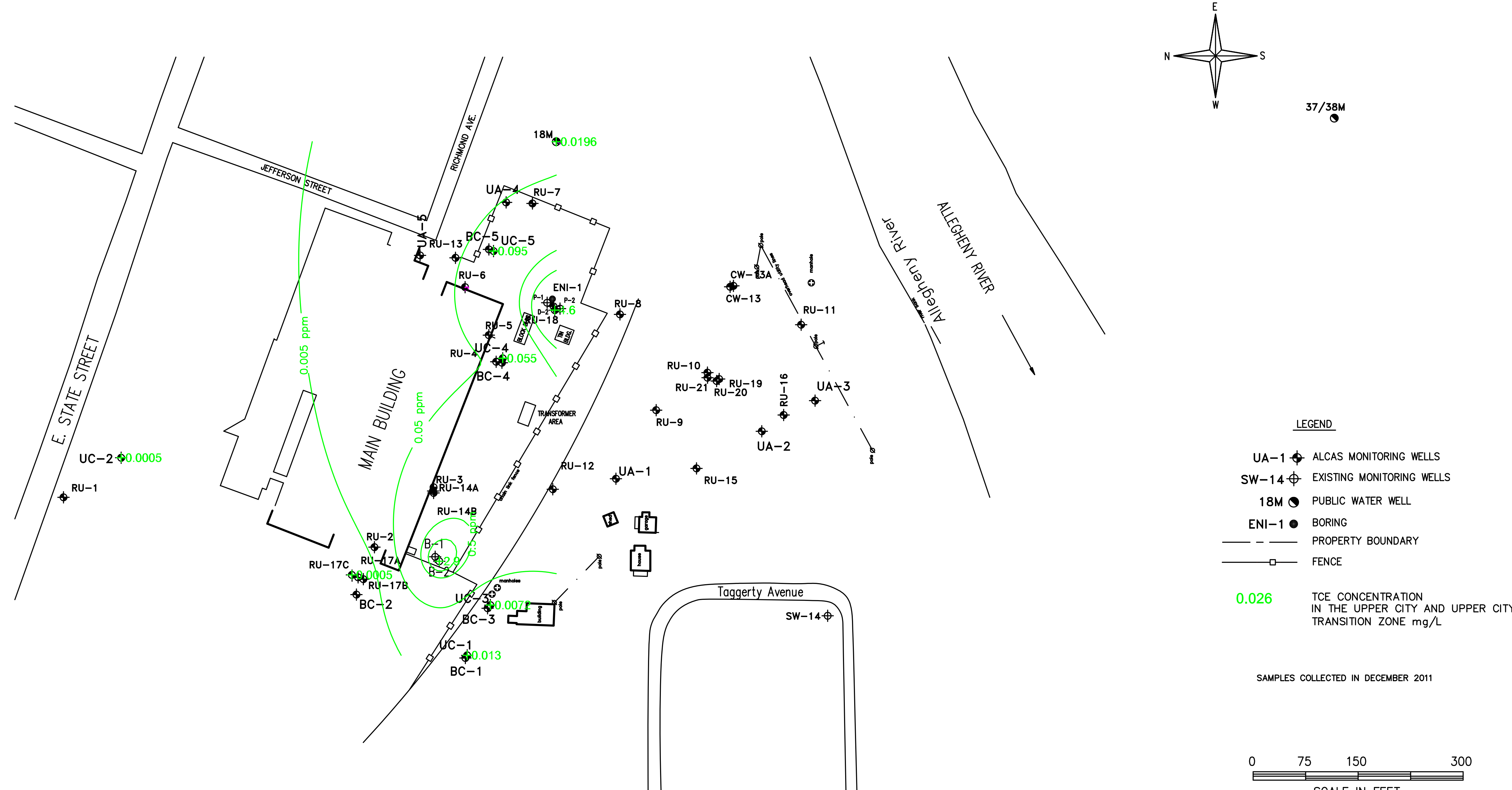
SCALE IN FEET

ENVIRONEERING, INC.

FIGURE 3-1
TCE
Concentration Isopleth Map
Upper Water Bearing Zone
ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO. 137-154

Notes:
This plot was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245
Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

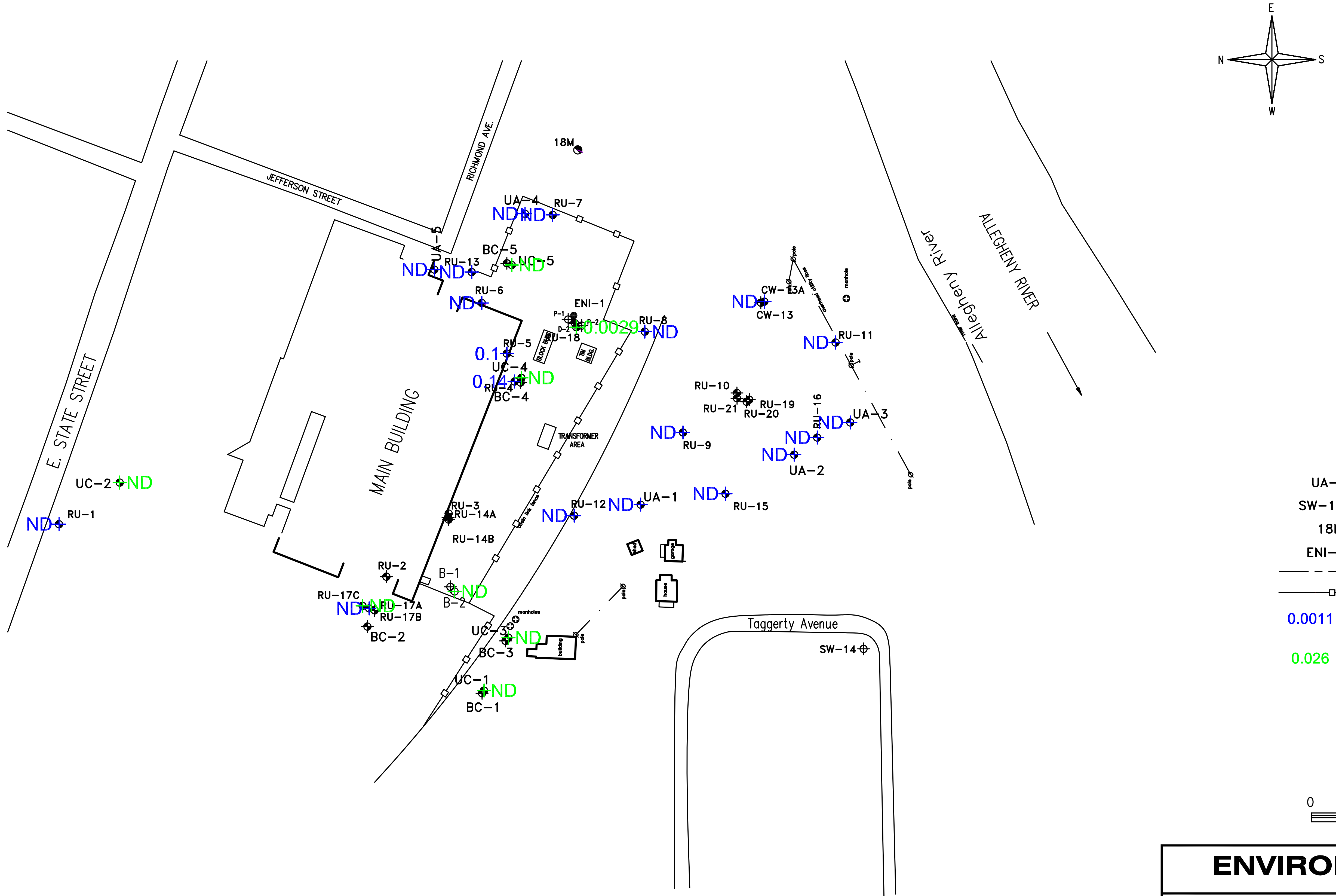


ENVIRONEERING, INC.

FIGURE 3-2
TCE
Concentration Isopleth Map
Upper City and Upper City Transition Zone
ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO. 137-154

Notes:
This plat was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245
Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.



LEGEND

UA-1	ALCAS MONITORING WELLS
SW-14	EXISTING MONITORING WELLS
18M	PUBLIC WATER WELL
ENI-1	BORING
	PROPERTY BOUNDARY
	FENCE
0.0011	PCE CONCENTRATION IN THE UPPER CITY AND UPPER CITY TRANSITION ZONE mg/L
0.026	PCE CONCENTRATION IN THE UPPER WATER BEARING ZONE mg/L

SAMPLES COLLECTED IN DECEMBER 2011

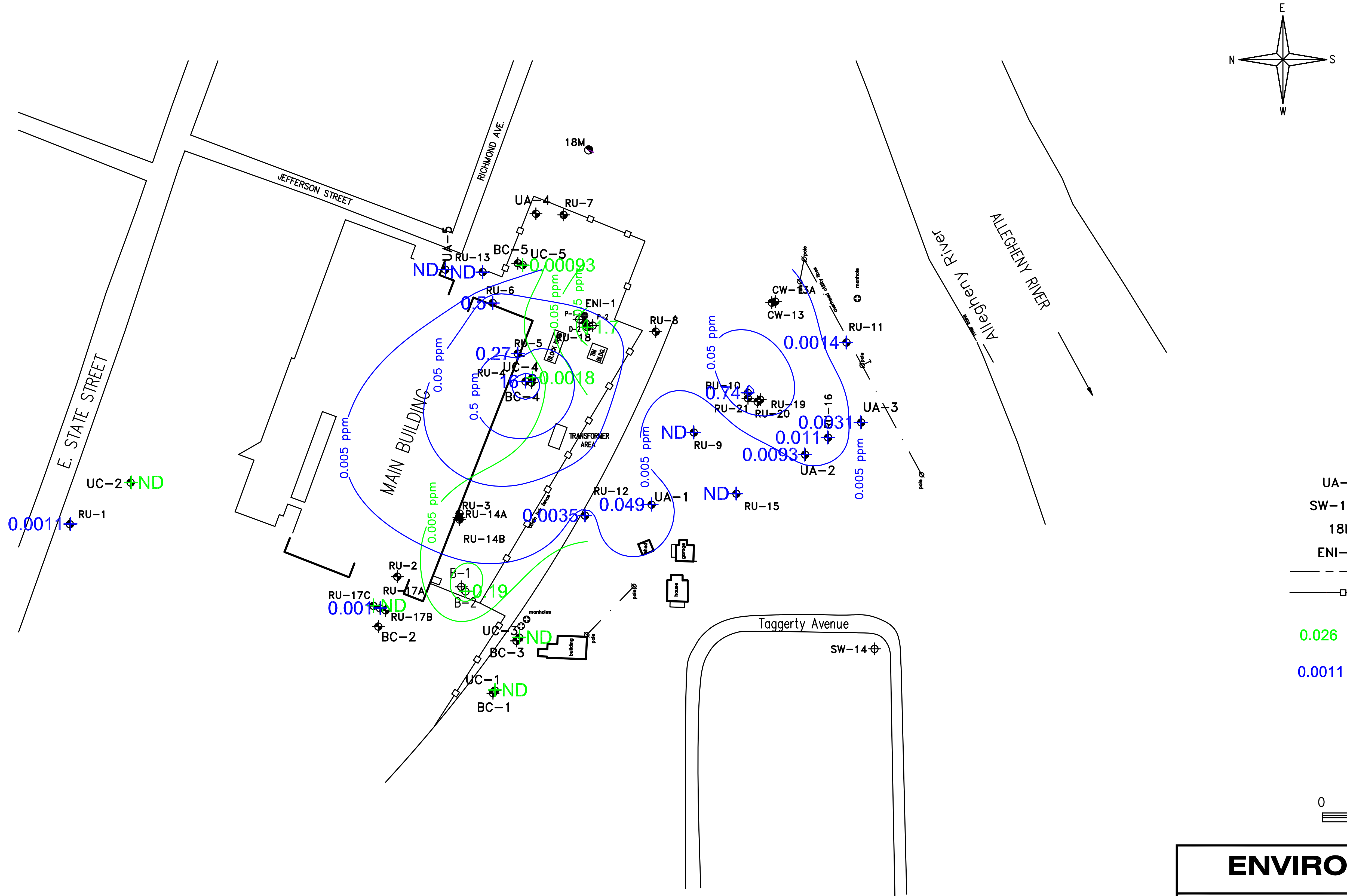
0 75 150 300
SCALE IN FEET

Notes:
This plat was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245
Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

ENVIRONEERING, INC.

FIGURE 3-3
PCE
Concentration Isopleth Map
ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	11/13/2012	137-154



LEGEND

UA-1	ALCAS MONITORING WELLS
SW-14	EXISTING MONITORING WELLS
18M	PUBLIC WATER WELL
ENI-1	BORING
	PROPERTY BOUNDARY
	FENCE
0.026	cis-1,2-DCE CONCENTRATION IN THE UPPER CITY AND UPPER CITY TRANSITION ZONE mg/L
0.0011	cis-1,2-DCE CONCENTRATION IN THE UPPER WATER BEARING ZONE mg/L

SAMPLES COLLECTED IN DECEMBER 2011

0 75 150 300

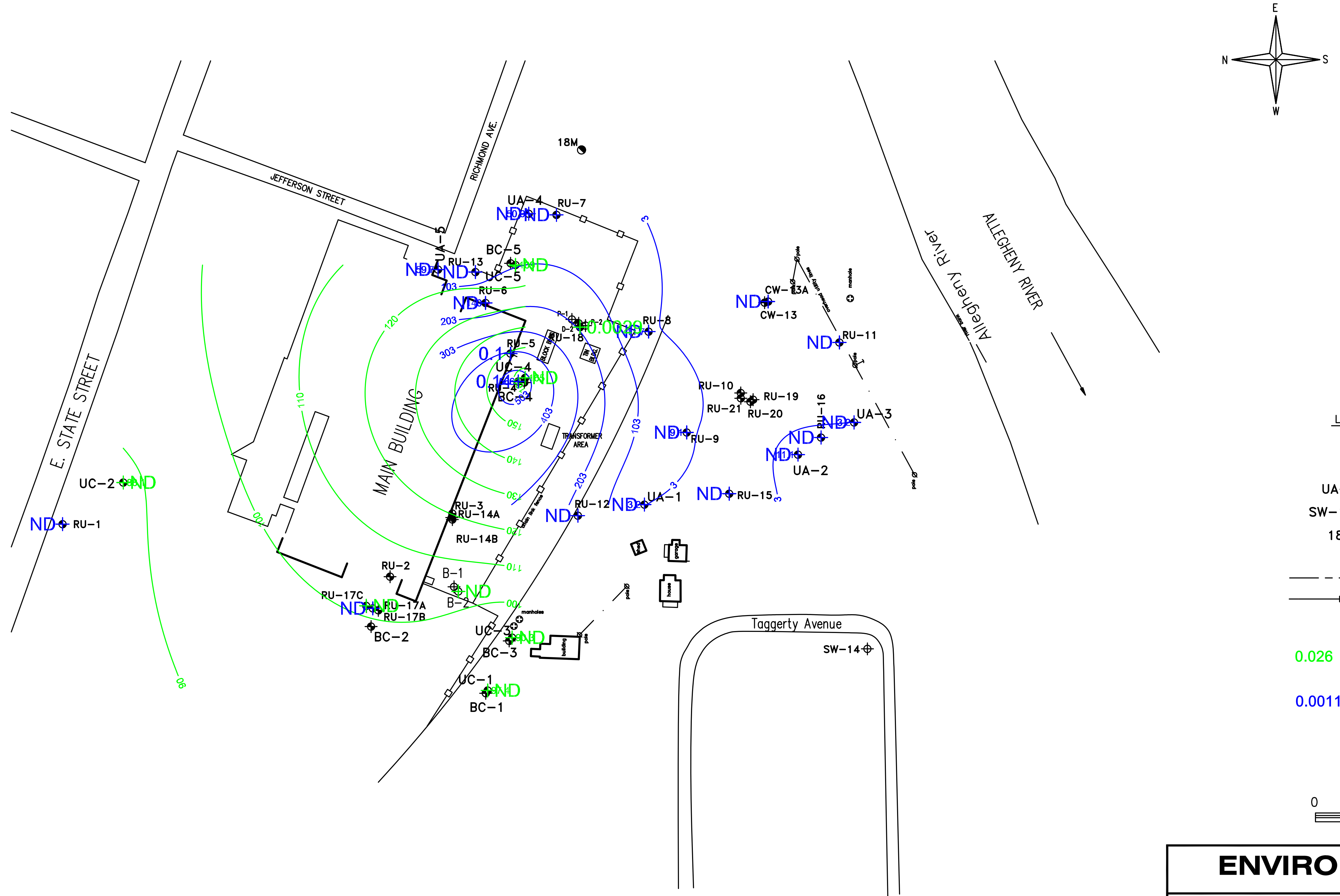
SCALE IN FEET

Notes:
This plat was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245
Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

ENVIRONEERING, INC.

FIGURE 3-4
cis-1,2-DCE
Concentration Isopleth Map
ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	11/13/2012	137-154



LEGEND

UA-1 ALCAS MONITORING WELLS

SW-14 EXISTING MONITORING WELLS

18M PUBLIC WATER WELL

PROPERTY BOUNDARY

FENCE

0.026 cis-1,2-DCE CONCENTRATION IN THE UPPER CITY AND UPPER CITY TRANSITION ZONE mg/L

0.0011 cis-1,2-DCE CONCENTRATION IN THE UPPER WATER BEARING ZONE mg/L

SAMPLES COLLECTED IN DECEMBER 2011

0 75 150 300

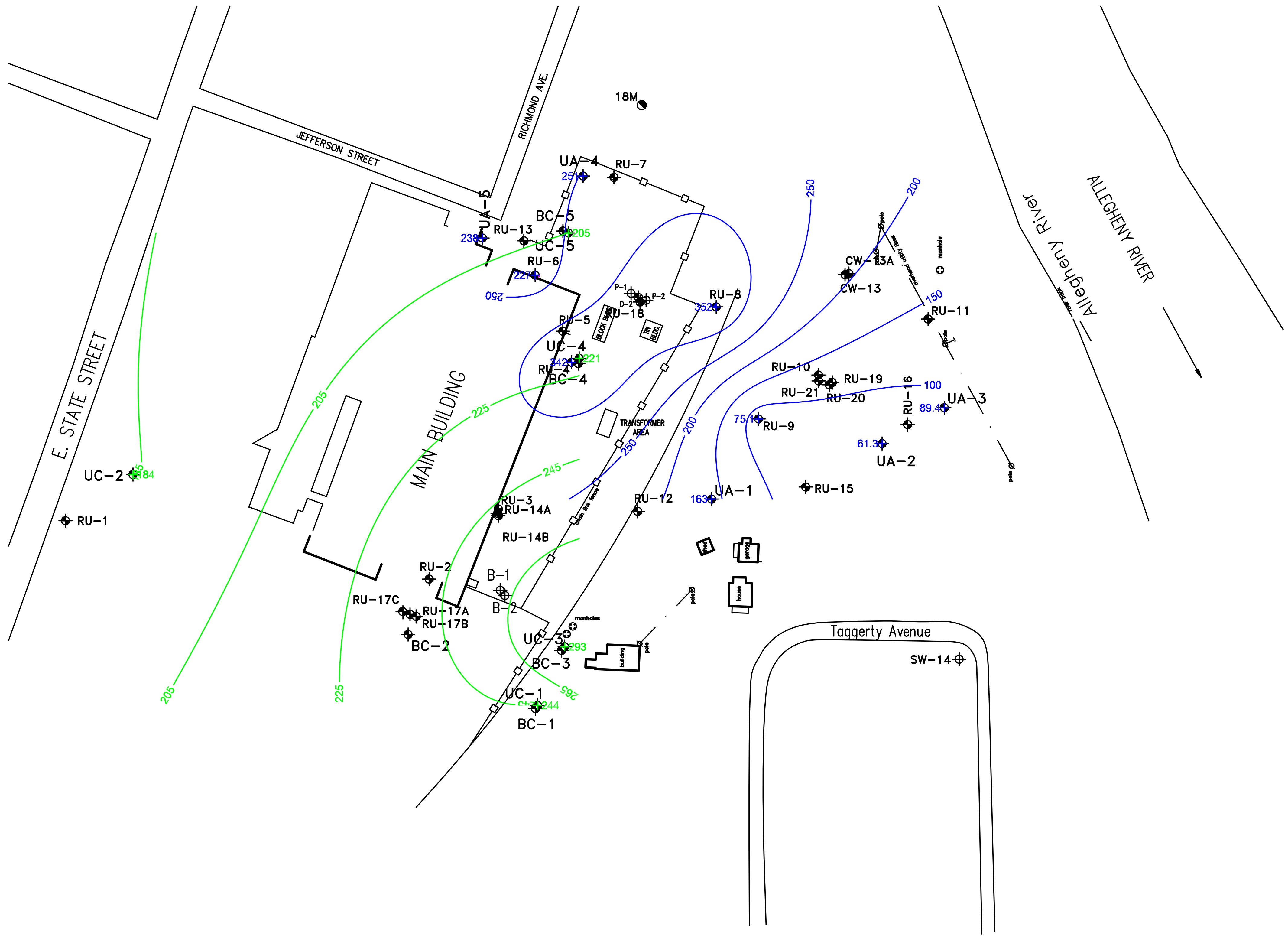
SCALE IN FEET

Notes:
This plat was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245
Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

ENVIRONEERING, INC.

FIGURE 3-6
Chloride
Concentration Isopleth Map
ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	11/13/2012	137-154



N
E
S
W

37/38M

LEGEND

UA-1 ALCAS MONITORING WELLS

SW-14 EXISTING MONITORING WELLS

18M PUBLIC WATER WELL

PROPERTY BOUNDARY

FENCE

0.026 ALKALINITY CONCENTRATION IN THE UPPER CITY AND UPPER CITY TRANSITION ZONE mg/L

0.0011 ALKALINITY CONCENTRATION IN THE UPPER WATER BEARING ZONE mg/L

SAMPLES COLLECTED IN DECEMBER 2011

0 75 150 300

SCALE IN FEET

Notes:
This plat was completed on Jan. 2012
D. Michael Canada P.L.S. No. 49245
Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

ENVIRONEERING, INC.

FIGURE 3-7
Alkalinity
Concentration Isopleth Map
ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.
AF	11/13/2012	137-154

Appendix F

Enhanced Anaerobic Bioremediation Pilot Study

Report

Enhanced Anaerobic Bioremediation Pilot Study Alcas Cutlery Corporation Facility, Olean, New York

Prepared by:

CDM Smith
555 17th Street, Suite 1100
Denver, Colorado 80202

Prepared for:

ALCOA INC.
2300 North Wright Rd.
Alcoa TN, 37701

Attn: Mr. Robert Prezbindowski

May 2012

CDM Smith

Table of Contents

List of Figures

List of Tables

Appendices

Exhibits

Acronyms

bgs	below ground surface
bls	below land surface
DCE	dichloroethene
deg C	degrees Celsius
DNA	deoxyribonucleic acid
DNAPL	dense non-aqueous phase liquid
DO	dissolved oxygen
DPT	direct push technology
DQO	Data Quality Objectives
EAB	enhanced anaerobic bioremediation
EPA	U.S. Environmental Protection Agency
FFS	Focused Feasibility Study
mg/L	milligrams per liter
ORP	oxidation reduction potential
OU1	Operable Unit 1
PCE	tetrachloroethene
psi	pounds per square inch
ROD	Record of Decision
ROI	radius of influence
Site	Alcas Cutlery Corporation Facility Site
TCE	trichloroethene
TOC	total organic carbon
UWBZ	upper water bearing zone
VC	vinyl chloride
VFA	volatile fatty acid
VOCs	volatile organic compounds

Section 1

Introduction

This report presents the results of the enhanced anaerobic bioremediation (EAB) pilot study completed to support evaluation and selection of *in-situ* treatment technologies "short listed" in Part I of the Focused Feasibility Study (FFS) for the Alcas Cutlery Corporation Facility Site (Site) Olean, Cattaraugus County, New York. Part II of the FFS includes a pilot test to evaluate EAB to treat dissolved-phase trichloroethene (TCE) present at the Site. This introductory section provides an overview of the project background, the report objectives, and the technology description.

1.1 Project and Regulatory Background

The U.S. Environmental Protection Agency (EPA) added the Olean Well Field to the National Priorities List in September 1983 when TCE and other solvents were detected above drinking water standards in the City of Olean municipal supply wells. Based on the results of the early studies and interim actions, EPA issued the Record of Decision (ROD) for the First Operable Unit (OU1 ROD) in September 1985, which included installation of an air stripper to treat chlorinated solvents at well 18M, located near the Site. **Figure 1-1** illustrates the features of the Alcas property, including the estimated extent of the TCE plumes. Previous investigations have determined that the governing source of the chlorinated volatile organic compounds (VOCs) found in the Upper and City aquifers was from residual dense non-aqueous phase liquid (DNAPL) located underneath the main building.

Part II Phase 2 of the FFS for the Site includes the scope of work defined in the Pilot and Bench Study Remedial Action Plan (CDM Smith 2011) to implement bench and pilot testing at the Site. This testing is focused on obtaining targeted parameters to evaluate the technologies that were "short listed" in the previously submitted Part I of the FFS. Technology selection will be detailed during the Part II Phase 3 of the FFS effort, following completion of Phase 2 field characterization, bench testing, and pilot testing activities.

Several previous investigations have identified and characterized the presence of chlorinated VOCs in soil and groundwater at the Site, including an offsite area to the south. EAB with bioaugmentation is being considered as a potential remedy for the TCE groundwater plume. The findings of this pilot study will be used to assess the viability of EAB for larger-scale application and to compare it to other alternatives.

Additional Site background information is presented in the final Pilot and Bench Study Remedial Action Plan (CDM Smith 2011).

1.2 Objectives

The overall objectives of the pilot testing were to collect data to evaluate the efficacy of EAB to treat the Site plume and to ensure whatever is done in the field at the Site will "do no harm" to the City Aquifer or existing municipal well treatment system. Specific objectives of the pilot test were as follows:

1. Demonstrate whether bioremediation with bioaugmentation can successfully dechlorinate TCE to non-hazardous byproducts, e.g., ethene.

2. Determine injection parameters needed for full-scale design, including amendment dosing rates, and lag time before onset of efficient dechlorination.

3. Determine hydraulic parameters needed for a full-scale design, including target depth intervals, feasible injection rates, and radius of influence through a single injection point.

4. Evaluate production and mitigation of secondary water quality factors, such as total organic carbon (TOC), and dissolved metals (e.g., iron and manganese) to ensure no impacts to the 18M municipal supply well.

1.3 Technology Description

1.3.1 EAB

During EAB, TCE will be completely transformed to innocuous products following the reductive dechlorination pathway: TCE →dichloroethene (DCE) → vinyl chloride (VC) →ethene (Freedman and Gossett 1989). EAB is generally facilitated through the addition of fermentable carbon compounds that serve as "electron donors" for subsurface bacteria that use the chloroethenes as "electron acceptors." The hydrogen produced during fermentation reactions is the primary electron donor for dechlorinating bacteria and drives EAB. This electron transfer process provides the bacteria with energy for population growth and metabolic activity.

The two primary requirements for successful implementation of EAB are: 1) adequate spatial distribution of the electron donor to achieve strongly reducing conditions, and 2) a microbial community capable of complete reductive dechlorination of the chlorinated compounds. Meeting both of these requirements is therefore the focus of this pilot study.

1.3.2 Electron Donors

Electron donors come in two basic types: aqueous and "slow-release." Aqueous electron donors are generally miscible and of a viscosity similar to water, and are therefore relatively easy to distribute in the subsurface, and are very quickly used by the microbial community. They have the disadvantage that they typically last only a few months in the subsurface, and therefore have to be reinjected periodically. Slow-release donors are typically high-viscosity liquids or solids that last much longer than aqueous donors, but are more difficult to distribute in subsurface soils. At this Site, slow-release donors are appropriate at least for the more permeable soils for a couple reasons. First, the shallow depth of the target treatment zone (up to about 25 feet below land surface [bls]) and the unconsolidated soils allow emplacement of a large amount of electron donor using a grid of direct-push injection points. Second, the residential land use in the area makes it desirable to minimize the number of injections. However, the less permeable Site soils will make distribution of viscous compounds challenging. Therefore, the electron donor used for the pilot study will be a combination of aqueous and slow-release donors, to maximize the longevity of the amendment, but take advantage of better distribution and reduced lag time before onset of microbial activity.

Although a variety of electron donor compounds are available, their impact on groundwater conditions will generally be quite similar. In almost all cases fermentation, hydrolysis, or a combination of both will transform the electron donor compounds into smaller, volatile fatty acid (VFA) compounds such as acetate, propionate, and butyrate. The relative proportions of the VFAs will depend on the donor and the indigenous microbial community. The VFAs are then transformed into hydrogen, carbon dioxide, and hydrogen ions (protons). The hydrogen is utilized by a wide variety of anaerobic microbes, including dechlorinators, methanogens, sulfate-reducers, etc. Metals that become more soluble under reducing conditions, such as iron and manganese, are likely to increase in concentration in the active treatment zone, but are typically precipitated within a short distance down gradient as conditions become less reducing.

1.3.3 Redox Conditions

The most important aspect of groundwater chemistry with respect to the fate of chlorinated hydrocarbons is the oxidation-reduction, or redox, conditions. Chlorinated hydrocarbons serve as electron acceptors in microbially-mediated redox reactions during reductive dechlorination (including EAB). Therefore, they have to compete with naturally occurring electron acceptors in groundwater. The use of electron acceptors is generally governed by the available free energy from redox reactions. In order of decreasing energy available, some common, naturally occurring electron acceptors are oxygen, nitrate, iron-III, sulfate, and carbon dioxide. At a minimum, oxygen and nitrate must be depleted for any reductive dechlorination to occur. Dechlorination of tetrachloroethene (PCE) and TCE to DCE generally occurs under iron-reducing to sulfate-reducing conditions. Complete dechlorination to ethene typically occurs under methanogenic conditions (carbon dioxide is the only remaining naturally occurring electron acceptor.) Thus, understanding redox conditions (aerobic, nitrate-reducing, iron-reducing, sulfate-reducing, or methanogenic) provides key insight into the potential for reductive dechlorination to occur at a site. The more electron donor present, the more reducing the conditions will be.

1.3.4 Bioaugmentation

EAB can be accomplished through either biostimulation or bioaugmentation. Biostimulation involves only the addition of electron donors, and potentially nutrients such as nitrogen and phosphorous, relying on indigenous microorganisms to carry out the desired reactions. Bioaugmentation on the other hand is the introduction of non-indigenous microorganisms as well as electron donors into site groundwater to provide a metabolic capability that either is not present in the native community, or can be significantly enhanced. The dechlorinating bacteria, *Dehalococcoides spp.,* have been found to be very important for achieving complete dechlorination of PCE and TCE to ethene in groundwater (Hendrickson et al. 2002). While these bacteria are fairly common, they are not present at every site, and their absence can lead to the stall of dechlorination at DCE. Several studies have now been performed to demonstrate that these bacteria can be added to an aquifer to facilitate complete dechlorination (e.g., Ellis et al. 2000, Major et al. 2002, Lendvay et al. 2003). As these bacteria only grow in the presence of chlorinated hydrocarbons, their long-term impact on the microbiological community is negligible.

1.4 Data Quality Objectives

The EPA's Data Quality Objectives (DQO) process was used to help frame the "problem" to be addressed by the EAB pilot study at the Site, and to define the associated data needs. This section restates the DQOs developed in the work plan (CDM Smith 2011).

1.4.1 Problem Statement

Historical operations at the Site have resulted in impacted soils and groundwater with TCE and other chlorinated products. An EAB pilot study was completed at the Site for the purpose of determining its potential viability for full-scale application for remediation of the plume.

1.4.2 Decision Questions

The decisions to be made based on the EAB pilot study pertain to the performance of the technology as a whole. Specific decision questions include the following:

- Can electron donor be effectively distributed at the Site to affect the reducing conditions necessary to support complete dechlorination?
- Assuming a limited presence of indigenous microorganisms that have a capability for complete dechlorination, can bioaugmentation be used to provide that capability?
- Does injection of electron donor within the upper water bearing zone (UWBZ) present any risk of undesired effects within the City Aquifer?
- Assuming complete dechlorination is achieved using EAB, will the selected electron donor provide the most cost-effective treatment?

1.4.3 Inputs to the Decision

The data collected during the pilot study are considered inputs to the decision questions. The various data required are grouped here into categories roughly corresponding to the most relevant questions:

- **Electron donor distribution** – electron donor concentrations (measured as TOC and VFAs), biological activity indicators (measured as alkalinity and pH), and redox conditions (measured as oxidation reduction potential [ORP], dissolved oxygen [DO], dissolved iron, sulfate, methane, and TAL metals).
- **Bioaugmentation effectiveness** – chlorinated hydrocarbon and ethene trends over time (measured as PCE, TCE, DCE, VC, and ethene); and growth and proliferation of *Dehalococcoides spp*. bacteria over time (measured as increases in *Dehalococcoides spp*. DNA in groundwater samples).
- **Electron donor selection** – raw electron donor cost; electron donor mass required, distribution strategy, and longevity (based on electron donor distribution measurements over time); and effectiveness for stimulating efficient reductive dechlorination (based on the same measurements as bioaugmentation effectiveness).

1.4.4 Boundaries of the Study

In this context, the term "boundaries" refers both to spatial and temporal boundaries for the pilot study. The pilot study was completed in an area south of the Alcas facility, in the vicinity of well RU-10. The pilot study included three injection locations in the vicinity of newly installed well RU-21, approximately 10 feet apart on centers. Vertically, all injections and monitoring wells targeted the UWBZ (observed between 10 and 20 feet bls in the pilot study location). The pilot study duration (including baseline sampling), was planned for a maximum of 6 months.

1.4.5 Decision Rules

Decision rules identify the actions to be taken for a given answer to each of the questions in Section 3.2. In some cases the decision rules are qualitative in nature due to the multiple lines of evidence that must be considered to evaluate this technology.

- If the electron donor tested cannot be effectively distributed at the Site, then an assessment of additional alternatives would need to be made. This should be evident very early in the pilot study and would prevent the use of EAB for full-scale remediation.
- If bioaugmentation does not facilitate complete dechlorination in the treatment zones, EAB would be precluded from full-scale application.
- If the rates of biodegradation are not sufficient to meet cleanup objectives, EAB would be precluded from full-scale application.

Once it is determined that electron donor can be distributed effectively and EAB achieves the desired degradation, an electron donor (or some combination of electron donors) must be selected for full-scale implementation. A decision regarding the most cost-effective electron donor will depend upon the ease of distribution, the rate of biodegradation, the cost of the electron donor, the mass of electron donor required, and the longevity of the electron donor in the subsurface. All of these factors will be considered to develop cost estimates for a potential full-scale implementation approach.

1.4.6 Limits on Decision Errors

Limits on allowable errors for decision inputs ensure that data quality will be sufficient for the intended purpose. Total study error consists of two types of decision errors: sampling design errors and measurement errors. Because a judgmental sampling design is being followed in the pilot test, statistically derived limits on sampling design error are not quantifiable.

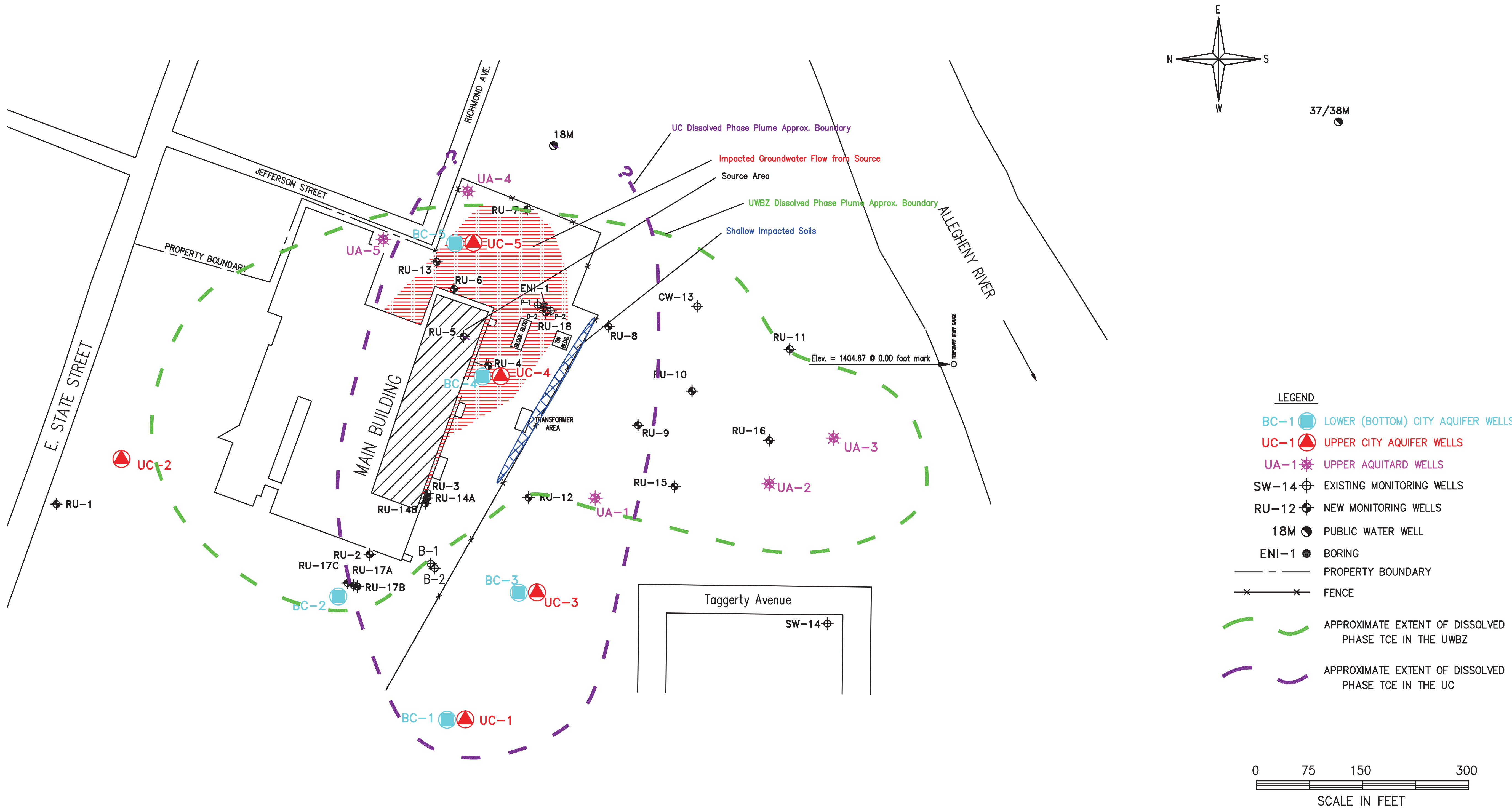
The judgmental sampling approach is designed to limit the probability of sampling design errors by:

- Collecting data from multiple lines of evidence (electron donor concentrations, biological activity indicators, redox conditions, TCE and degradation products, and bacterial deoxyribonucleic acid [DNA]) to ensure an internally consistent data set.
- Collecting data at a sufficient frequency to demonstrate reproducibility of results.
- Locating monitoring wells so as to maximize the potential for influence by the electron donor injections.
- Designing the pilot study based on successful pilot studies at other sites.

Measurement errors are limited by selecting appropriate analytical procedures, detection limits, and quality control acceptance criteria (precision and accuracy). These parameters were presented in Table 3-1 of the Bench and Pilot Study Work Plan (CDM Smith 2011).

1.5 Report Organization

The report is organized in keeping with the objectives of assessing electron donor delivery and distribution and presents results regarding the overall effectiveness of EAB in this pilot study. Section 2 provides an overview of field activities performed at the site. Section 3 summarizes the results pertaining to electron donor delivery and subsequent distribution. Section 4 presents the results for EAB, including redox conditions, dechlorination, and bioaugmentation. A summary of the conclusions of the pilot study is provided in Section 5, and references are presented in Section 6.



Notes:

This plat was completed on Oct 12, 2000 from an instrument survey on Oct. 6, 1999 & Oct2 & 4, 2000. 2000 Robert C. Ackerman, P.L.S No. 49845

All elevations were taken on the top of the 2" PVC pipe casing around the 1" PVC well pipe and were marked thereon with a black marker pen.

Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

FIGURE 1–1

ALCAS FACILITY LAYOUT

CDM Smith

Section 2

Summary of Activities

This section provides a timeline of activities performed, followed by a brief description of those activities.

2.2 Implementation of EAB Pilot Study

Implementation of the EAB pilot study at the Site commenced in November of 2011. The following subsections describe the activities completed at the Site during the pilot study, including details regarding injection of the electron donor solutions, bioaugmentation, and groundwater monitoring events.

2.2.1 Well Installation

Prior to commencing electron donor injections, a total of three new monitoring wells were installed within the pilot study area. The three wells (RU-19, RU-20, and RU-21) were necessary to evaluate electron donor distribution adequately within the pilot study cell. The monitoring well locations are presented on **Figure 2-1**. Boring logs and well construction diagrams for the wells used during the pilot study are presented in Appendix A.

The wells were installed from November 14 to November 16, 2011 using hollow-stem auger drilling techniques. Based on lithology encountered during drilling, monitoring wells RU-19 and RU-21 were screened between 10 and 20 feet bls, and well RU-20 was screened between 30 and 40 feet bls. Clayey silt and silty clay were encountered between 17 and 23 feet bls, and gravelly clay was encountered between 23 and 31 feet bls, which was assumed to act as a low-permeability barrier between the shallow portion of the UWBZ and the upper portion of the City Aquifer. It is likely that RU-20 is screened within a transition zone between the UWBZ and upper City Aquifer. Based on lithology observed during well installation, concentrations of chlorinated VOCs, and the depth to groundwater in the UWBZ, the target interval for electron donor injection was determined to be between 10 and 20 feet bls.

2.2.2 Electron Donor Injection

Injection of electron donor solutions was conducted using direct-push technology (DPT) pressurized injection techniques. Injection of high-carbon electron donor was completed in the pilot study cell between November 21 and November 22, 2012. Injection was completed at the points shown on Figure 2-1. Injection was completed using a hydraulic pump and DPT drill rig. Injection was completed in a "top-down" fashion using a direct-push injection tool with a retractable injection screen manufactured by AMS. The injection tool was driven to the initial target depth of approximately 10 feet bls, and the DPT rods were retracted to expose a 1-foot long injection screen. Electron donor was then pumped through the DPT rods at pressures sufficient to facilitate electron donor distribution through lower-permeability zones in the subsurface. Typical injection pressures were between 30 and 50 pounds per square inch (psi) during injection, and pressures typically decreased during injection, likely indicative of hydraulic fracturing of the soil matrix. Electron donor pumping continued until planned volumes of electron donor had been injected at the depth interval.

No surfacing of electron donor was observed during injection activities. Injection flow rates were generally between 1.5 and 3 gallons per minute.

After injection at each depth, the retractable screen on the injection tool was closed and the injection tool was driven to the next target depth. Injection was targeted at approximately 3-foot vertical intervals within each DPT injection point through the treatment zone to a maximum depth of approximately 19 feet bls, which is above the gravelly clay interval identified in lithologic logs. Approximately 270 gallons of electron donor were injected at INJ-01, 205 gallons at INJ-02, and 285 gallons at INJ-03, resulting in a total volume of 760 gallons of electron donor injected into the pilot study cell. The injection boreholes were abandoned using hydrated bentonite.

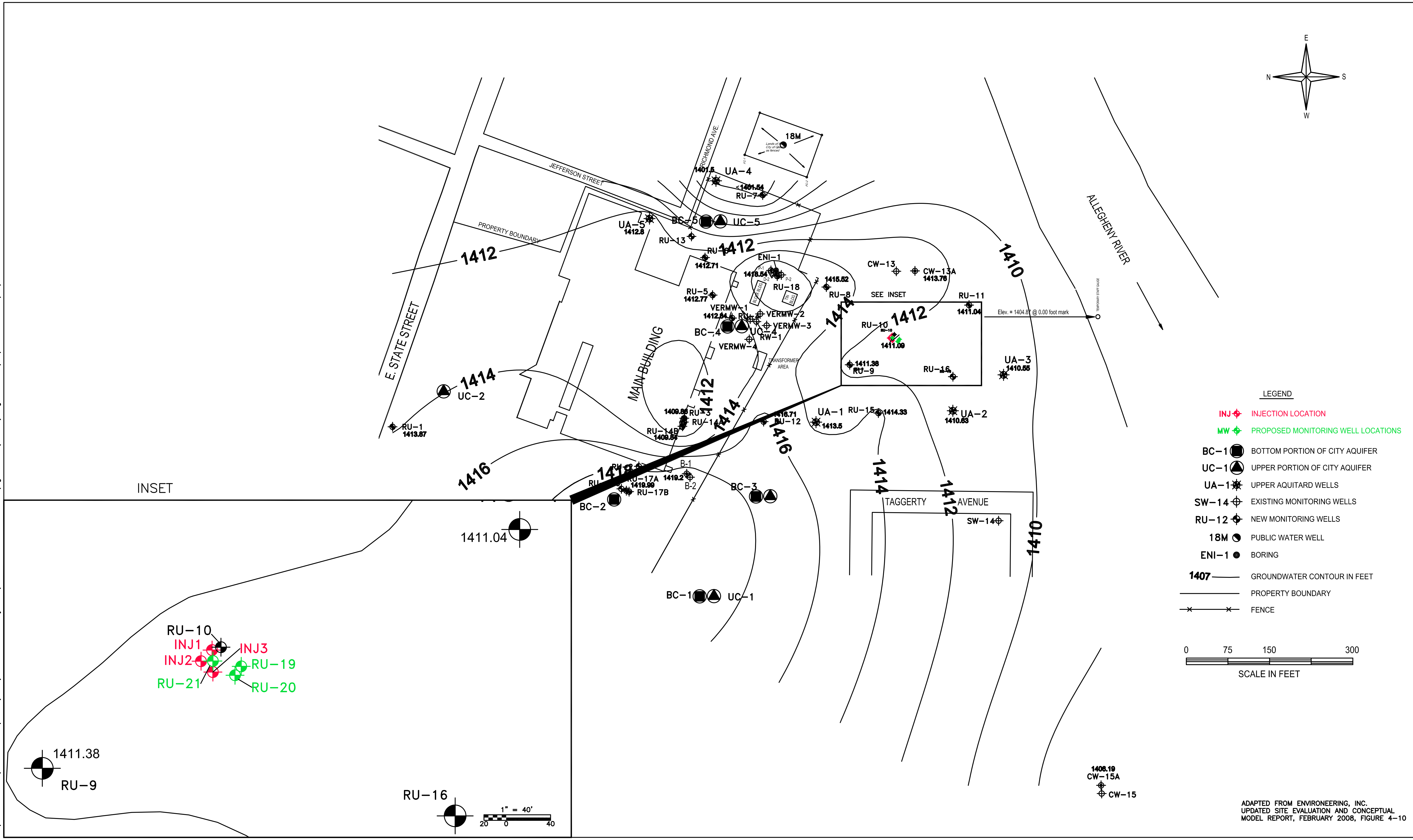
2.2.3 Bioaugmentation

Concentrations of chlorinated VOCs at the Site indicated a lack of TCE degradation products, suggesting that the existing bacterial community at the Site may not be capable of complete dechlorination. Bioaugmentation of the pilot study cell was completed on November 22, 2012 to introduce an appropriate bacterial community within the pilot study cell. Baseline groundwater sampling indicated that existing conditions in the UWBZ were generally reducing and anaerobic at the time of electron donor injection and bioaugmentation. Augmentation with a commercially available dechlorinating culture (Shaw's SDC-9) was completed at a single injection point adjacent to INJ-02 as presented on Figure 2-1. An expendable point was driven to a depth of approximately 16 feet, and the rods were then retracted to approximately 14 feet, leaving 3 feet of open hole in which to inject the culture. Approximately 19 liters of culture was injected into the injection location through the direct-push rods. Following inoculation of the direct-push point, approximately 50 gallons of anaerobic water (created by mixing sodium lactate with potable water at a concentration of 3 percent) was added to the injection point to push the dechlorinating culture out of the direct-push point and into the surrounding formation.

2.3 Groundwater Monitoring

Baseline groundwater samples were collected on November 17, 2012 from wells planned for evaluation during the extended pilot study. Data collected at this time was used to establish baseline concentrations of constituents and other geochemical and water quality parameters at the Site. Following injection activities in November of 2011, groundwater sampling events were conducted on January 4, February 29, and May 1, 2012 in accordance with the work plan. All groundwater samples were collected using low-flow sampling techniques, in accordance with procedures presented in the Bench and Pilot Study Work Plan (CDM Smith 2011). Sample locations, quantities, and analytes were in accordance with Tables 5-1, 5-2, and 5-3 of the Bench and Pilot Study Work Plan (CDM Smith 2011). Data from these monitoring events are summarized in the following sections of this report. Analytical data reports are included in Appendix B.

Z:\1902 – Alcoa\83734–Olean\Alcoa (Olean) Pilot–Bench Study RAP\Final EPA Submittal 091611\Figure 2–1 (062112).dwg SAVED: 6/21/12 PRINTED: 6/21/2012 BY: FISCHERMJ



CDM Smith

Figure 2-1
Pilot Study Layout

Section 3

Electron Donor Delivery and Distribution

This section provides a description of the delivery methods used to inject each electron donor, along with a discussion of the apparent effectiveness of delivery and distribution based upon electron donor concentrations in the monitoring wells. The results in this section address the first decision question in the data quality objectives section of the pilot study work plan (CDM Smith 2011): "Can electron donor be effectively distributed at the Site to affect the reducing conditions necessary to support complete dechlorination?"

3.1 Delivery

A high-carbon electron donor was injected at the Site using DPT delivery methods. The electron donor was injected one time at the start of the extended pilot study. The electron donor was prepared and delivered to the Site in drums; no dilution of the electron donor was conducted on-Site prior to injection.

The depth interval targeted for injection during this pilot study extended from approximately 10 to 20 feet bls in the pilot study cell. As described in Section 2.2.2, the target volume of electron donor was injected at each vertical interval in the pilot study cell using a top-down DPT injection technique. The top-down approach utilized during the pilot study provides greater confidence that electron donor was actually delivered to the target depth interval, as this technique does not create a preferential injection pathway through the open borehole as would be the case with a bottom-up injection approach. Based on observations during this extended pilot study, DPT injection is an efficient and cost-effective method to distribute electron donor at the Site.

3.2 Distribution

The distribution of the electron donor was monitored by measuring the concentrations of organic acids (initial breakdown products of biodegradation of the electron donors) and TOC in the monitoring wells. These data are used to answer the decision question posed in the work plan: "Can electron donor(s) be effectively distributed at the Site to affect the reducing conditions necessary to support complete dechlorination of constituents?" This section presents the organic acid and TOC data for each monitoring well evaluated during this pilot study.

3.2.1 TOC and Organic Acid Concentrations

Exhibits 3-1A through 3-1D illustrate the concentrations of TOC and organic acids measured in the monitoring wells in the pilot study cell. Concentrations of TOC and organic acids were measured at four locations in the cell: RU-21 (Exhibit 3-1A), RU-10 (Exhibit 3-1B), RU-19 (Exhibit 3-1C), and RU-20 (Exhibit 3-1D). Data from up gradient well RU-8 are shown on Exhibit 3-1E). RU-21 is discussed first, as the electron donor injection points are spaced surrounding this monitoring well and it is most likely to be influenced by the donor injections.

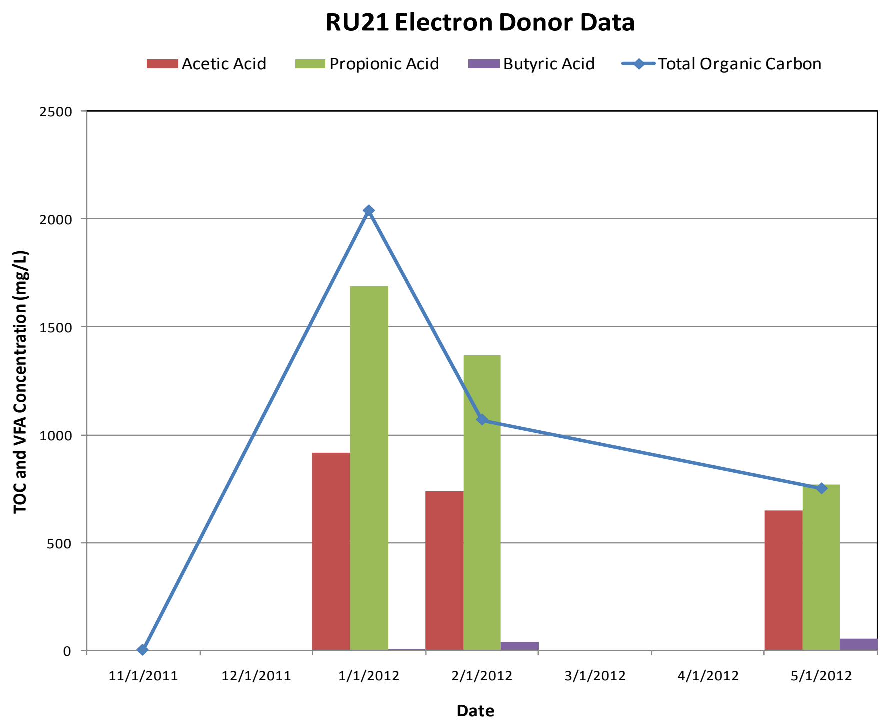


Exhibit 3-1A. RU-21 Electron Donor Data

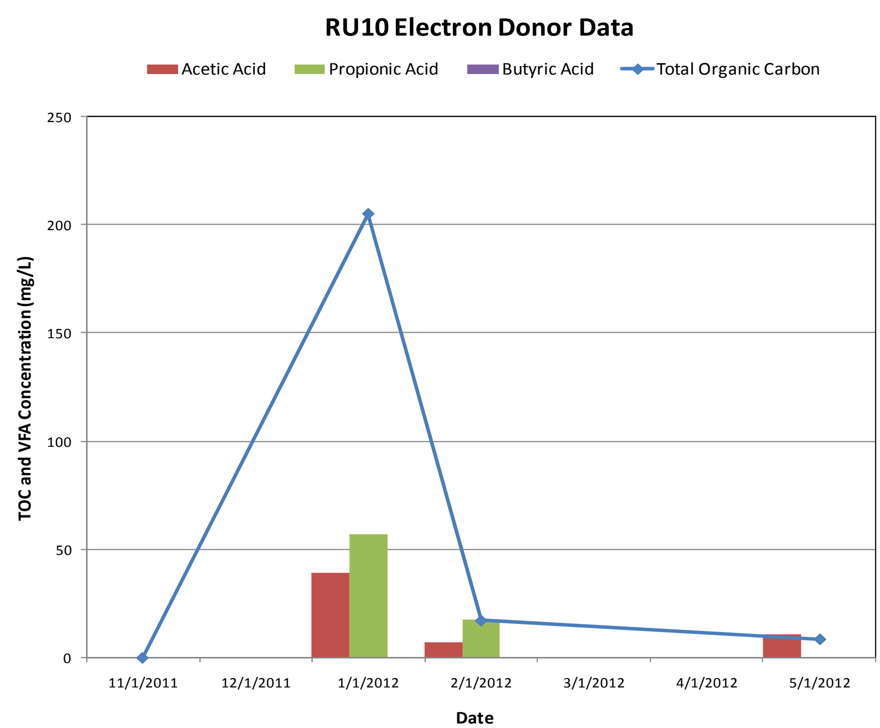


Exhibit 3-1B. RU-10 Electron Donor Data

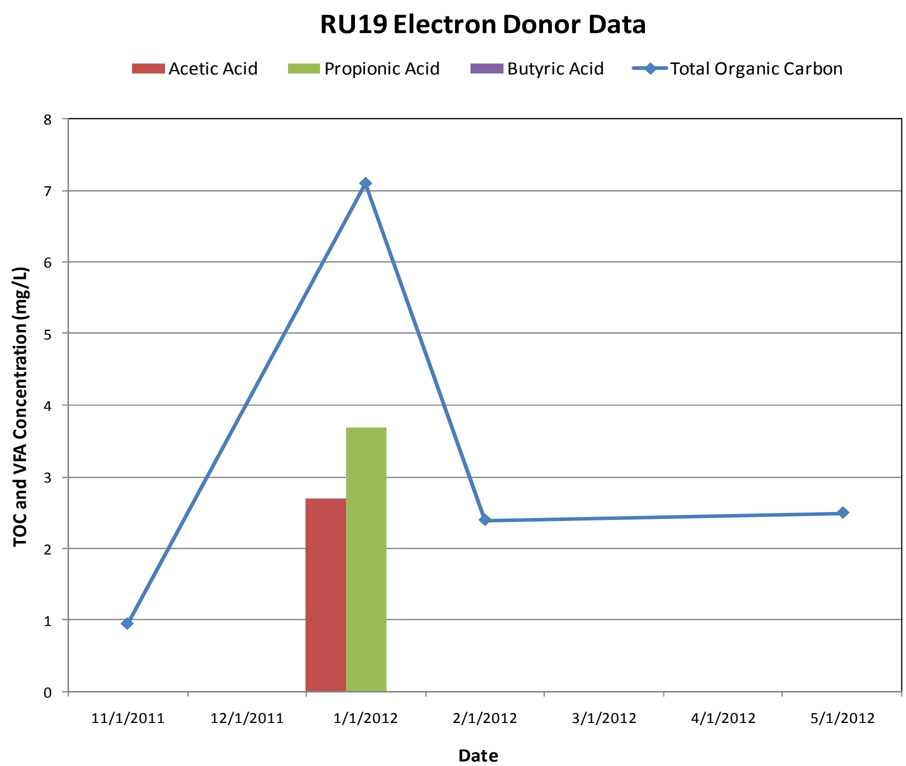


Exhibit 3-1C. RU-19 Electron Donor Data

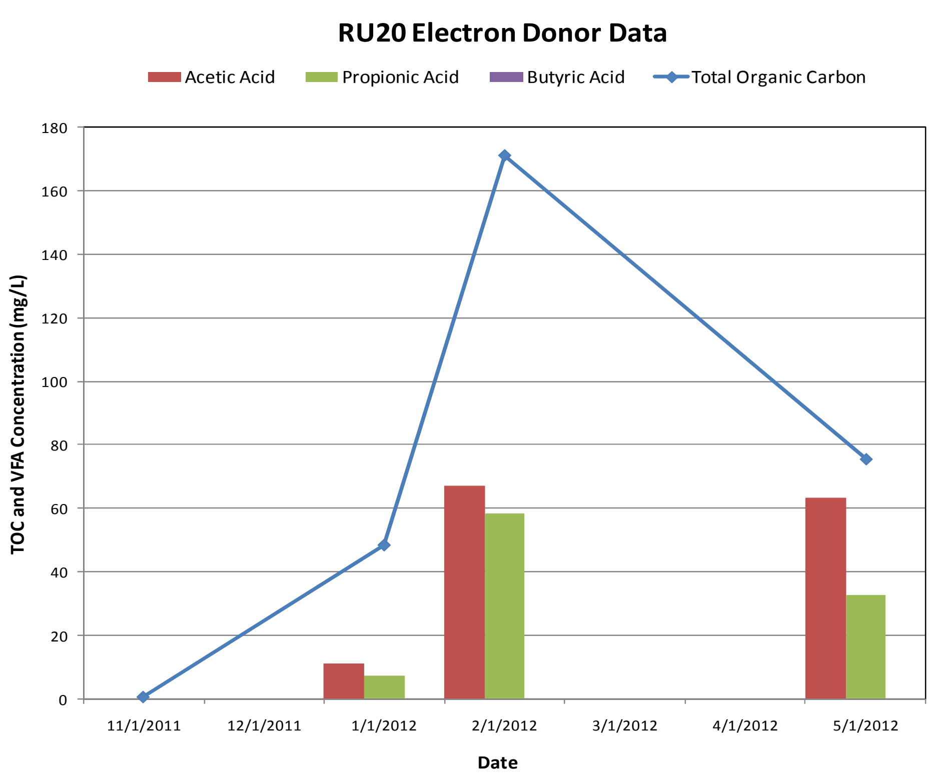


Exhibit 3-1D. RU-20 Electron Donor Data

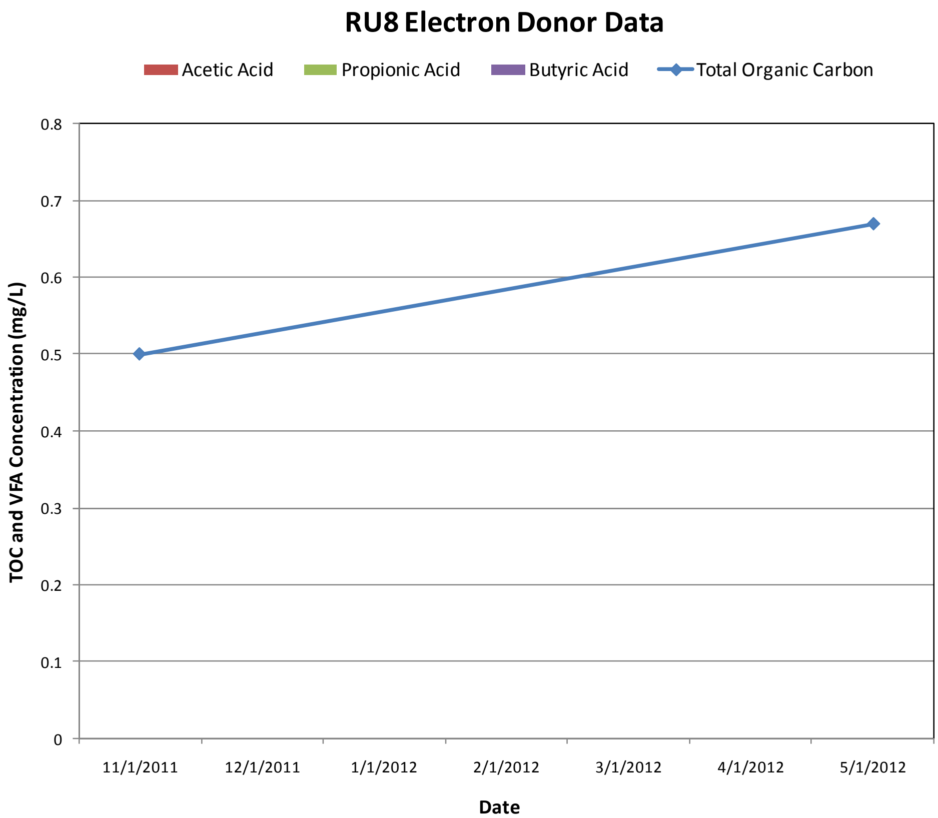


Exhibit 3-1E. RU-8 Electron Donor Data

TOC concentrations reached a maximum in January 2012 at RU-21 (2,040 milligrams per liter [mg/L]), RU-10 (205 mg/L), and RU-19 (7.1 mg/L), but peaked during February 2012 at RU-20 (171 mg/L). RU-21 was observed to have been directly impacted by the electron donor by the time monitoring activities commenced. TOC concentration gradually declined at RU-21, but was still observed at 751 mg/L in May 2012. As expected, TOC concentrations were somewhat lower at well RU-10, which is slightly further away from the injection points and screened several feet shallower (8-17 feet bls), and RU-19 appears to have been minimally impacted by electron donor injection. Surprisingly, increases in TOC were observed at RU-20 following injection activities, despite the deeper screen interval of the well. The elevated TOC and detected organic acids at this location indicate that there is hydraulic connection between the two units in which the wells are screened. This observation, combined with the VOC data presented in Section 4, indicate that the deeper well RU-20 is screened within either a lower portion of the UWBZ or within the transition between the UWBZ and upper City Aquifer, rather than being screened within the upper City Aquifer itself.

The primary contributors to TOC during the January and March 2012 events were acetic acid and propionic acid. As propionic acid fermentation produces hydrogen, and dechlorinating bacteria have been shown to grow on acetic acid and hydrogen, the production of these compounds from the electron donor solution was a promising result. Concentrations of organic acids decreased along with the TOC concentrations, and propionic acid concentrations decreased more rapidly than acetic acid. It is typical for propionic:acetic acid ratios to be highest near the injection point, and to decrease with time and distance following an injection, which is exactly what we observe here. Butyric acid (which is also fermented to produce hydrogen) concentrations increased at well RU-21 by February 2012, but were low relative to acetic and propionic acids.

Overall, TOC concentrations increased notably immediately following injection, and declined over time thereafter. TOC concentrations above 500 mg/L were sustained within the area under direct influence of the electron donor injection after nearly 6 months. While TOC concentrations at RU-10 were lower than at RU-21, and RU-10 is screened shallower than RU-21, increases in TOC at this well indicate that distribution of electron donor is possible to distances of at least 8 feet using the DPT injection technique and the volumes injected. A greater radius is likely if a larger volume of electron donor can be emplaced at each vertical interval.

3.2.2 Summary of Distribution

Overall, the results indicate that effective electron donor distribution was achieved at the Site using the injection techniques described in the work plan. Within the area directly influenced by the injections, TOC concentrations were sustained greater than 500 mg/L during the pilot study, and significant quantities of acetic acid and propionic acid were generated. Wells throughout the pilot study cell exhibited measurable increases in TOC and organic acid concentrations, indicating that the injections have had at least some effect on the aquifer at distances of up to 20 feet from the injection point. Additionally, there appears to be vertical hydraulic communication between the shallow injection interval and the deeper interval where well RU-20 is screened. This delayed reaction, combined with the much lower relative increase in TOC and organic acid concentrations at RU-19, suggest that electron donor may slowly be migrating throughout all portions of the UWBZ.

The analytical data from monitoring wells presented above, as well as observations made during electron donor injection, indicate that an electron donor radius of influence (ROI) of approximately 8 to 10 feet is possible from the injection point when using DPT injection techniques at the Site. Larger ROI may be achievable if a greater volume of electron donor is injected at each discrete depth interval. Vertical distribution of the electron donor is optimized by using a "top-down" injection approach with injections completed at 2-3 foot vertical intervals throughout the treatment zone. It is important to note that distribution of electron donors injected using pressurized DPT techniques may be quite heterogeneous, as high injection pressures may induce fracturing of the soil matrix at the injection point, and electron donors may travel more readily through natural or man-made preferential pathways in the subsurface; however, no real anomalies in electron donor distribution were observed in this portion of the Site.

3.3 Hydraulic Condictivity Testing

In order to evaluate potential for electron donor injections to reduce aquifer permeability, slug tests were performed before electron donor injections as well as approximately five months post-injection. Slug tests were completed in wells RU-19 and RU-21, which are both screened within the vertical interval targeted with electron donor injections (between 10 and 20 feet bls). Well RU-21 is located directly within the electron donor injection area, while RU-19 is located outside of the area impacted by electron donor injection. Testing at these two wells allow for comparison of measured hydraulic conductivity changes both due to electron donor injection. Table 3-1 summarizes the slug testing results, and analyses are presented in Appendix C.

At RU-19, the measured hydraulic conductivity decreased slightly from November 2011 to April 2012, though the change was less than one order of magnitude. This slight decrease is likely explained by the lower potentiometric surface observed during April 2012, as no notable impacts from electron donor were observed at this well. A greater decrease in hydraulic conductivity was observed at RU-21, where the measured hydraulic conductivity decreased by one order of magnitude. While a portion of this decrease is likely attributable to a lower potentiometric surface, the greater decrease in conductivity at RU-21 compared to RU-19 indicates that the electron donor did have a slight effect on hydraulic conductivity in the immediate vicinity of the injections. As the overall decrease in conductivity attributable to electron donor injection was less than one order of magnitude, and the conductivity should increase over time as electron donor is depleted, the long-term effect on hydraulic conductivity is not expected to be significant.

Table 3-1 Hydraulic Conductivity Testing Summary

Well ID		Falling Head Slug Test (cm/sec)		Rising Head Slug Test (cm/sec)		Overall Average (cm/sec)	
		Pre-injection	Post-injection	Pre-injection	Post-injection	Pre-Injection	Post-Injection
RU-19	Test 1	1.302E-03	7.997E-04	1.45E-03	1.023E-03		
	Test 2	1.331E-03	7.163E-04	1.49E-03	9.738E-04		
	Average	1.317E-03	7.580E-04	1.468E-03	9.984E-04	**1.392E-03**	**8.782E-04**
RU-21	Test 1	1.02E-03	1.782E-04	9.606E-04	1.439E-04		
	Test 2	8.952E-04	1.321E-04	4.55E-03	1.461E-04		
	Average	9.551E-04	1.552E-04	2.757E-03	1.450E-04	**1.856E-03**	**1.501E-04**

Section 4

EAB Results

In order for complete reductive dechlorination of TCE to ethene to occur, electron donor must be adequately distributed, redox conditions must be sufficiently reducing, and appropriate microbial populations must be present and active. The electron donor distribution was discussed in the previous section. The redox conditions, microbial populations, and dechlorination results are discussed in this section.

4.1 Redox Conditions

Redox conditions are frequently monitored by measuring the ORP. It is a simple indicator of redox conditions and can be easily measured on-Site during the field activities. However, it is not the most accurate parameter in assessing the actual redox conditions, and if considered alone can sometimes be misleading. Thus, it is required to monitor concentrations of certain inorganic electron acceptors in addition to ORP in order to assess the redox conditions at a site accurately.

4.1.1 Oxidation-Reduction Potential

ORP values over time for each treatment cell are presented in **Table 4-1**. An ORP of -100 mV to -300 mV is within the appropriate range to facilitate reductive dechlorination. The ORP should be viewed as a screening parameter because the electrodes often require long periods of exposure to water to register an accurate reading. Initial values generally ranged from about +102 mV to 130 mV within the pilot study cell wells. Following electron donor injections, ORP readings at one month post-injection were inconsistent, with ORP in RU-10 decreasing from approximately 102 mV to 2 mV, and the remaining pilot study wells exhibiting increases in ORP. At 3 months after injection, all wells exhibited strongly negative ORP values, ranging from -177 mV to -216 mV, which is within the range appropriate for reductive dechlorination. Finally, ORP increased at all wells at 5 months post-injection, with some values becoming positive. It is not clear why this occurred as the increases are not consistent with electron donor concentrations presented in Section 3 or electron acceptor data shown in Section 4.1.2. Given that ORP values fluctuated throughout the pilot study and are inconsistent with other redox conditions observed, it is suspected that higher values may have been due to an error with the instrument. In general, however, an obvious and significant drop in ORP was observed after injection as expected.

4.1.2 Inorganic Electron Acceptors

As discussed earlier, the more reliable indicator of redox conditions is the aqueous concentrations of inorganic electron acceptors and their reduced products. As discussed in the work plan, redox conditions typically progress from aerobic → nitrate reducing → iron reducing → sulfate reducing →methanogenic following addition of a sufficient supply of electron donor. The data indicate that this progression has occurred in all the areas impacted by electron donor injection.

The redox parameters measured during the course of the pilot study at each well are presented on Exhibits 4-1A through 4-1D, with data from the up gradient monitoring well RU-8 presented on Exhibit 4-1E. The observed trends for nitrate, ferrous iron, sulfate, and methane within the pilot study cell are described in the following subsections.

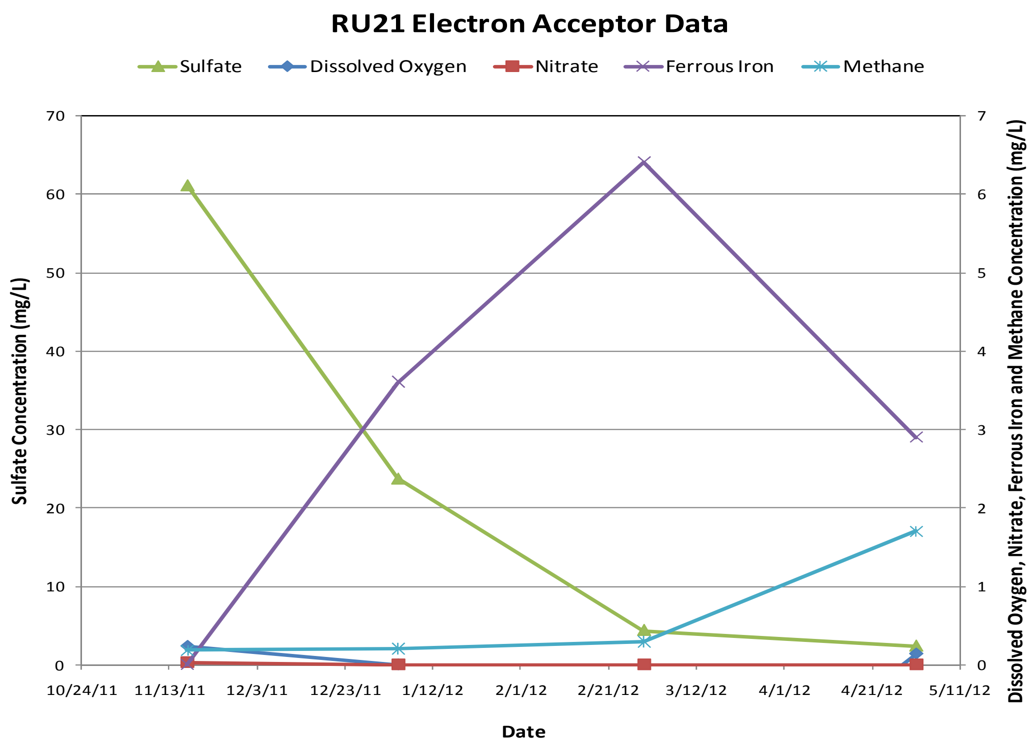


Exhibit 4-1A. RU-21 Electron Acceptor Data

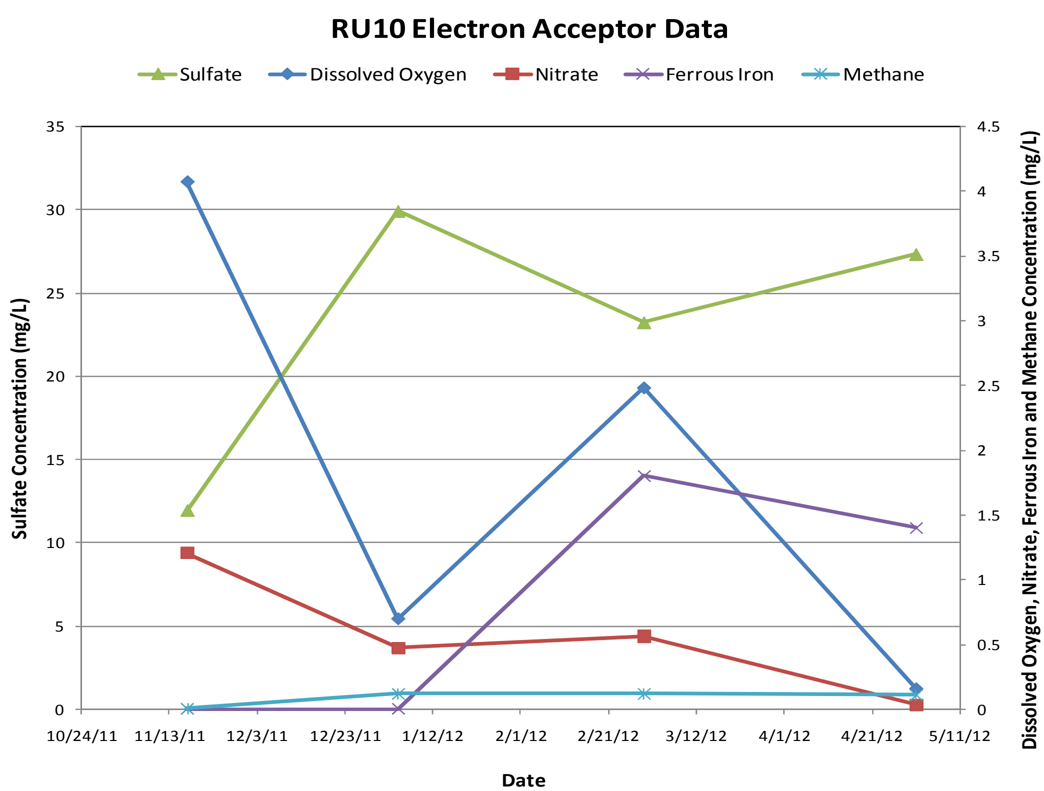


Exhibit 4-1B. RU-21 Electron Acceptor Data

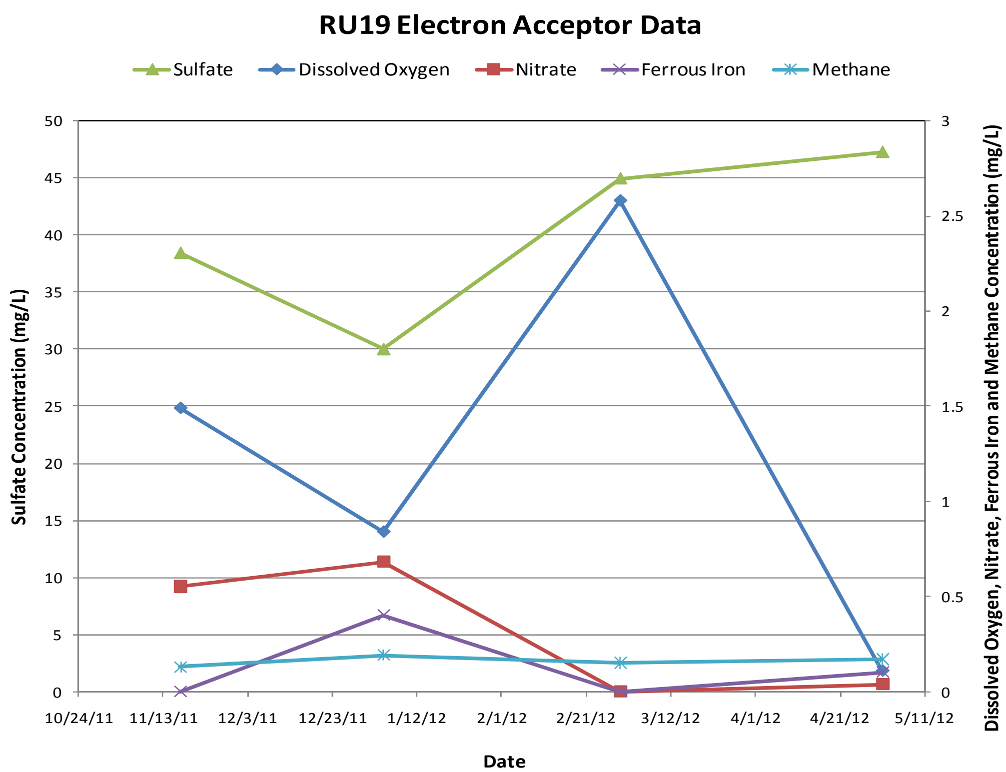


Exhibit 4-1C RU-19 Electron Acceptor Data

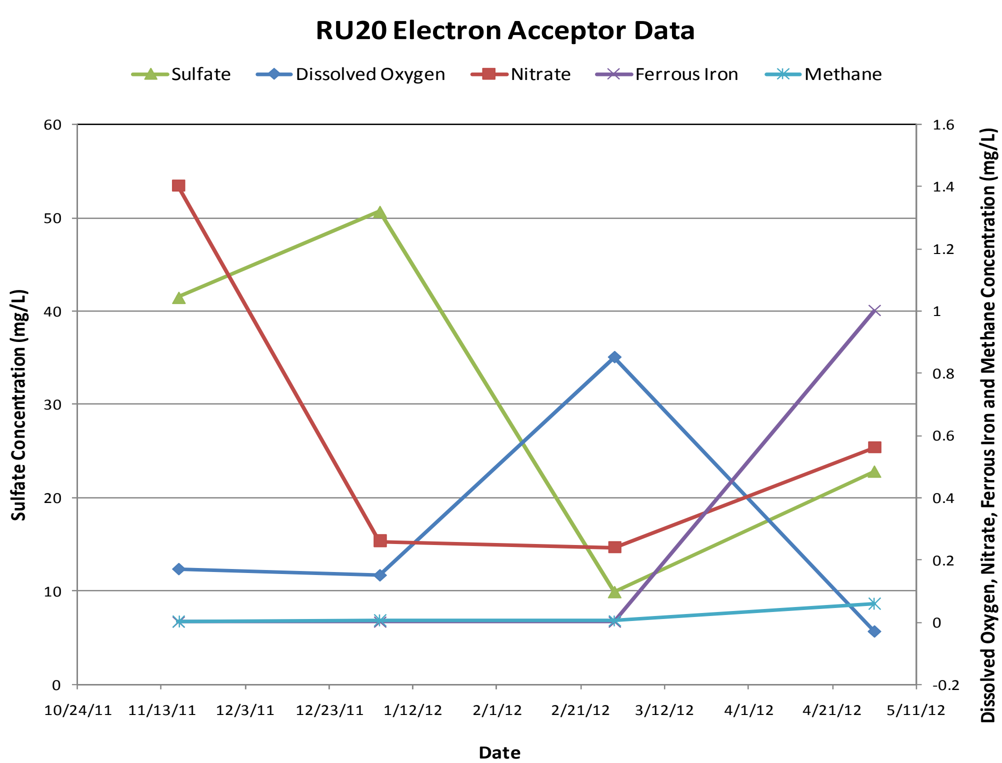


Exhibit 4-1D RU-20 Electron Acceptor Data

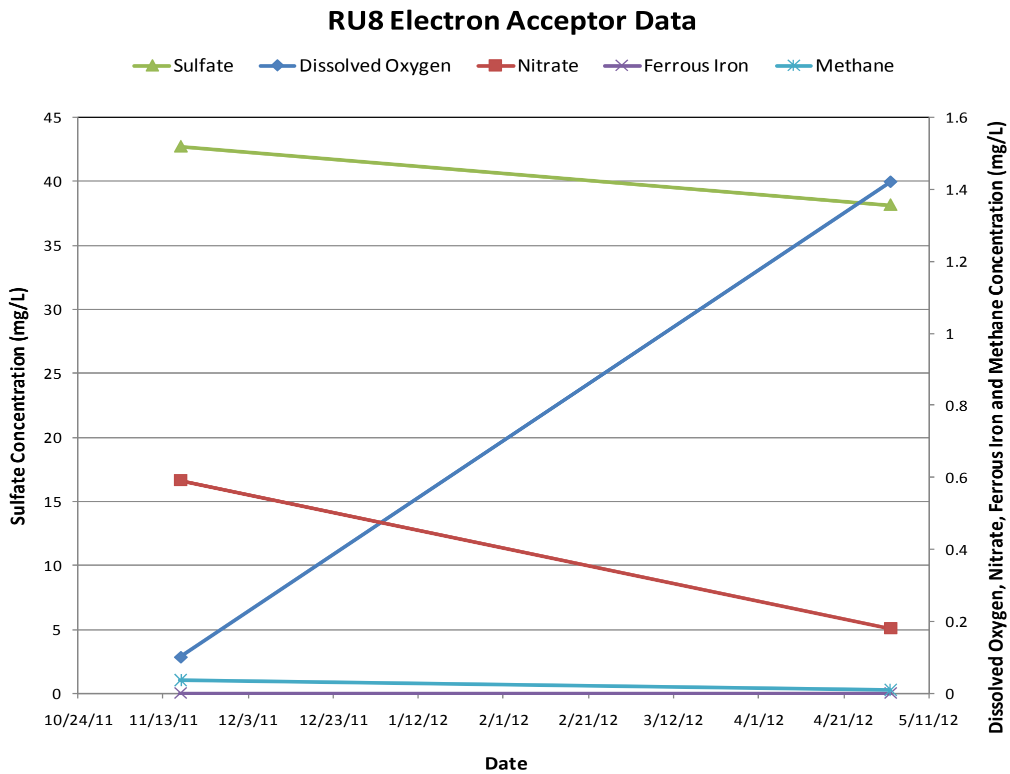


Exhibit 4-1E.RU-8 Electron Acceptor Data

4.1.2.1 Nitrate

Nitrate concentrations during the pilot study are indicated as red lines on Exhibits 4-1A through 4-1E. Nitrate concentrations were generally low during baseline sampling at the site, with the maximum concentration being 1.4 mg/L at RU-20. Nitrate concentrations decreased during the pilot study, with the most marked decreases at wells RU-10 and RU-19, which are within the depth interval targeted for injection. Nitrate concentrations at these wells all decreased by at least one order of magnitude. Nitrate also decreased at RU-20, the deeper-screened well within the pilot study cell. Nitrate at RU-21 was measured at 0.026 mg/L during baseline sampling, which was the lowest detected nitrate concentration during baseline sampling, and nitrate was not detected at RU-21 during the remainder of the pilot study.

4.1.2.2 Ferrous Iron

Ferrous iron is the product of ferric iron reduction. Ferrous iron (indicated by purple lines on Exhibits 4-1A through 4-1E) was not detected at the site during baseline sampling, but was eventually detected within all wells except RU-8 following electron donor injection.

At RU-21, where the electron donor was injected, ferrous iron concentrations increased to a maximum concentration of 6.4 mg/L 3 months after injection, and remained elevated (2.9 mg/L) 5 months after injection. Ferrous iron was also detected at RU-10, with a maximum concentration of 1.8 mg/L, RU-19 with a maximum concentration of 0.4 mg/L, and RU-20 with a maximum concentration of 1.0 mg/L. Observed ferrous iron concentrations correlated well with COD and organic acid results. The lower magnitude increases in ferrous iron at RU-19 and RU-20 are expected, given their greater distances from the injection point.

4.1.2.3 Sulfate

Exhibits 4-1A through 4-1E show sulfate concentrations over time in green at the wells within the pilot study cell. Pre-injection concentrations of sulfate ranged from 11.9 mg/L to 61.1 mg/L within the cell. Sulfate concentrations decreased at wells RU-20 and RU-21 over the course of the pilot study, while sulfate remained steady or increased slightly at RU-10 and RU-19. RU-21 exhibited the greatest change in sulfate, decreasing from 61.1 mg/L to 4.4 mg/L three months into the study, and to 2.4 mg/L by the end of the study. The sulfate decrease was less pronounced at RU-20, with sulfate decreasing from 41.4 mg/L during baseline to 9.9 mg/L 3 months after injection, then increasing slightly at 5 months after injection. As expected, these trends correlate inversely to the observed TOC and organic acid concentrations at this well, which increased at 3 months post injection and started to decrease at the 5-month sampling event.

Overall, the injected electron donor was effective at producing sulfate-reducing conditions in the subsurface in the vicinity of the injection point. The sulfate concentrations suggest that strongly reducing conditions were established near the injection point within approximately 3 to 5 months after injection. The decrease in sulfate at RU-20 corresponding with the increase in TOC concentrations is also an indicator that the electron donor is capable of producing strongly reducing conditions at some distance from the injection point.

4.1.2.4 Methane

Methane provides an indication of conditions most conducive to complete reductive dechlorination of TCE to ethene. Methane concentrations over time for the pilot study wells are shown in blue on Exhibits 4-1A through 4-1E.

Baseline methane concentrations ranged from 0.021 to 0.19 mg/L. Other than a slight increase in RU-10 immediately after injection, methane concentrations within the pilot study cell remained relatively unchanged from baseline conditions during the first 3 months of the pilot study. Five months after injection, methane concentrations increased by nearly an order of magnitude at RU-21, increasing from 0.3 mg/L at 3 months post-injection to 1.7 mg/L at 5 months post-injection. This result is promising, as it indicates the likely onset of methanogenesis within 5 months of electron donor injection.

Slight increases in methane were also observed at RU-20 and RU-10 during the pilot study; however, the methane concentrations at these locations remained below 0.2 mg/L, which are not indicative of significant methanogenesis occurring at these locations. This result is consistent with the fact that sulfate was never fully depleted at these locations.

No notable changes in redox conditions were observed at well RU-8, located up gradient of the pilot study cell, before and after completion of the pilot study.

4.1.3 Redox Summary

Based on the results discussed in this section it can be concluded that redox conditions have shifted in the areas impacted directly by the electron donor injection, and that conditions are generally favorable for reductive dechlorination where the electron donor is present, especially near RU-21. This is supported by the increases in concentration of ferrous iron, decreases in sulfate, and increases in methane generation observed at well RU-21, indicating the presence of strongly reducing conditions near the electron donor injection points.

4.2 Dechlorination

The concentrations of organic acids and redox conditions only indicate whether conditions are favorable for reductive dechlorination to progress at the Site. Of course the concentrations of chloroethenes and ethene provide direct evidence of the removal of chloroethenes, which are the constituents of concern at the Site. Molar concentrations are used in the exhibits in this section so that an evaluation of mass balance can be made (1 mole of DCE is produced from reductive dechlorination of 1 mole of TCE, 1 mole of VC is produced from 1 mole of DCE, and so on). The molar concentrations were used to calculate a chlorine number for each monitoring well. The chlorine number is a measure of the average number of chlorine atoms associated with the chloroethenes (and ethene) in groundwater. Chlorine numbers also need to be interpreted in the context of concentration data, as chlorine numbers are based on proportions of contaminants present. Chlorine numbers range from four (PCE is the only chloroethene present) to zero (only ethene is present). At the Site, because TCE was the original primary contaminant, it would be anticipated that the chlorine number for most wells would be approximately three under baseline conditions. However, as TCE is dechlorinated to DCE, VC, and finally ethene, the chlorine number decreases. As the concentrations of VOCs decline and approach zero, mass balance is often lost. Thus, it is not uncommon for chlorine numbers to increase as contaminant concentrations become very low. In addition, exhibits indicating concentrations in mass units have been provided to enable comparison to regulatory limits.

4.2.1 Injection Area

The molar and mass concentrations of chlorinated ethenes at RU-21 are shown on Exhibits 4-2A and 4-2B, respectively.

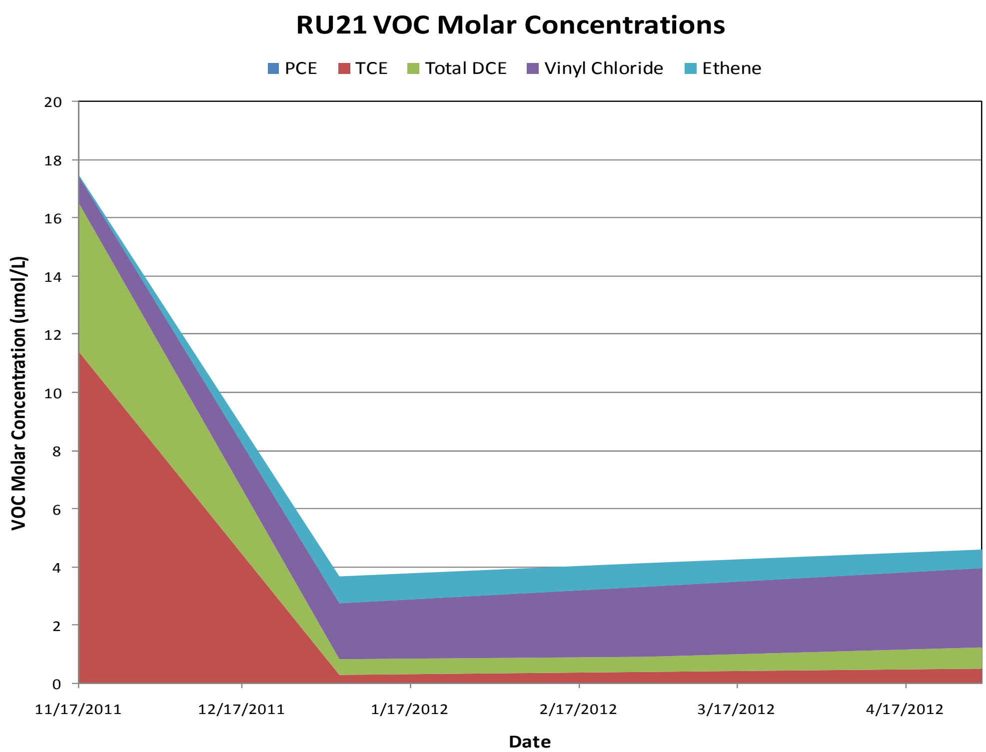


Exhibit 4-2A. RU-21 VOC Molar Concentrations

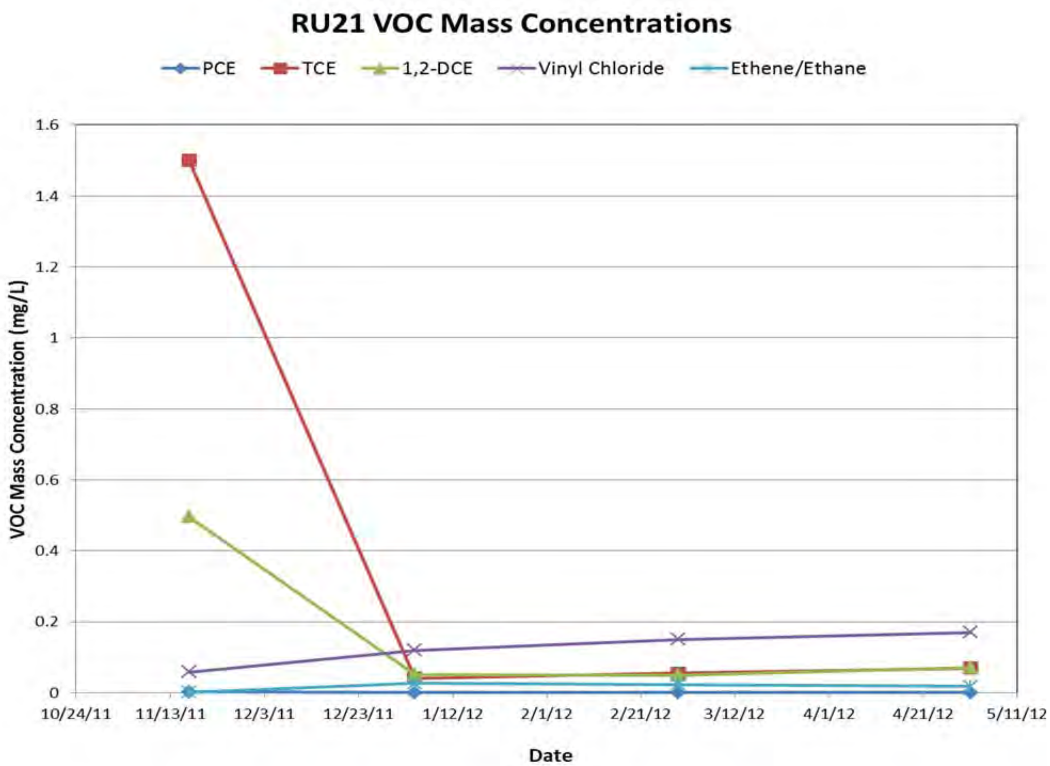


Exhibit 4-2B. RU-21 VOC Mass Concentrations

Total chloroethene concentrations exhibited an overall decline at RU-21 following injection. Initially, it was assumed that this may have been partially due to dilution during injection or partitioning of some portion of TCE into the electron donor (vegetable oil) phase, as the monitoring well RU-21 was directly impacted by the donor. While TCE and *cis*-DCE concentrations decreased substantially by one month, molar concentrations of VC and ethene both increased substantially by one month. The majority of chloroethene molar mass present during the remainder of the pilot study was present as VC and ethene. The baseline chlorine number during the pilot study was 2.59, which decreased to a low of 1.03 by one month after injection, and then increasing slightly to 1.25 by the end of the pilot study. These results indicate that the majority of chloroethene mass was present as TCE and DCE at the start of the pilot study, and that the majority of mass remaining at the end of the pilot study was present as VC. These results indicate that reductive dechlorination is occurring within the injection area.

While ethene increased from baseline conditions, the ethene concentrations are not as high as would be expected after methanogenesis has been established and significant reductive dechlorination is occurring. Lab and field studies published in the literature have shown that significant ethene production does not typically occur until after the onset of methanogenesis. Given the duration of the pilot study of approximately 5 months, and the fact that methanogenesis has just begun to be established in the injection area, it is likely that ethene generation will accelerate at this location within the next several months. However, the observed increases in VC and ethene, combined with the observed redox conditions described previously and the bacterial populations described in Section 4.3, indicate that reductive dechlorination is occurring within the treatment area.

With regard to chloroethene mass concentrations, TCE decreased significantly from 1.5 mg/L to 0.041 mg/L at one month, and DCE decreased from 0.49 mg/L to 0.052 mg/L, VC increased from 0.058 to 0.120 mg/L, and ethene increased from 0.0017 mg/L to 0.026 mg/L. At 5 months post-injection, TCE had increased only slightly, to 0.069 mg/L, DCE had increased slightly to 0.071 mg/L, and VC increased to 0.17 mg/L. Mass concentrations have generally remained unchanged since one month post-injection.

4.2.2 Monitoring Wells

Chloroethene molar and mass concentrations at well RU-10, adjacent to the injection zone, are presented on Exhibits 4-3A and 4-3B, concentrations at well RU-19 are presented on Exhibits 4-4A and 4-4B, and concentrations at RU-20 are presented on Exhibits 4-5A and 4-5B. Molar and mass results from up gradient well RU-8 are presented on Exhibits 4-6A and 4-6B, respectively. At all wells, baseline molar concentrations indicated that the majority of chloroethenes were present as TCE and *cis*-DCE, with only minor amounts of VC present.

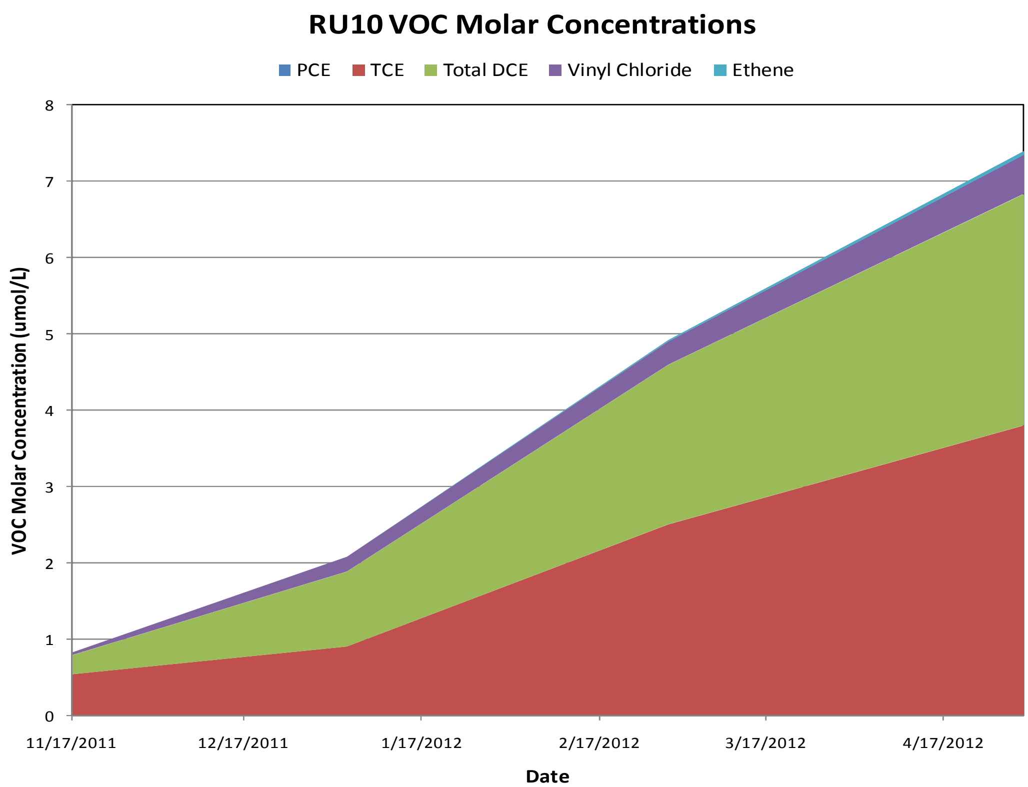


Exhibit 4-3A. RU-10 VOC Molar Concentrations

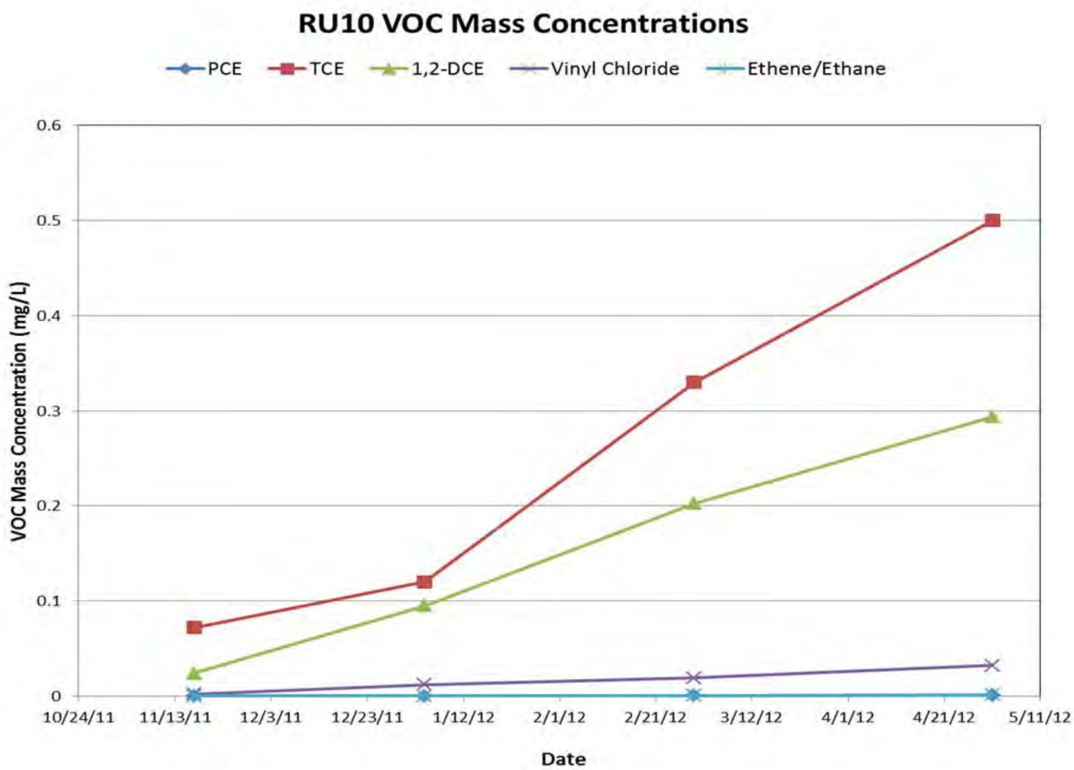


Exhibit 4-3B. RU-10 VOC Mass Concentrations

At well RU-10, VOC concentrations increased throughout the course of the pilot study. The reason for this increase is unclear; however, it is worth noting that while concentrations in RU-10 increased over time, the concentrations during the pilot study remained lower than the observed concentrations when RU-10 was sampled during 2001, when the TCE concentration at RU-10 was 2.8 mg/L, and DCE was 1 mg/L. It is possible that the VOC concentration observed during baseline sampling in November 2011 was representative of a seasonal low. Molar concentrations of TCE, DCE, and VC all increased, though VC appears to have increased at a slightly higher rate when compared to baseline conditions. This is indicated by a slight decrease in the chlorine number from 2.62 to a low of 2.35 one month after injection, which coincided with an increase in TOC and organic acid concentrations. Significant formation of degradation products was not observed following the one month sampling event, coinciding with declines in TOC and organic acid concentrations.

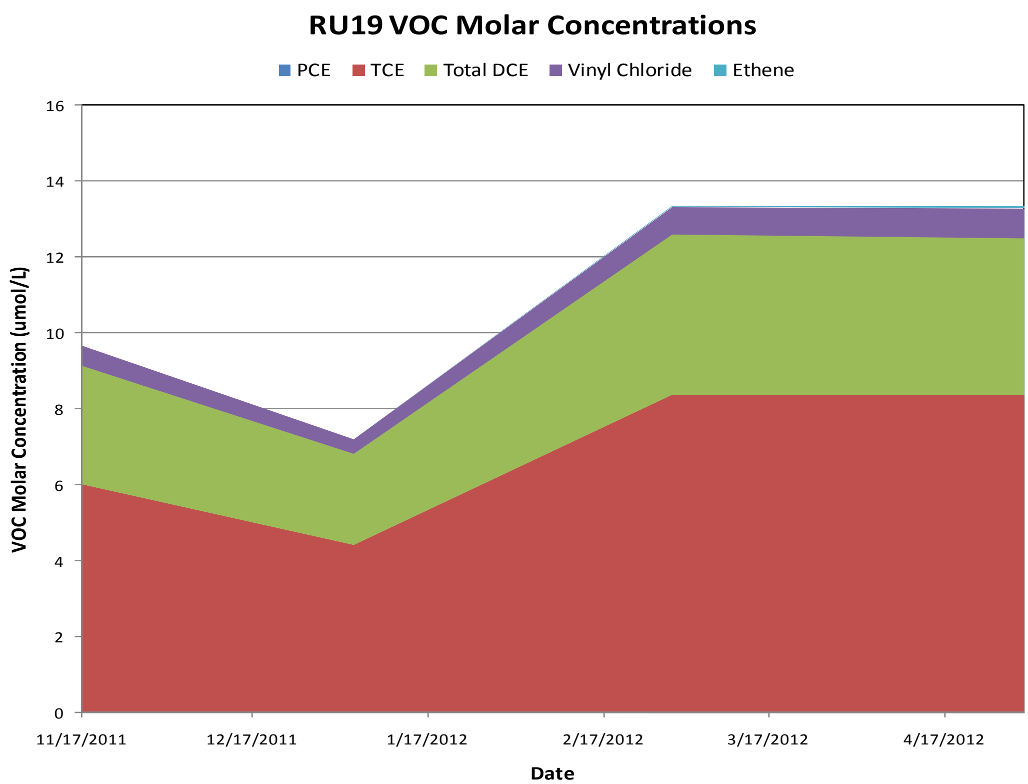


Exhibit 4-4A. RU-19 VOC Molar Concentrations

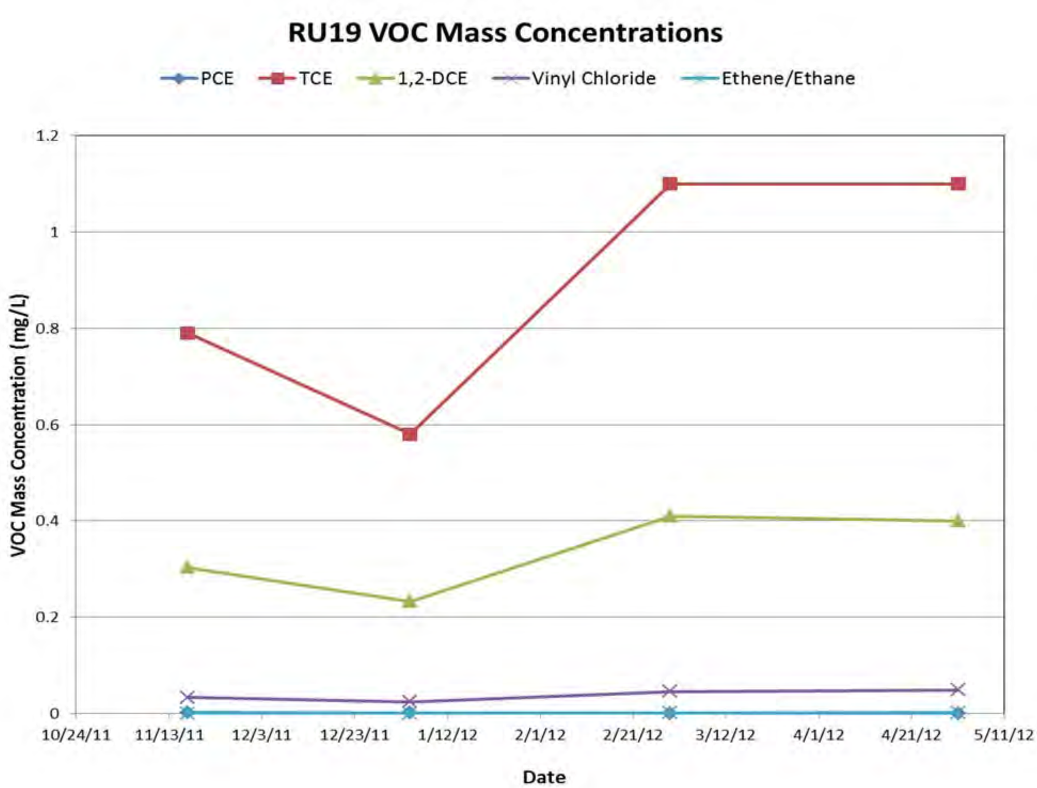


Exhibit 4-4B. RU-19 VOC Mass Concentrations

At well RU-19, approximately 20 feet down gradient of the injection locations, very little change was observed in chloroethene molar and mass concentrations. The chlorine number at this well remained constant (2.56 to 2.57) throughout the pilot study, indicating that the majority of mass is present as TCE and DCE, with no notable formation of breakdown products by reductive dechlorination. Mass concentrations of TCE increased slightly, from 0.79 mg/L to 1.1 mg/L, DCE concentrations increased slightly from 0.3 mg/L to 0.4 mg/L, and VC concentrations increased from 0.033 mg/L to 0.049 mg/L. The lack of significant change is not surprising, given the distance from injection points, the observation that no significant quantity of electron donor migrated to this well following injection, and that redox conditions have not changed significantly since injection activities.

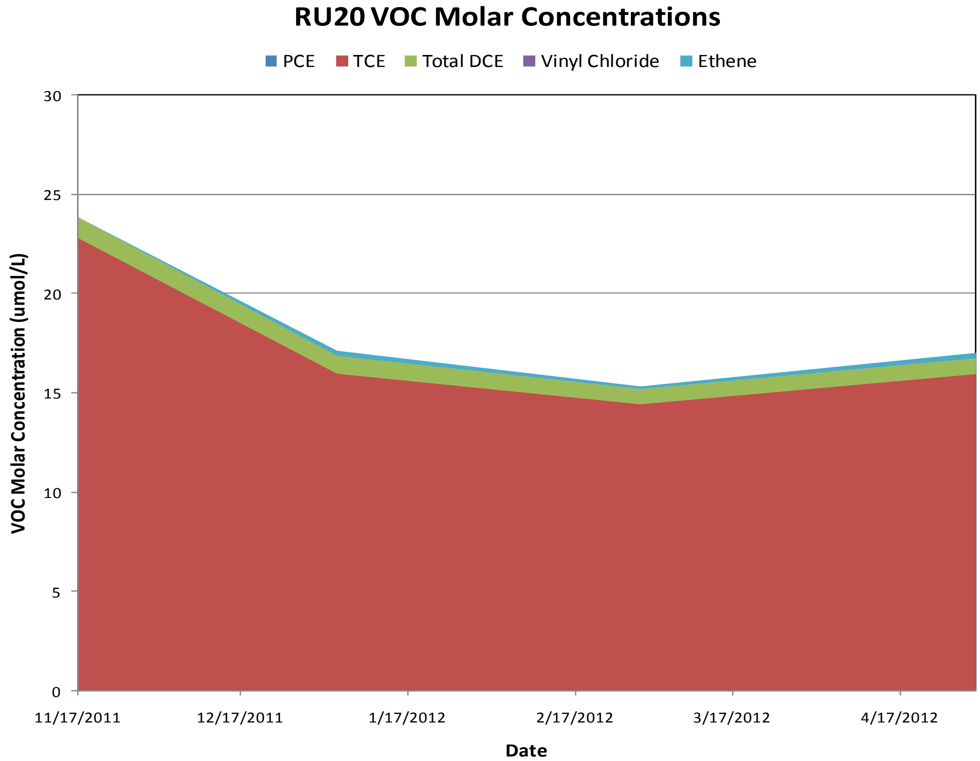


Exhibit 4-5A. RU-20 VOC Molar Concentrations

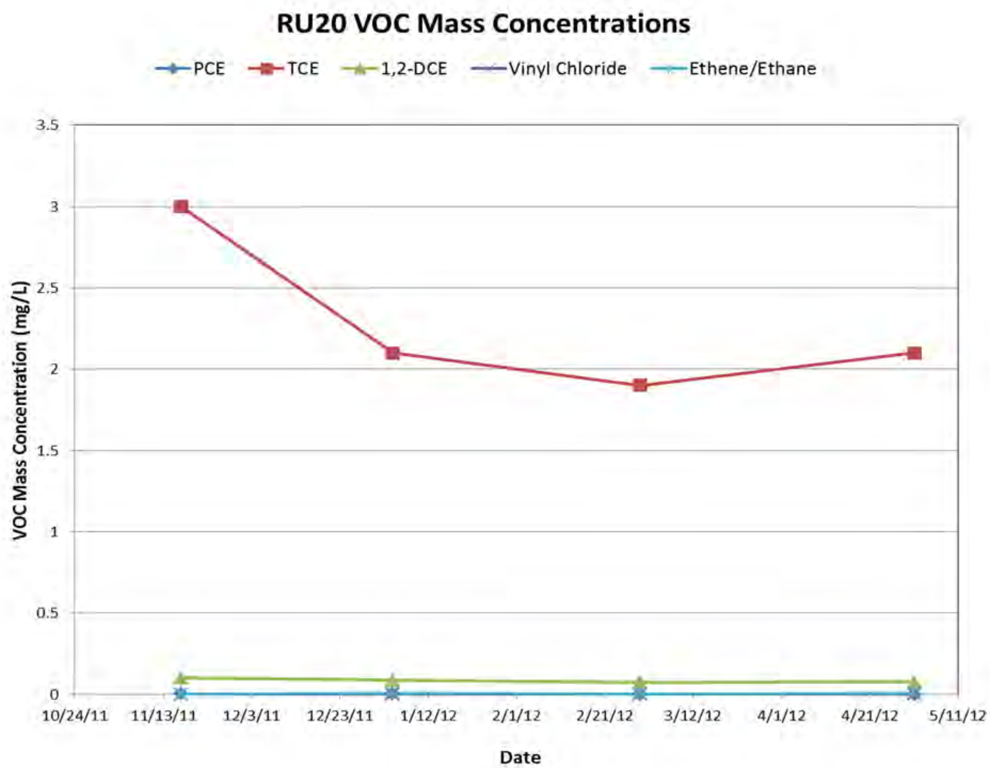


Exhibit 4-5B. RU-20 VOC Mass Concentrations

Well RU-20 contained the highest chloroethene concentrations throughout the pilot study, with a TCE concentration of 3 mg/L at baseline, decreasing to a low of 1.9 mg/L 3 months after injection, and increasing slightly at 5 months. As described in the previous sections, some electron donor was observed to reach this location following injection, and slight changes in redox conditions were observed. However, while chloroethene concentrations did decrease slightly from baseline conditions, no notable reductive dechlorination was observed to occur as degradation products were not observed to increase. The chlorine number ranged from 2.90 to 2.96 throughout the pilot study, indicating that the chloroethene mass is predominantly TCE and that there was virtually no change in the relative molar concentrations of TCE, DCE, VC, and ethene over time. It is likely that while some influence from electron donor injections was observed at RU-20, either insufficient donor or an inadequate bacterial population, or a combination of these, were present at RU-20 to support reductive dechlorination. Given the distance to this location from the injection, both horizontally and vertically, no enhancement of reductive dechlorination was expected at RU-20 as a result of the pilot test injection.

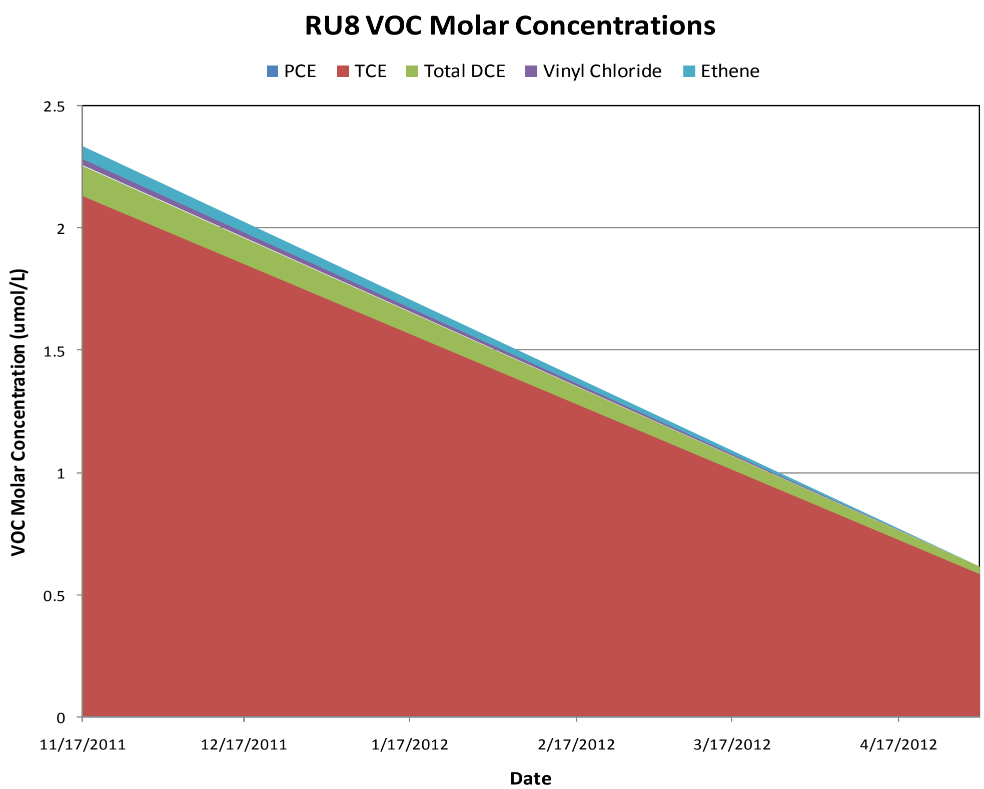


Exhibit 4-6A. RU-8 VOC Molar Concentrations

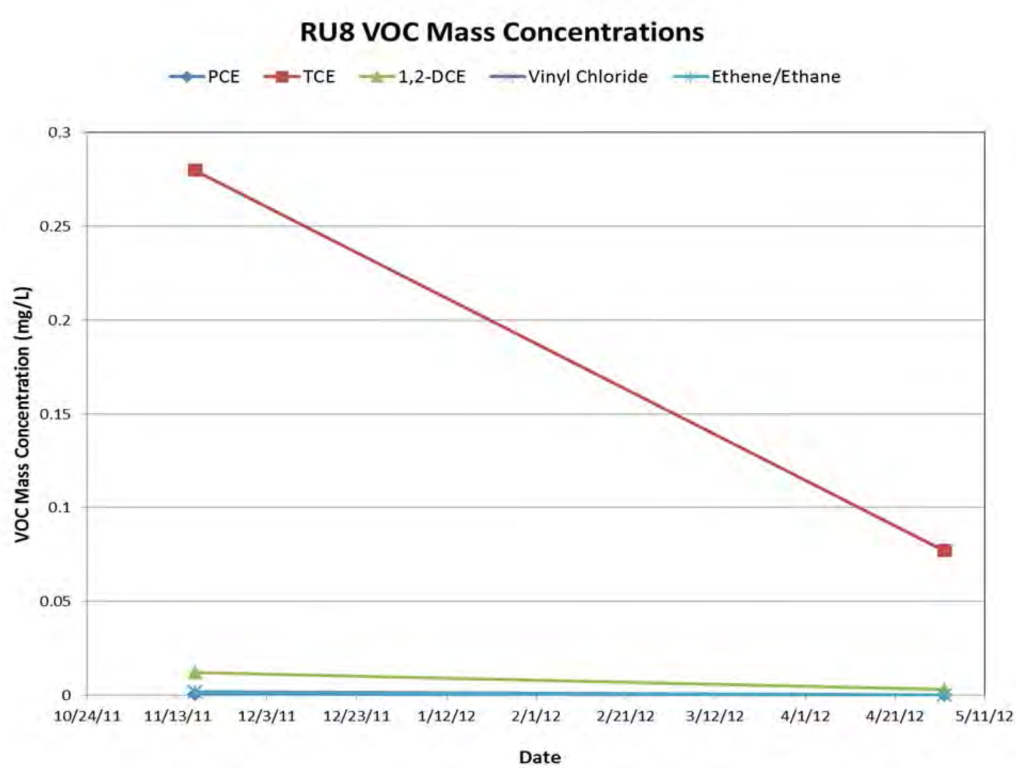


Exhibit 4-6B. RU-8 VOC Mass Concentrations

At RU-8, located up gradient of the pilot study, a decrease in VOC molar and mass concentrations was observed between the start of the pilot study and 5 months post-injection. The chlorine number observed at this well increased slightly, from 2.86 to 2.95, between November 2011 and May 2012. This indicates that reductive dechlorination has not occurred at this location, and that these mass concentration decreases are not associated with the EAB pilot study.

4.2.3 Dechlorination Summary

Overall, the data indicate that reductive dechlorination is occurring at the locations where electron donor was injected and well distributed during the pilot study. In addition to an overall decrease in TCE concentration at RU-21, the remaining chloroethene mass was predominantly composed of VC and ethene formed by reductive dechlorination. While this process is occurring in the area of the Site affected by electron donor injection, significant formation of ethene has not been produced to date. Given the 5-month duration of the pilot study and the observation that methanogenesis is only just beginning in the pilot study cell at 5 months, it is likely that additional ethene generation will occur during the next several months as methanogenesis continues. One additional consideration is groundwater temperature. The measured temperature at well RU-21 in the treatment zone was 12.8 degrees Celsius (deg C) during baseline sampling, and ranged from 9.43 to 9.84 deg C during post-injection monitoring. Biological activity decreases at lower temperatures, which likely explains the lag time for the onset of methanogenesis, as well as the time required to achieve complete dechlorination. Regardless, the data from RU-21 indicate that the electron donor has created appropriate redox conditions to support reductive dechlorination, and the chloroethene results indicate that reductive dechlorination has occurred in the treatment zone.

4.3 Bioaugmentation

While it is sometimes possible to stimulate indigenous *Dehalococcoides spp.* bacteria through electron donor injections alone, in order to evaluate the potential for reductive dechlorination to occur at the Site during the relatively short duration of the pilot study, the pilot study cell was bioaugmented with a commercially available dechlorinating culture (Shaw's SDC-9) immediately following electron donor injection. The bioaugmentation procedure was described in Section 2.2.3. DNA samples for *Dehalococcoides spp.* were collected from all wells in the pilot study during the baseline sampling event to evaluate whether *Dehalococcoides spp.* bacteria may be indigenous in the groundwater at the Site. If indigenous *Dehalococcoides spp.* are present, future scale-up of enhanced bioremediation activities at the Site might be able to be completed without bioaugmentation. Additionally, DNA samples were collected at the 5-month post-injection sampling event to confirm whether the bioaugmentation was successful and to evaluate the populations of *Dehalococcoides spp.* and the functional genes necessary for dechlorination.

Total *Dehalococcoides spp.* concentrations of at least 106 gene copies per liter are generally required to achieve rapid dechlorination. The results of *Dehalococcoides spp.* samples collected from the Site are summarized in Table 4-2. *Dehalococcoides spp.* were not detected during the baseline sampling event at any of the pilot study monitoring wells. The table contains concentrations of Dehalococcoides, as well as three functional genes that are necessary for dechlorination to occur. The tceA gene is responsible for degradation of TCE to DCE, while the bvcA and vcrA genes encode for two different enzymes that degrade DCE to ethene. The DNA results at RU-21 confirm that the added dechlorinating bacteria are thriving in the injection area at the Site, and combined with the observed dechlorination and VC production during the pilot study, indicate that the microbial community in these areas is more than sufficient to support complete dechlorination. Additionally, the detected

Dehalococcoides spp. at RU-19, located approximately 20 feet down gradient of the treatment zone within the same subsurface interval, are an encouraging result indicating that transport of *Dehalococcoides spp.* within the subsurface at the site is occurring.

4.4 Dissolved Metals

Dissolved metals were measured at site monitoring wells during both the baseline monitoring event and the 5-month post-injection event. The purpose was to evaluate the potential for increases in dissolved metals concentrations in groundwater in response to changed redox conditions in the aquifer following injection activities. Dissolved metals concentrations are presented in Table 4-3.

Several metals exhibited increases in concentration after injection activities when compared to baseline concentrations. In general the greatest increases were observed at RU-21, within the area influenced by the electron donor injection. Arsenic increased from less than 0.005 mg/L to 0.023 mg/L, which is still below the New York groundwater standard of 0.025 mg/L. Slight increases in aluminum, barium, chromium, cobalt, nickel, and sodium. Iron and manganese concentrations increased in the vicinity of the electron donor injection activities; however this is expected as iron and manganese act as electron acceptors for reducing bacteria.

While slight increases in some dissolved metals concentrations were observed following electron donor injection, these increases are not expected to lead to migration of metals outside of the treatment area, as the metals become more immobile as redox conditions become less reducing outside of the EAB treatment area.

		VOC - Mass Concentrations									Donor				Redox Conditions						General Chemistry					
Well ID	**Sample Date**	**PCE**	**TCE**	**cis-1,2-DCE**	**trans-1,2-DCE**	**Vinyl Chloride**	**Ethene**	**Ethane**	**1,1-DCE**	**Chlorine Number**	**Total Organic Carbon**	**Acetic Acid**	**Propionic Acid**	**Butyric Acid**	**Dissolved Oxygen**	**ORP**	**Nitrate + Nitrite (as N)**	**Ferrous Iron**	**Sulfate**	**Methane**	**pH**	**Conductivity**	**Temperature**	**Turbidity**	**Chloride**	**Alkalinity**
	Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mV	mg/L	mg/L	mg/L	mg/L	s.u.	uS/cm	deg C	NTU	mg/L	mg/L
RU10	11/17/2011	<0.00036	0.072	0.024	<0.0009	0.0022	<0.00052	<0.00049	<0.00029	2.62	<0.43	<0.15	<0.17	<0.16	4.07	101.8	1.2	0	11.9	0.0074	7.14	126	12.69	14.3	1.8	68
	1/4/2012	<0.00036	0.12	0.094	0.0011	0.012	<0.00052	0.004	0.00059	2.35	205	39.6	57	<0.16	0.7	2.7	0.47	0	29.9	0.12	7.09	90	8.3	36.1	9.3	425
	2/29/2012	0.00046	0.33	0.2	0.0025	0.019	0.00054	0.0057	0.0013	2.44	17.2	7.4	17.7	<0.16	2.48	-176.8	0.56	1.8	23.2	0.12	6.81	292	7.99	12.6	11.1	323
	5/1/2012	0.001	0.5	0.29	0.0038	0.032	0.0014	0.0087	0.0018	2.43	8.6	10.9	<0.17	<0.16	0.16	-64.3	0.034	1.4	27.3	0.11	6.96	415	10.14	48	17.1	320
RU19	11/17/2011	0.0017	0.79	0.3	0.0035	0.033	<0.00052	0.0078	0.0021	2.57	0.95	<0.15	<0.17	<0.16	1.49	8.7	0.55	0	38.4	0.13	7.29	450	12.98	15.5	17	272
	1/4/2012	0.0013	0.58	0.23	0.0028	0.024	<0.00052	0.007	0.0014	2.56	7.1	2.7	3.7	<0.16	0.84	67.2	0.68	0.4	30	0.19	6.99	403	9.91	2	14.3	221
	2/29/2012	<0.0036	1.1	0.41	<0.009	0.045	0.00057	0.0049	<0.0029	2.57	2.4	<0.15	<0.17	<0.16	2.58	-188.7	<0.02	0	44.9	0.15	6.81	483	9.24	1.9	26	340
	5/1/2012	<0.0036	1.1	0.4	<0.009	0.049	0.0015	0.0099	<0.0029	2.56	2.5	<0.15	<0.17	<0.16	0.11	85.2	0.037	0.1	47.2	0.17	6.82	436	11.13	10.7	24.4	320
RU20	11/17/2011	0.0038	3	0.1	0.0015	<0.0009	<0.00052	<0.00049	0.0012	2.96	0.75	<0.15	<0.17	<0.16	0.17	-130.4	1.4	0	41.4	0.0021	7.47	653	11.86	33.2	83.5	272
	1/4/2012	0.0022	2.1	0.086	0.0013	<0.0009	0.0073	0.0026	0.00095	2.90	48.5	11.3	7.6	<0.16	0.15	-108.2	0.26	0	50.6	0.0069	8.96	761	10.35	12.7	79.6	238
	2/29/2012	<0.009	1.9	0.075	<0.023	<0.023	0.0035	0.0019	<0.0073	2.93	171	67.4	58.8	<0.16	0.85	-216.3	0.24	0	9.9	0.0046	7.61	815	10.08	19.1	71.1	391
	5/1/2012	<0.018	2.1	0.077	<0.045	<0.045	0.0076	0.0078	<0.015	2.91	75.5	63.6	33	<0.16	-0.03	-25.5	0.56	1	22.8	0.06	7.24	563	11.51	13.9	71.6	340
RU21	11/17/2011	0.0026	1.5	0.49	0.0062	0.058	0.0017	0.012	0.0036	2.59	2	<0.15	<0.17	<0.16	0.24	-56.5	0.026	0	61.1	0.19	7.52	618	12.76	22.6	26.6	323
	1/4/2012	<0.00072	0.041	0.052	<0.0018	0.12	0.026	0.011	<0.00058	1.06	2040	920	1690	10.9	0	50.9	<0.011	3.6	23.7	0.21	6.25	7633	9.43	3	23.8	2125
	2/29/2012	<0.00072	0.055	0.05	<0.0018	0.15	0.023	0.0084	<0.00058	1.13	1070	740	1370	40	-2.56	-185.1	<0.02	6.4	4.4	0.3	6.35	2891	9.61	6.2	18.4	3791
	5/1/2012	<0.00072	0.069	0.071	<0.0018	0.17	0.018	0.016	<0.00058	1.25	751	650	770	57	0.14	55.2	<0.02	2.9	2.4	1.7	6.45	2069	9.84	11.7	36.6	1600
RU8	11/17/2011	0.00052	0.28	0.012	<0.0009	0.0017	0.0015	0.0026	<0.00029	2.86	0.5	<0.15	<0.17	<0.16	0.1	2	0.59	0	42.7	0.037	7.52	566	11.34	58.8	10.5	391
	5/2/2012	<0.00036	0.077	0.003	<0.0009	<0.0009	<0.00052	0.0014	<0.00029	2.95	0.67	<0.15	<0.17	<0.16	1.42	72.2	0.18	0	38.1	0.0097	7.4	461	11.28	8.2	12.2	380

Notes:

< - indicates analyte not detected at concentration greater than the detection limit indicated
mg/L - milligrams per liter
mV - millivolt
s.u - standard unit
deg C - degrees Celsius
NTU - nephelometric turbidity unit

PCE - tetrachloroethene
TCE - trichloroethene
DCE - dichloroethene
ORP - oxidation-reduction potential

Table 4-1 - Analytical Results Summary
Bioremediation Pilot Study
Alcas Cutlery Corporation Facility, Olean, NY

Table 4-2 Dehalococcoides Spp. Analytical Results

Well	Date	Total Dehalococcoides spp. (gene copies/L)	Functional Gene tceA (gene copies/L)	Functional Gene bvcA (gene copies/L)	Functional Gene vcrA (gene copies/L)
RU-8	11/17/2012	ND	ND	ND	ND
	5/2/2012	ND	ND	ND	ND
RU-10	11/17/2012	ND	ND	ND	ND
	5/1/2012	ND	ND	ND	ND
RU-19	11/17/2012	ND	ND	ND	ND
	5/1/2012	6.79×10^{6}	4.18×10^{6}	ND	1.74×10^{6}
RU-20	11/17/2012	ND	ND	ND	ND
	5/1/2012	ND	ND	ND	ND
RU-21	11/17/2012	ND	ND	ND	ND
	5/1/2012	1.16×10^{9}	6.74×10^{8}	ND	2.39×10^{8}

Notes:

ND – not detected

L - liter

		Dissolved Metals																						
Well ID	**Sample Date**	**Aluminum**	**Antimony**	**Arsenic**	**Barium**	**Beryllium**	**Cadmium**	**Calcium**	**Chromium**	**Cobalt**	**Copper**	**Iron**	**Lead**	**Magnesium**	**Manganese**	**Mercury (total)**	**Nickel**	**Potassium**	**Selenium**	**Silver**	**Sodium**	**Thallium**	**Vanadium**	**Zinc**
	Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
RU10	11/17/2011	<0.06	<0.0068	<0.0056	0.051	<0.0003	<0.00033	22.1	<0.00087	<0.00063	0.004	<0.019	<0.003	3.6	0.0063	<0.00012	<0.0013	0.56	<0.0087	<0.0017	2.4	<0.01	<0.0011	0.0026
	1/4/2012	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2/29/2012	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	5/1/2012	0.075	<0.0068	0.013	0.18	<0.0003	<0.0005	79.6	0.0026	0.0052	<0.0016	3.4	<0.003	10.9	3.2	NS	0.0044	1.2	0.019	<0.0017	18.6	<0.01	<0.0015	0.028
RU19	11/17/2011	<0.06	<0.0068	<0.0056	0.052	<0.0003	0.00041	73.3	<0.00087	0.00087	0.0047	<0.019	<0.003	11.2	0.45	<0.00012	0.0024	1.7	<0.0087	<0.0017	13.6	<0.01	<0.0011	0.0038
	1/4/2012	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2/29/2012	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	5/1/2012	<0.06	<0.0068	<0.0056	0.065	<0.0003	<0.0005	95.1	<0.001	0.0011	<0.0016	0.11	<0.003	15.2	2.6	<0.00012	0.0023	1.5	<0.0087	<0.0017	18.2	<0.01	<0.0015	0.0033
RU20	11/17/2011	<0.06	<0.0068	<0.0056	0.14	<0.0003	<0.00033	107	<0.00087	<0.00063	0.0034	<0.019	<0.003	16.6	0.098	<0.00012	0.0015	2.4	<0.0087	<0.0017	31.6	<0.01	<0.0011	0.0031
	1/4/2012	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2/29/2012	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	5/1/2012	<0.06	<0.0068	0.0069	0.12	<0.0003	<0.0005	98	0.0012	<0.00063	<0.0016	0.42	<0.003	15.2	0.85	<0.00012	0.0016	4.7	<0.0087	<0.0017	64.2	<0.01	<0.0015	<0.0015
RU21	11/17/2011	<0.06	<0.0068	<0.0056	0.06	<0.0003	0.00043	114	<0.00087	0.0011	0.0043	<0.019	<0.003	16.7	0.45	<0.00012	0.0032	2.3	<0.0087	<0.0017	20	<0.01	<0.0011	0.0032
	1/4/2012	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2/29/2012	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	5/1/2012	0.1	<0.0068	0.023	0.46	<0.0003	0.00052	83.1	0.0028	0.01	<0.0016	18.7	<0.003	16.3	17.1	<0.00012	0.0086	1.5	0.0098	<0.0017	524	0.02	<0.0015	0.0029
RU8	11/17/2011	<0.06	<0.0068	<0.0056	0.11	<0.0003	<0.00033	104	<0.00087	<0.00063	0.0019	<0.019	<0.003	21.5	0.28	<0.00012	<0.0013	1.7	<0.0087	<0.0017	17.6	<0.01	<0.0011	0.0058
	5/2/2012	<0.06	<0.0068	<0.0056	0.13	<0.0003	<0.0005	117	<0.001	<0.00063	0.0017	<0.019	<0.003	22.5	0.48	<0.00012	<0.0013	1.8	<0.0087	<0.0017	12.7	<0.01	<0.0015	0.0086

Notes:

< - indicates analyte not detected at concentration greater than the detection limit indicated
mg/L - milligrams per liter
mV - millivolt
s.u - standard unit
deg C - degrees Celsius
NTU - nephelometric turbidity unit

Section 5

Pilot Scale Summary and Conclusions

The primary objective of the pilot study, determining whether bioremediation with bioaugmentation is a viable, cost-effective remedy for off-Site chlorinated solvent impacts in groundwater, was successfully accomplished, and answered in the affirmative. The electron donor was effectively distributed using the DPT injection method and in the presence of the bioaugmentation culture, reductive dechlorination occurred with a reduction in TCE concentration of approximately 95 percent, and a reduction in total chloroethenes of approximately 85 percent.

In terms of electron donor distribution, the donor was successfully distributed within the aquifer using low-pressure DPT injection techniques. Due to the relatively low, but highly variable, permeability of the aquifer formations at the Site, pressurized DPT injection using a "top-down" approach is an effective method for distributing electron donor both horizontally and vertically at the Site. This method was facilitated through the use of the AMS retractable remediation injection tool. Given the conditions observed during the pilot study, it is anticipated that up to approximately 800 – 1,000 gallons of electron donor might be able to be injected in a single day using one DPT rig with this injection tool.

The pilot study cell showed strongly reducing conditions following electron donor injection, and in general these favorable reducing conditions have been maintained throughout the duration of the pilot study. It is clear that the bioaugmentation in the cell was successful based on the results of groundwater DNA samples, and contributed to the development of an efficient dechlorinating culture in the pilot study cell. While ethene formation has been limited to date, the recent onset of methanogenesis combined with the presence of electron donor and appropriate dechlorinating bacteria 5 months after injection, suggest that ethene production will likely increase in the coming months.

The pilot study results demonstrate that EAB can be stimulated for cost-effective treatment of the chlorinated VOC constituents in groundwater at the Site. These results may be used as the basis for scaling up the EAB treatment in phases to achieve treatment in other areas of the site.

Section 6

References

CDM Smith Inc. 2011. Pilot and Bench Study Remedial Action Plan, Alcas Cutlery Corporation Facility, Olean, New York. September.

Ellis, D. E.; E. J. Lutz; J. M. Odom; R. J. Buchanan, Jr.; C. L. Bartlett. 2000. *Environmental Science and Technology* 34(11): 2254-2260.

Environeering, Inc. 2008. Updated Site Evaluation and Conceptual Model Report, Alcas Cutlery Corporation Property, Olean Well Field Superfund Site, Olean, New York.

Environeering, Inc. 2011. Part II Phase 2 Data Collection Work Plan for the Focused Feasibility Study ("FFS") Alcas Cutlery Corporation Facility Site, Olean, New York.

Freedman, D. L.; Gossett, J. M. 1989.*Applied and Environmental Microbiology* 55, 2144-2151.

Hendrickson, E. R., J. A. Payne, R. M. Young, M. G. Starr, M. P. Perry, S. Fahnestock, D. E. Ellis, and R. C. Ebersole. 2002. *Applied and Environmental Microbiology* 68: 485-495.

Lendvay, J. M., F. E. Loeffler, M. Dollhopf, M. R. Aiello, G. Daniels, B. Z. Fathepure, M. Gebhard, R. Heine, R. Helton, J. Shi, R. Krajmalnik-Brown, C. L. Major, M. J. Barcelona, E. Petrovskis, R. Hickey, J. M. Tiedje, and P. Adriaens. 2003. *Environmental Science and Technology*, 37:1422-1431.

Major, D. W., M. L. McMaster, E. E. Cox, E. A. Edwards, S. M. Dworatzek, E. R. Hendrickson, M. G. Starr, J. A. Payne, and L. W. Buonamici. 2002. *Environmental Science and Technology*, 36(23):5106-5116.

U.S. Environmental Protection Agency. 1998. Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water. Report EPA/600/R-98/128

Appendix A

Boring Logs and Well Construction Diagrams

DRILLING LOG

HOLE NO.: RU-19

SHEET 1 OF 1 SHEETS

1. COMPANY NAME: CDM Smith	2. DRILLING SUBCONTRACTOR: SJB
3. PROJECT: Alcas - Bioremediation Pilot Study	4. LOCATION: Olean, NY
5. NAME OF DRILLER:	6. MANUFACTURER'S DESIGNATION OF DRILL: CME550 ATV
7. SIZES/TYPES OF DRILLING & SAMPLING EQUIPMENT: CME550 Hollow-Stem Auger	8. HOLE LOCATION:
	9. SURFACE ELEVATION (Elevation top of hole): NA
	10. DATE STARTED: 11/15/2012 — 11. DATE COMPLETED: 11/15/2011
12. OVERBURDEN THICKNESS: 20 ft	15. DEPTH GROUNDWATER ENCOUNTERED: 8 ft bgs
13. DEPTH DRILLED INTO ROCK: NA	16. DIRECTION OF HOLE: Vertical
14. TOTAL DEPTH OF HOLE: 20 ft bgs	17. TOTAL NUMBER OF CORE BOXES: NA
18. GEOTECHNICAL SAMPLES: NA — DISTURBED: — UNDISTURBED:	19. TOTAL # OF SPLIT SPOON SAMPLES: 4

20. SAMPLES FOR CHEMICAL ANALYSIS:	8 RCRA METALS	VOC's	SVOC's	TPH	Ph	Pest/PCB's	Herbs	RAD's	Triaxial Permeability	Other Physical	21. TOTAL CORE RECOVERY:
TCLP	X	X									

22. DISPOSITION OF HOLE:	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. INSPECTOR:
		X		Neil Smith

DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE/CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	BLOW COUNT g.	REMARKS h.	Well Construction Details i.
0	Sandy silt cuttings to 5 feet	0 ppm					
2						Cement grout w/3% bentonite	
4						2" SCH 40 PVC riser	
5	Sandy silt (ML), sl clayey, moist, brown				4/5/10/13		
6	Silty sand (SM), 10% gravel, Subround, fine, moist, brown					Bentonite seal	
8	Few gravels 7-9 ft while drilling						
10	Silty sand (SM), Fine-med, few gravels, wet, brown Silt lens 11.5 ft				3/4/5/5	Filter Pack Sand 7.5-20 ft (#0)	
12							
14						2" SCH 40 PVC Screen 0.01-Slot	
15	Sand (SW), gravelly, wet, Fine-coarse, brown				5/8/4/5		
16	Silt (ML), sandy, fine bedding, wet, brown						
18							
20	Silt, clayey, fine bedding, moist, gray				2/2/2/2		
22							

COMMENTS:

PROJECT: Olean Bioremediation Pilot Study

HOLE NO.: RU-19

DRILLING LOG

HOLE NO.: RU-20

1. COMPANY NAME: CDM Smith	2. DRILLING SUBCONTRACTOR: SJB	SHEET 1 OF 2 SHEETS
3. PROJECT: Alcas - Bioremediation Pilot Study	4. LOCATION: Olean, NY	
5. NAME OF DRILLER:	6. MANUFACTURER'S DESIGNATION OF DRILL: CME550 ATV	
7. SIZES/TYPES OF DRILLING & SAMPLING EQUIPMENT: CME550 Hollow-Stem Auger	8. HOLE LOCATION:	
	9. SURFACE ELEVATION (Elevation top of hole): NA	
	10. DATE STARTED: 11/14/2011	11. DATE COMPLETED: 11/15/2011
12. OVERBURDEN THICKNESS: 40 ft	15. DEPTH GROUNDWATER ENCOUNTERED: 8 ft bgs	
13. DEPTH DRILLED INTO ROCK: NA	16. DIRECTION OF HOLE: Vertical	
14. TOTAL DEPTH OF HOLE: 40 ft bgs	17. TOTAL NUMBER OF CORE BOXES NA	
18. GEOTECHNICAL SAMPLES: NA / DISTURBED: / UNDISTURBED:	19. TOTAL # OF SPLIT SPOON SAMPLES: 18	

20. SAMPLES FOR CHEMICAL ANALYSIS:	8 RCRA METALS	VOC's	SVOC's	TPH	Ph	Pest/PCB's	Herbs	RAD's	Triaxial Permeability	Other Physical	21. TOTAL CORE RECOVERY:
TCLP	X	X									

22. DISPOSITION OF HOLE:	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. INSPECTOR:
		X		Neil Smith

DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE/CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	BLOW COUNT g.	REMARKS h.	Well Construction Details i.
0	Clayey sand (SC), silty, fine, moist, brown, roots, iron deposits	0 ppm			1/2/2/3		
2	Silt (ML), clayey, moist, brown, tan, iron deposits				2/3/7/9		
4					4/6/9/ 10		
6	Sand, silty (SM), fine, few clay nodules, few coarse sand grains, moist, brown				1/11/12/ 13	Cement grout w/3% bentonite and Microbond additive	
8	Wet at 8 ft				3/5/4/4		
10	V. silty 9.5-10 ft and 11.5-12 ft				2/2/5/9		
12					9/9/21/2 1	2" SCH 40 PVC riser	
14	Sandy silt w/gravel (ML),dense, subround gravel, wet, brown, gray V. sandy 14.5-15				7/12/7/1 1		
16	Sand, silty (SM), 5% gravel (subround), wet, gray-brown				7/8/9/ 11		
17	Silt (ML), sl. Clayey, sl. Sandy, moist, brown						
18					3/3/4/5		
20	Color change at 19 ft - gray						

COMMENTS:

PROJECT: Olean Bioremediation Pilot Study

HOLE NO.: RU-20

DRILLING LOG

HOLE NO.: RU-20

SHEET 2 OF 2 SHEETS

1. COMPANY NAME: CDM Smith	2. DRILLING SUBCONTRACTOR: SJB
3. PROJECT: Alcas - Bioremediation Pilot Study	4. LOCATION: Olean, NY
5. NAME OF DRILLER:	6. MANUFACTURER'S DESIGNATION OF DRILL: CME550 ATV
7. SIZES/TYPES OF DRILLING & SAMPLING EQUIPMENT: CME550 Hollow-Stem Auger	8. HOLE LOCATION:
	9. SURFACE ELEVATION (Elevation top of hole): NA
	10. DATE STARTED: 11/14/2011 — 11. DATE COMPLETED: 11/15/2011
12. OVERBURDEN THICKNESS: 40 ft	15. DEPTH GROUNDWATER ENCOUNTERED: 8 ft bgs
13. DEPTH DRILLED INTO ROCK: NA	16. DIRECTION OF HOLE: Vertical
14. TOTAL DEPTH OF HOLE: 40 ft bgs	17. TOTAL NUMBER OF CORE BOXES: NA
18. GEOTECHNICAL SAMPLES: NA — DISTURBED: — UNDISTURBED:	19. TOTAL # OF SPLIT SPOON SAMPLES: 18

20. SAMPLES FOR CHEMICAL ANALYSIS:	8 RCRA METALS	VOC's	SVOC's	TPH	Ph	Pest/PCB's	Herbs	RAD's	Triaxial Permeability	Other Physical	21. TOTAL CORE RECOVERY:
TCLP	X	X									

22. DISPOSITION OF HOLE:	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. INSPECTOR:
		X		Neil Smith

DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE/CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	BLOW COUNT g.	REMARKS h.	Well Construction Details i.
20	Silt (ML), sl. Clayey, sl. Sandy, moist, brown	0 ppm			2/2/3/4	Cement grout w/3% bentonite and Microbond additive	
22	Clay (CL) w/ silt lenses, fine-med bedding, moist, gray-brown				8/11/9/10		
24	Clay (CL), gravelly, subround - subangular, moist, gray				6/8/8/ 11		
26	More gravelly with depth				10/11/ 17/16	Bentonite Seal 25.5-27.5'	
28					6/7/11/15		
30					10/11/ 14/27	Sand filter pack 27.5-40 ft bgs - #0	
32	Gravel (GW), sandy, fine-coarse, subround - subangular, wet, gray, brown				14/16/ 35/33		
34					8/6/5/7	2" diameter SCH 40 PVC screen 0.01-slot	
36							
38							
40							

COMMENTS:

PROJECT: Olean Bioremediation Pilot Study

HOLE NO.: RU-20

DRILLING LOG

HOLE NO.: RU-21

SHEET 1 OF 1 SHEETS

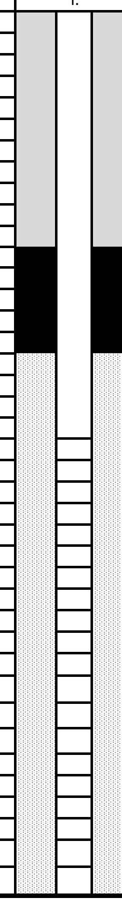
1. COMPANY NAME: CDM Smith	2. DRILLING SUBCONTRACTOR: SJB
3. PROJECT: Alcas - Bioremediation Pilot Study	4. LOCATION: Olean, NY
5. NAME OF DRILLER:	6. MANUFACTURER'S DESIGNATION OF DRILL: CME550 ATV
7. SIZES/TYPES OF DRILLING & SAMPLING EQUIPMENT: CME550 Hollow-Stem Auger	8. HOLE LOCATION:
	9. SURFACE ELEVATION (Elevation top of hole): NA
	10. DATE STARTED: 11/16/2011 — 11. DATE COMPLETED: 11/16/2011
12. OVERBURDEN THICKNESS: 20 ft	15. DEPTH GROUNDWATER ENCOUNTERED: 8 ft bgs
13. DEPTH DRILLED INTO ROCK: NA	16. DIRECTION OF HOLE: Vertical
14. TOTAL DEPTH OF HOLE: 20 ft bgs	17. TOTAL NUMBER OF CORE BOXES: NA
18. GEOTECHNICAL SAMPLES: NA — DISTURBED: — UNDISTURBED:	19. TOTAL # OF SPLIT SPOON SAMPLES: 10

20. SAMPLES FOR CHEMICAL ANALYSIS:	8 RCRA METALS	VOC's	SVOC's	TPH	Ph	Pest/PCB's	Herbs	RAD's	Triaxial Permeability	Other Physical	21. TOTAL CORE RECOVERY:
TCLP	X	X									

22. DISPOSITION OF HOLE:	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. INSPECTOR:
		X		Neil Smith

DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE/CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	BLOW COUNT g.	REMARKS h.
0	Silty clay (CL), sandy, soft, moist, brown	0 ppm			0/1/1/1	
2	Silt (ML), sl. Clayey, stiff, moist, brown, tan, iron deposits				3/6/8/ 10	Cement grout w/3% bentonite
4	Sand, silty (SM), fine, few gravels, moist, brown				3/6/9/ 11	2" SCH 40 PVC riser
6	Sand finer with depth, few thin silt lenses				12/11/ 12/10	Bentonite seal
8					3/5/6/5	Filter Pack Sand 7.5-20 ft (#0)
10					0/1/21/ 16	
12	Gravelly silt (ML), Sandy, wet, brown, subround-subangular gravel				17/14/ 19/20	
14					8/9/11/ 10	2" SCH 40 PVC Screen 0.01-Slot
16	Gravelly sand (SW), sl silty, wet, brown				10/10/ 14/16	
18	Silt (ML), sl gravelly, wet, brown, subrounded gravel				3/5/8/6	
20	Silt (ML), sl clayey, fine bedding, moist, gray					

Well Construction Details i.



COMMENTS:

PROJECT: Olean Bioremediation Pilot Study

HOLE NO.: RU-21

LOCATION

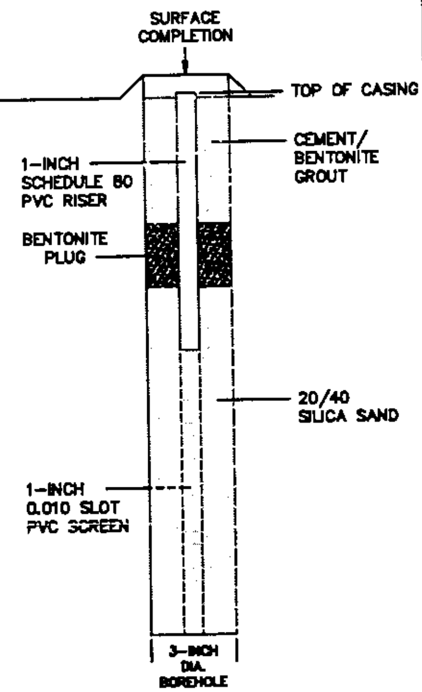
DRILLER: BUFFALO DRILLING
GEOLOGIST: J. BYRD
WORK ORDER: 137-09
CLIENT: ALCOA, INC.
DATE COMPLETED: 9-30-00
LOCATION: 1116 E. STATE ST.
OLEAN, NY
METHOD: GEOPROBE

NOTES:

SOIL BORING RU-10

DEPTH, FT.	OVA, PPM	SAMPLE	CORE	INTERVAL	MATERIAL	DESCRIPTION
						SANDY LEAN CLAY, BROWN, ROOTS & GRASS LIGHT IRON STAINING
	0					
5						GRAVEL & INCREASING SAND
	0 0					SILTY CLAYEY SAND, BROWN/TAN
10	0					
	0					SANDY LEAN CLAY, BROWN
15	0					DECREASING SAND W/DEPTH, GRAVEL SILTY, LITTLE SAND
	0					END OF BORING
20						
25						
30						

MONITOR WELL RU-10



ENVIRONEERING, INC.

BORING LOG

ALCAS CUTLERY FACILITY
OLEAN, NY

DRAWN BY:	DATE:	PROJ. NO.
LMG	1-25-01	137-09

E1370918

Appendix B

Laboratory Data

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Buffalo
10 Hazelwood Drive
Amherst, NY 14228-2298
Tel: (716)691-2600

TestAmerica Job ID: 480-12940-1
Client Project/Site: Olean Pilot Study

For:
Camp Dresser & McKee Inc
555 17th Street
Suite 1100
Denver, Colorado 80202

Attn: Neil Smith

EBerry

Authorized for release by:
12/6/2011 2:35:24 PM

Eve Berry
Project Administrator
eve.berry@testamericainc.com

Designee for

Peggy Gray-Erdmann
Project Manager II
peggy.gray-erdmann@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Client: Camp Dresser & McKee Inc
Project/Site: Olean Pilot Study

TestAmerica Job ID: 480-12940-1

Qualifiers

GC/MS VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
*	LCS or LCSD exceeds the control limits
H	Sample was prepped or analyzed beyond the specified holding time

Metals

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
B	Compound was found in the blank and sample.
4	MS, MSD: The analyte present in the original sample is 4 times greater than the matrix spike concentration; therefore, control limits are not applicable.

General Chemistry

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

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
☼	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DL, RA, RE, IN	Indicates a Dilution, Reanalysis, Re-extraction, or additional Initial metals/anion analysis of the sample
EDL	Estimated Detection Limit
EPA	United States Environmental Protection Agency
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
RL	Reporting Limit
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 480-12940-1

Laboratory: TestAmerica Buffalo

Narrative

Job Narrative
480-12940-1

Receipt
All samples were received in good condition within temperature requirements.

GC/MS VOA
Method(s) 8260B: The following samples were diluted due to the abundance of target analytes: RU19-111711 (480-12940-3), RU21-111711 (480-12940-5), RU8-111711 (480-12940-4). Elevated reporting limits (RLs) are provided.

Method(s) 8260B: The following sample were diluted due to the abundance of target analytes: RU20-111711 (480-12940-1). Elevated reporting limits (RLs) are provided.

Method(s) 8260B: The following sample required a dilution which was performed outside of the analytical holding time: RU20-111711 (480-12940-1).

No other analytical or quality issues were noted.

Ion Chromatography
No analytical or quality issues were noted.

GC VOA
No analytical or quality issues were noted.

Metals
No analytical or quality issues were noted.

General Chemistry
No analytical or quality issues were noted.

Detection Summary

Client: Camp Dresser & McKee Inc
Project/Site: Olean Pilot Study

TestAmerica Job ID: 480-12940-1

Client Sample ID: RU20-111711 — Lab Sample ID: 480-12940-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,1,2-Trichloroethane	0.52	J	1.0	0.23	ug/L	1		8260B	Total/NA
1,1,2-Trichloro-1,2,2-trifluoroethane	0.66	J	1.0	0.31	ug/L	1		8260B	Total/NA
1,1-Dichloroethene	1.2		1.0	0.29	ug/L	1		8260B	Total/NA
Tetrachloroethene	3.8		1.0	0.36	ug/L	1		8260B	Total/NA
trans-1,2-Dichloroethene	1.5		1.0	0.90	ug/L	1		8260B	Total/NA
cis-1,2-Dichloroethene - DL	100	H	50	41	ug/L	50		8260B	Total/NA
Trichloroethene - DL	3000	H	50	23	ug/L	50		8260B	Total/NA
Methane	2.1		1.0	0.22	ug/L	1		RSK-175	Total/NA
Barium	0.14		0.0020	0.00050	mg/L	1		6010B	Dissolved
Calcium	107		0.50	0.10	mg/L	1		6010B	Dissolved
Copper	0.0034	J	0.010	0.0015	mg/L	1		6010B	Dissolved
Magnesium	16.6		0.20	0.043	mg/L	1		6010B	Dissolved
Manganese	0.098	B	0.0030	0.00030	mg/L	1		6010B	Dissolved
Nickel	0.0015	J	0.010	0.0013	mg/L	1		6010B	Dissolved
Potassium	2.4		0.50	0.20	mg/L	1		6010B	Dissolved
Sodium	31.6		1.0	0.32	mg/L	1		6010B	Dissolved
Zinc	0.0031	J	0.010	0.0017	mg/L	1		6010B	Dissolved
Chloride	83.5		0.50	0.28	mg/L	1		300.0	Total/NA
Sulfate	41.4		2.0	0.35	mg/L	1		300.0	Total/NA
Nitrate Nitrite as N	1.4		0.050	0.020	mg/L	1		353.2	Total/NA
Total Organic Carbon	0.75	J	1.0	0.43	mg/L	1		SM 5310D	Total/NA

Client Sample ID: RU10-111711 — Lab Sample ID: 480-12940-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	24		1.0	0.81	ug/L	1		8260B	Total/NA
Trichloroethene	72		1.0	0.46	ug/L	1		8260B	Total/NA
Vinyl chloride	2.2		1.0	0.90	ug/L	1		8260B	Total/NA
Methane	7.4		1.0	0.22	ug/L	1		RSK-175	Total/NA
Barium	0.051		0.0020	0.00050	mg/L	1		6010B	Dissolved
Cadmium	0.00033	J	0.0010	0.00033	mg/L	1		6010B	Dissolved
Calcium	22.1		0.50	0.10	mg/L	1		6010B	Dissolved
Copper	0.0040	J	0.010	0.0015	mg/L	1		6010B	Dissolved
Magnesium	3.6		0.20	0.043	mg/L	1		6010B	Dissolved
Manganese	0.0063	B	0.0030	0.00030	mg/L	1		6010B	Dissolved
Potassium	0.56		0.50	0.20	mg/L	1		6010B	Dissolved
Sodium	2.4		1.0	0.32	mg/L	1		6010B	Dissolved
Zinc	0.0026	J	0.010	0.0017	mg/L	1		6010B	Dissolved
Chloride	1.8		0.50	0.28	mg/L	1		300.0	Total/NA
Sulfate	11.9		2.0	0.35	mg/L	1		300.0	Total/NA
Nitrate Nitrite as N	1.2		0.050	0.020	mg/L	1		353.2	Total/NA

Client Sample ID: RU19-111711 — Lab Sample ID: 480-12940-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,1,2-Trichloro-1,2,2-trifluoroethane	0.52	J	1.0	0.31	ug/L	1		8260B	Total/NA
1,1-Dichloroethene	2.1		1.0	0.29	ug/L	1		8260B	Total/NA
Tetrachloroethene	1.7		1.0	0.36	ug/L	1		8260B	Total/NA
trans-1,2-Dichloroethene	3.5		1.0	0.90	ug/L	1		8260B	Total/NA
Vinyl chloride	33		1.0	0.90	ug/L	1		8260B	Total/NA
cis-1,2-Dichloroethene - DL	300		10	8.1	ug/L	10		8260B	Total/NA
Trichloroethene - DL	790		10	4.6	ug/L	10		8260B	Total/NA
Ethane	7.8		1.5	0.49	ug/L	1		RSK-175	Total/NA
Methane	130		10	2.2	ug/L	10		RSK-175	Total/NA

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Client Sample ID: RU19-111711 (Continued) — Lab Sample ID: 480-12940-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Barium	0.052		0.0020	0.00050	mg/L	1		6010B	Dissolved
Cadmium	0.00041	J	0.0010	0.00033	mg/L	1		6010B	Dissolved
Calcium	73.3		0.50	0.10	mg/L	1		6010B	Dissolved
Cobalt	0.00087	J	0.0040	0.00063	mg/L	1		6010B	Dissolved
Copper	0.0047	J	0.010	0.0015	mg/L	1		6010B	Dissolved
Magnesium	11.2		0.20	0.043	mg/L	1		6010B	Dissolved
Manganese	0.45	B	0.0030	0.00030	mg/L	1		6010B	Dissolved
Nickel	0.0024	J	0.010	0.0013	mg/L	1		6010B	Dissolved
Potassium	1.7		0.50	0.20	mg/L	1		6010B	Dissolved
Sodium	13.6		1.0	0.32	mg/L	1		6010B	Dissolved
Zinc	0.0038	J	0.010	0.0017	mg/L	1		6010B	Dissolved
Chloride	17.0		0.50	0.28	mg/L	1		300.0	Total/NA
Sulfate	38.4		2.0	0.35	mg/L	1		300.0	Total/NA
Nitrate Nitrite as N	0.55		0.050	0.020	mg/L	1		353.2	Total/NA
Total Organic Carbon	0.95	J	1.0	0.43	mg/L	1		SM 5310D	Total/NA

Client Sample ID: RU8-111711 — Lab Sample ID: 480-12940-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	12		1.0	0.81	ug/L	1		8260B	Total/NA
Tetrachloroethene	0.52	J	1.0	0.36	ug/L	1		8260B	Total/NA
Vinyl chloride	1.7		1.0	0.90	ug/L	1		8260B	Total/NA
Trichloroethene - DL	280		5.0	2.3	ug/L	5		8260B	Total/NA
Ethane	2.6		1.5	0.49	ug/L	1		RSK-175	Total/NA
Ethene	1.5		1.5	0.52	ug/L	1		RSK-175	Total/NA
Methane	37		1.0	0.22	ug/L	1		RSK-175	Total/NA
Barium	0.11		0.0020	0.00050	mg/L	1		6010B	Dissolved
Calcium	104		0.50	0.10	mg/L	1		6010B	Dissolved
Copper	0.0019	J	0.010	0.0015	mg/L	1		6010B	Dissolved
Magnesium	21.5		0.20	0.043	mg/L	1		6010B	Dissolved
Manganese	0.28	B	0.0030	0.00030	mg/L	1		6010B	Dissolved
Potassium	1.7		0.50	0.20	mg/L	1		6010B	Dissolved
Sodium	17.6		1.0	0.32	mg/L	1		6010B	Dissolved
Zinc	0.0058	J	0.010	0.0017	mg/L	1		6010B	Dissolved
Chloride	10.5		0.50	0.28	mg/L	1		300.0	Total/NA
Sulfate	42.7		2.0	0.35	mg/L	1		300.0	Total/NA
Nitrate Nitrite as N	0.59		0.050	0.020	mg/L	1		353.2	Total/NA
Total Organic Carbon	0.50	J	1.0	0.43	mg/L	1		SM 5310D	Total/NA

Client Sample ID: RU21-111711 — Lab Sample ID: 480-12940-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,1,2-Trichloro-1,2,2-trifluoroethane	0.88	J	1.0	0.31	ug/L	1		8260B	Total/NA
1,1-Dichloroethene	3.6		1.0	0.29	ug/L	1		8260B	Total/NA
Cyclohexane	0.59	J	1.0	0.18	ug/L	1		8260B	Total/NA
Tetrachloroethene	2.6		1.0	0.36	ug/L	1		8260B	Total/NA
trans-1,2-Dichloroethene	6.2		1.0	0.90	ug/L	1		8260B	Total/NA
Vinyl chloride	58		1.0	0.90	ug/L	1		8260B	Total/NA
cis-1,2-Dichloroethene - DL	490		25	20	ug/L	25		8260B	Total/NA
Trichloroethene - DL	1500		25	12	ug/L	25		8260B	Total/NA
Ethane	12		1.5	0.49	ug/L	1		RSK-175	Total/NA
Ethene	1.7		1.5	0.52	ug/L	1		RSK-175	Total/NA
Methane	190		10	2.2	ug/L	10		RSK-175	Total/NA
Barium	0.060		0.0020	0.00050	mg/L	1		6010B	Dissolved

Detection Summary

Client: Camp Dresser & McKee Inc
Project/Site: Olean Pilot Study

TestAmerica Job ID: 480-12940-1

Client Sample ID: RU21-111711 (Continued)

Lab Sample ID: 480-12940-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Cadmium	0.00043	J	0.0010	0.00033	mg/L	1		6010B	Dissolved
Calcium	114		0.50	0.10	mg/L	1		6010B	Dissolved
Cobalt	0.0011	J	0.0040	0.00063	mg/L	1		6010B	Dissolved
Copper	0.0043	J	0.010	0.0015	mg/L	1		6010B	Dissolved
Magnesium	16.7		0.20	0.043	mg/L	1		6010B	Dissolved
Manganese	0.45	B	0.0030	0.00030	mg/L	1		6010B	Dissolved
Nickel	0.0032	J	0.010	0.0013	mg/L	1		6010B	Dissolved
Potassium	2.3		0.50	0.20	mg/L	1		6010B	Dissolved
Sodium	20.0		1.0	0.32	mg/L	1		6010B	Dissolved
Zinc	0.0032	J	0.010	0.0017	mg/L	1		6010B	Dissolved
Chloride	26.6		0.50	0.28	mg/L	1		300.0	Total/NA
Sulfate	61.1		2.0	0.35	mg/L	1		300.0	Total/NA
Nitrate Nitrite as N	0.026	J	0.050	0.020	mg/L	1		353.2	Total/NA
Total Organic Carbon	2.0		1.0	0.43	mg/L	1		SM 5310D	Total/NA

Client Sample ID: DUP-111711

Lab Sample ID: 480-12940-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	24		1.0	0.81	ug/L	1		8260B	Total/NA
Trichloroethene	72		1.0	0.46	ug/L	1		8260B	Total/NA
Vinyl chloride	2.4		1.0	0.90	ug/L	1		8260B	Total/NA
Methane	8.1		1.0	0.22	ug/L	1		RSK-175	Total/NA
Barium	0.052		0.0020	0.00050	mg/L	1		6010B	Dissolved
Calcium	22.9		0.50	0.10	mg/L	1		6010B	Dissolved
Copper	0.0029	J	0.010	0.0015	mg/L	1		6010B	Dissolved
Magnesium	3.7		0.20	0.043	mg/L	1		6010B	Dissolved
Manganese	0.0063	B	0.0030	0.00030	mg/L	1		6010B	Dissolved
Potassium	0.54		0.50	0.20	mg/L	1		6010B	Dissolved
Sodium	2.5		1.0	0.32	mg/L	1		6010B	Dissolved
Zinc	0.0020	J	0.010	0.0017	mg/L	1		6010B	Dissolved
Chloride	1.9		0.50	0.28	mg/L	1		300.0	Total/NA
Sulfate	11.9		2.0	0.35	mg/L	1		300.0	Total/NA
Nitrate Nitrite as N	1.3		0.050	0.020	mg/L	1		353.2	Total/NA

Client Sample ID: RB-111711

Lab Sample ID: 480-12940-7

No Detections

Client Sample ID: TRIP BLANK

Lab Sample ID: 480-12940-8

No Detections

Client: Camp Dresser & McKee Inc | TestAmerica Job ID: 480-12940-1
Project/Site: Olean Pilot Study

Client Sample ID: RU20-111711 | **Lab Sample ID: 480-12940-1**
Date Collected: 11/17/11 09:50 | **Matrix: Water**
Date Received: 11/18/11 09:30

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			12/01/11 01:38	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			12/01/11 01:38	1
1,1,2-Trichloroethane	**0.52**	**J**	1.0	0.23	ug/L			12/01/11 01:38	1
1,1,2-Trichloro-1,2,2-trifluoroethane	**0.66**	**J**	1.0	0.31	ug/L			12/01/11 01:38	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			12/01/11 01:38	1
1,1-Dichloroethene	**1.2**		1.0	0.29	ug/L			12/01/11 01:38	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			12/01/11 01:38	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			12/01/11 01:38	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			12/01/11 01:38	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			12/01/11 01:38	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			12/01/11 01:38	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			12/01/11 01:38	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			12/01/11 01:38	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			12/01/11 01:38	1
2-Hexanone	ND		5.0	1.2	ug/L			12/01/11 01:38	1
2-Butanone (MEK)	ND		10	1.3	ug/L			12/01/11 01:38	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			12/01/11 01:38	1
Acetone	ND		10	3.0	ug/L			12/01/11 01:38	1
Benzene	ND		1.0	0.41	ug/L			12/01/11 01:38	1
Bromodichloromethane	ND		1.0	0.39	ug/L			12/01/11 01:38	1
Bromoform	ND		1.0	0.26	ug/L			12/01/11 01:38	1
Bromomethane	ND	*	1.0	0.69	ug/L			12/01/11 01:38	1
Carbon disulfide	ND		1.0	0.19	ug/L			12/01/11 01:38	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			12/01/11 01:38	1
Chlorobenzene	ND		1.0	0.75	ug/L			12/01/11 01:38	1
Dibromochloromethane	ND		1.0	0.32	ug/L			12/01/11 01:38	1
Chloroethane	ND		1.0	0.32	ug/L			12/01/11 01:38	1
Chloroform	ND		1.0	0.34	ug/L			12/01/11 01:38	1
Chloromethane	ND		1.0	0.35	ug/L			12/01/11 01:38	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			12/01/11 01:38	1
Cyclohexane	ND		1.0	0.18	ug/L			12/01/11 01:38	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			12/01/11 01:38	1
Ethylbenzene	ND		1.0	0.74	ug/L			12/01/11 01:38	1
Isopropylbenzene	ND		1.0	0.79	ug/L			12/01/11 01:38	1
Methyl acetate	ND		1.0	0.50	ug/L			12/01/11 01:38	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			12/01/11 01:38	1
Methylcyclohexane	ND		1.0	0.16	ug/L			12/01/11 01:38	1
Methylene Chloride	ND		1.0	0.44	ug/L			12/01/11 01:38	1
Styrene	ND		1.0	0.73	ug/L			12/01/11 01:38	1
Tetrachloroethene	**3.8**		1.0	0.36	ug/L			12/01/11 01:38	1
Toluene	ND		1.0	0.51	ug/L			12/01/11 01:38	1
trans-1,2-Dichloroethene	**1.5**		1.0	0.90	ug/L			12/01/11 01:38	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			12/01/11 01:38	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			12/01/11 01:38	1
Vinyl chloride	ND		1.0	0.90	ug/L			12/01/11 01:38	1
Xylenes, Total	ND		2.0	0.66	ug/L			12/01/11 01:38	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*112*		*66 - 137*		*12/01/11 01:38*	*1*

Client Sample ID: RU20-111711
Date Collected: 11/17/11 09:50
Date Received: 11/18/11 09:30

Lab Sample ID: 480-12940-1
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Toluene-d8 (Surr)	106		71 - 126		12/01/11 01:38	1
4-Bromofluorobenzene (Surr)	100		73 - 120		12/01/11 01:38	1

Method: 8260B - Volatile Organic Compounds (GC/MS) - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**100**	**H**	50	41	ug/L			12/02/11 13:16	50
Trichloroethene	**3000**	**H**	50	23	ug/L			12/02/11 13:16	50

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	116		66 - 137		12/02/11 13:16	50
Toluene-d8 (Surr)	108		71 - 126		12/02/11 13:16	50
4-Bromofluorobenzene (Surr)	102		73 - 120		12/02/11 13:16	50

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethane	ND		1.5	0.49	ug/L			11/22/11 10:29	1
Ethene	ND		1.5	0.52	ug/L			11/22/11 10:29	1
Methane	**2.1**		1.0	0.22	ug/L			11/22/11 10:29	1

Method: 6010B - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.20	0.060	mg/L		11/21/11 09:15	11/21/11 22:40	1
Antimony	ND		0.020	0.0068	mg/L		11/21/11 09:15	11/21/11 22:40	1
Arsenic	ND		0.010	0.0056	mg/L		11/21/11 09:15	11/21/11 22:40	1
Barium	**0.14**		0.0020	0.00050	mg/L		11/21/11 09:15	11/21/11 22:40	1
Beryllium	ND		0.0020	0.00030	mg/L		11/21/11 09:15	11/22/11 17:11	1
Cadmium	ND		0.0010	0.00033	mg/L		11/21/11 09:15	11/21/11 22:40	1
Calcium	**107**		0.50	0.10	mg/L		11/21/11 09:15	11/21/11 22:40	1
Chromium	ND		0.0040	0.00087	mg/L		11/21/11 09:15	11/21/11 22:40	1
Cobalt	ND		0.0040	0.00063	mg/L		11/21/11 09:15	11/21/11 22:40	1
Copper	**0.0034**	**J**	0.010	0.0015	mg/L		11/21/11 09:15	11/21/11 22:40	1
Iron	ND		0.050	0.019	mg/L		11/21/11 09:15	11/21/11 22:40	1
Lead	ND		0.0050	0.0030	mg/L		11/21/11 09:15	11/21/11 22:40	1
Magnesium	**16.6**		0.20	0.043	mg/L		11/21/11 09:15	11/21/11 22:40	1
Manganese	**0.098**	**B**	0.0030	0.00030	mg/L		11/21/11 09:15	11/21/11 22:40	1
Nickel	**0.0015**	**J**	0.010	0.0013	mg/L		11/21/11 09:15	11/21/11 22:40	1
Potassium	**2.4**		0.50	0.20	mg/L		11/21/11 09:15	11/21/11 22:40	1
Selenium	ND		0.015	0.0087	mg/L		11/21/11 09:15	11/21/11 22:40	1
Silver	ND		0.0030	0.0017	mg/L		11/21/11 09:15	11/21/11 22:40	1
Sodium	**31.6**		1.0	0.32	mg/L		11/21/11 09:15	11/21/11 22:40	1
Thallium	ND		0.020	0.010	mg/L		11/21/11 09:15	11/21/11 22:40	1
Vanadium	ND		0.0050	0.0011	mg/L		11/21/11 09:15	11/21/11 22:40	1
Zinc	**0.0031**	**J**	0.010	0.0017	mg/L		11/21/11 09:15	11/21/11 22:40	1

Method: 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020	0.00012	mg/L		11/23/11 11:20	11/23/11 15:20	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**83.5**		0.50	0.28	mg/L			12/02/11 04:47	1

Client Sample ID: RU20-111711
Date Collected: 11/17/11 09:50
Date Received: 11/18/11 09:30

Lab Sample ID: 480-12940-1
Matrix: Water

General Chemistry (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Sulfate	**41.4**		2.0	0.35	mg/L			12/02/11 04:47	1
Nitrate Nitrite as N	**1.4**		0.050	0.020	mg/L			12/02/11 14:32	1
Total Organic Carbon	**0.75**	**J**	1.0	0.43	mg/L			11/22/11 19:48	1
Acetic acid	ND		1.0	0.15	mg/L			12/04/11 05:31	1
Butyric acid	ND		1.0	0.16	mg/L			12/04/11 05:31	1
Propionic acid	ND		1.0	0.17	mg/L			12/04/11 05:31	1

Client Sample ID: RU10-111711
Date Collected: 11/17/11 11:00
Date Received: 11/18/11 09:30

Lab Sample ID: 480-12940-2
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			12/01/11 02:01	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			12/01/11 02:01	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			12/01/11 02:01	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			12/01/11 02:01	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			12/01/11 02:01	1
1,1-Dichloroethene	ND		1.0	0.29	ug/L			12/01/11 02:01	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			12/01/11 02:01	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			12/01/11 02:01	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			12/01/11 02:01	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			12/01/11 02:01	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			12/01/11 02:01	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			12/01/11 02:01	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			12/01/11 02:01	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			12/01/11 02:01	1
2-Hexanone	ND		5.0	1.2	ug/L			12/01/11 02:01	1
2-Butanone (MEK)	ND		10	1.3	ug/L			12/01/11 02:01	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			12/01/11 02:01	1
Acetone	ND		10	3.0	ug/L			12/01/11 02:01	1
Benzene	ND		1.0	0.41	ug/L			12/01/11 02:01	1
Bromodichloromethane	ND		1.0	0.39	ug/L			12/01/11 02:01	1
Bromoform	ND		1.0	0.26	ug/L			12/01/11 02:01	1
Bromomethane	ND	*	1.0	0.69	ug/L			12/01/11 02:01	1
Carbon disulfide	ND		1.0	0.19	ug/L			12/01/11 02:01	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			12/01/11 02:01	1
Chlorobenzene	ND		1.0	0.75	ug/L			12/01/11 02:01	1
Dibromochloromethane	ND		1.0	0.32	ug/L			12/01/11 02:01	1
Chloroethane	ND		1.0	0.32	ug/L			12/01/11 02:01	1
Chloroform	ND		1.0	0.34	ug/L			12/01/11 02:01	1
Chloromethane	ND		1.0	0.35	ug/L			12/01/11 02:01	1
cis-1,2-Dichloroethene	**24**		1.0	0.81	ug/L			12/01/11 02:01	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			12/01/11 02:01	1
Cyclohexane	ND		1.0	0.18	ug/L			12/01/11 02:01	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			12/01/11 02:01	1
Ethylbenzene	ND		1.0	0.74	ug/L			12/01/11 02:01	1
Isopropylbenzene	ND		1.0	0.79	ug/L			12/01/11 02:01	1
Methyl acetate	ND		1.0	0.50	ug/L			12/01/11 02:01	1

Client Sample ID: RU10-111711
Date Collected: 11/17/11 11:00
Date Received: 11/18/11 09:30

Lab Sample ID: 480-12940-2
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			12/01/11 02:01	1
Methylcyclohexane	ND		1.0	0.16	ug/L			12/01/11 02:01	1
Methylene Chloride	ND		1.0	0.44	ug/L			12/01/11 02:01	1
Styrene	ND		1.0	0.73	ug/L			12/01/11 02:01	1
Tetrachloroethene	ND		1.0	0.36	ug/L			12/01/11 02:01	1
Toluene	ND		1.0	0.51	ug/L			12/01/11 02:01	1
trans-1,2-Dichloroethene	ND		1.0	0.90	ug/L			12/01/11 02:01	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			12/01/11 02:01	1
Trichloroethene	**72**		1.0	0.46	ug/L			12/01/11 02:01	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			12/01/11 02:01	1
Vinyl chloride	**2.2**		1.0	0.90	ug/L			12/01/11 02:01	1
Xylenes, Total	ND		2.0	0.66	ug/L			12/01/11 02:01	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*112*		*66 - 137*		*12/01/11 02:01*	*1*
Toluene-d8 (Surr)	*104*		*71 - 126*		*12/01/11 02:01*	*1*
4-Bromofluorobenzene (Surr)	*98*		*73 - 120*		*12/01/11 02:01*	*1*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethane	ND		1.5	0.49	ug/L			11/22/11 10:46	1
Ethene	ND		1.5	0.52	ug/L			11/22/11 10:46	1
Methane	**7.4**		1.0	0.22	ug/L			11/22/11 10:46	1

Method: 6010B - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.20	0.060	mg/L		11/21/11 09:15	11/21/11 22:42	1
Antimony	ND		0.020	0.0068	mg/L		11/21/11 09:15	11/21/11 22:42	1
Arsenic	ND		0.010	0.0056	mg/L		11/21/11 09:15	11/21/11 22:42	1
Barium	**0.051**		0.0020	0.00050	mg/L		11/21/11 09:15	11/21/11 22:42	1
Beryllium	ND		0.0020	0.00030	mg/L		11/21/11 09:15	11/22/11 17:13	1
Cadmium	**0.00033**	**J**	0.0010	0.00033	mg/L		11/21/11 09:15	11/21/11 22:42	1
Calcium	**22.1**		0.50	0.10	mg/L		11/21/11 09:15	11/21/11 22:42	1
Chromium	ND		0.0040	0.00087	mg/L		11/21/11 09:15	11/21/11 22:42	1
Cobalt	ND		0.0040	0.00063	mg/L		11/21/11 09:15	11/21/11 22:42	1
Copper	**0.0040**	**J**	0.010	0.0015	mg/L		11/21/11 09:15	11/21/11 22:42	1
Iron	ND		0.050	0.019	mg/L		11/21/11 09:15	11/21/11 22:42	1
Lead	ND		0.0050	0.0030	mg/L		11/21/11 09:15	11/21/11 22:42	1
Magnesium	**3.6**		0.20	0.043	mg/L		11/21/11 09:15	11/21/11 22:42	1
Manganese	**0.0063**	**B**	0.0030	0.00030	mg/L		11/21/11 09:15	11/21/11 22:42	1
Nickel	ND		0.010	0.0013	mg/L		11/21/11 09:15	11/21/11 22:42	1
Potassium	**0.56**		0.50	0.20	mg/L		11/21/11 09:15	11/21/11 22:42	1
Selenium	ND		0.015	0.0087	mg/L		11/21/11 09:15	11/21/11 22:42	1
Silver	ND		0.0030	0.0017	mg/L		11/21/11 09:15	11/21/11 22:42	1
Sodium	**2.4**		1.0	0.32	mg/L		11/21/11 09:15	11/21/11 22:42	1
Thallium	ND		0.020	0.010	mg/L		11/21/11 09:15	11/21/11 22:42	1
Vanadium	ND		0.0050	0.0011	mg/L		11/21/11 09:15	11/21/11 22:42	1
Zinc	**0.0026**	**J**	0.010	0.0017	mg/L		11/21/11 09:15	11/21/11 22:42	1

Client Sample ID: RU10-111711

Lab Sample ID: 480-12940-2

Date Collected: 11/17/11 11:00

Matrix: Water

Date Received: 11/18/11 09:30

Method: 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020	0.00012	mg/L		11/23/11 11:20	11/23/11 15:22	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**1.8**		0.50	0.28	mg/L			12/02/11 04:57	1
Sulfate	**11.9**		2.0	0.35	mg/L			12/02/11 04:57	1
Nitrate Nitrite as N	**1.2**		0.050	0.020	mg/L			12/02/11 14:33	1
Total Organic Carbon	ND		1.0	0.43	mg/L			11/22/11 20:08	1
Acetic acid	ND		1.0	0.15	mg/L			12/04/11 06:59	1
Butyric acid	ND		1.0	0.16	mg/L			12/04/11 06:59	1
Propionic acid	ND		1.0	0.17	mg/L			12/04/11 06:59	1

Client Sample ID: RU19-111711

Lab Sample ID: 480-12940-3

Date Collected: 11/17/11 12:15

Matrix: Water

Date Received: 11/18/11 09:30

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			12/01/11 02:25	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			12/01/11 02:25	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			12/01/11 02:25	1
1,1,2-Trichloro-1,2,2-trifluoroethane	**0.52**	**J**	1.0	0.31	ug/L			12/01/11 02:25	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			12/01/11 02:25	1
1,1-Dichloroethene	**2.1**		1.0	0.29	ug/L			12/01/11 02:25	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			12/01/11 02:25	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			12/01/11 02:25	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			12/01/11 02:25	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			12/01/11 02:25	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			12/01/11 02:25	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			12/01/11 02:25	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			12/01/11 02:25	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			12/01/11 02:25	1
2-Hexanone	ND		5.0	1.2	ug/L			12/01/11 02:25	1
2-Butanone (MEK)	ND		10	1.3	ug/L			12/01/11 02:25	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			12/01/11 02:25	1
Acetone	ND		10	3.0	ug/L			12/01/11 02:25	1
Benzene	ND		1.0	0.41	ug/L			12/01/11 02:25	1
Bromodichloromethane	ND		1.0	0.39	ug/L			12/01/11 02:25	1
Bromoform	ND		1.0	0.26	ug/L			12/01/11 02:25	1
Bromomethane	ND	*	1.0	0.69	ug/L			12/01/11 02:25	1
Carbon disulfide	ND		1.0	0.19	ug/L			12/01/11 02:25	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			12/01/11 02:25	1
Chlorobenzene	ND		1.0	0.75	ug/L			12/01/11 02:25	1
Dibromochloromethane	ND		1.0	0.32	ug/L			12/01/11 02:25	1
Chloroethane	ND		1.0	0.32	ug/L			12/01/11 02:25	1
Chloroform	ND		1.0	0.34	ug/L			12/01/11 02:25	1
Chloromethane	ND		1.0	0.35	ug/L			12/01/11 02:25	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			12/01/11 02:25	1
Cyclohexane	ND		1.0	0.18	ug/L			12/01/11 02:25	1

Client Sample ID: RU19-111711 — **Lab Sample ID: 480-12940-3**
Date Collected: 11/17/11 12:15 — **Matrix: Water**
Date Received: 11/18/11 09:30

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			12/01/11 02:25	1
Ethylbenzene	ND		1.0	0.74	ug/L			12/01/11 02:25	1
Isopropylbenzene	ND		1.0	0.79	ug/L			12/01/11 02:25	1
Methyl acetate	ND		1.0	0.50	ug/L			12/01/11 02:25	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			12/01/11 02:25	1
Methylcyclohexane	ND		1.0	0.16	ug/L			12/01/11 02:25	1
Methylene Chloride	ND		1.0	0.44	ug/L			12/01/11 02:25	1
Styrene	ND		1.0	0.73	ug/L			12/01/11 02:25	1
Tetrachloroethene	**1.7**		1.0	0.36	ug/L			12/01/11 02:25	1
Toluene	ND		1.0	0.51	ug/L			12/01/11 02:25	1
trans-1,2-Dichloroethene	**3.5**		1.0	0.90	ug/L			12/01/11 02:25	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			12/01/11 02:25	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			12/01/11 02:25	1
Vinyl chloride	**33**		1.0	0.90	ug/L			12/01/11 02:25	1
Xylenes, Total	ND		2.0	0.66	ug/L			12/01/11 02:25	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*116*		*66 - 137*		*12/01/11 02:25*	*1*
Toluene-d8 (Surr)	*108*		*71 - 126*		*12/01/11 02:25*	*1*
4-Bromofluorobenzene (Surr)	*101*		*73 - 120*		*12/01/11 02:25*	*1*

Method: 8260B - Volatile Organic Compounds (GC/MS) - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**300**		10	8.1	ug/L			12/01/11 13:55	10
Trichloroethene	**790**		10	4.6	ug/L			12/01/11 13:55	10

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*115*		*66 - 137*		*12/01/11 13:55*	*10*
Toluene-d8 (Surr)	*110*		*71 - 126*		*12/01/11 13:55*	*10*
4-Bromofluorobenzene (Surr)	*106*		*73 - 120*		*12/01/11 13:55*	*10*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethane	**7.8**		1.5	0.49	ug/L			11/22/11 11:03	1
Ethene	ND		1.5	0.52	ug/L			11/22/11 11:03	1
Methane	**130**		10	2.2	ug/L			11/22/11 12:20	10

Method: 6010B - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.20	0.060	mg/L		11/21/11 09:15	11/21/11 22:45	1
Antimony	ND		0.020	0.0068	mg/L		11/21/11 09:15	11/21/11 22:45	1
Arsenic	ND		0.010	0.0056	mg/L		11/21/11 09:15	11/21/11 22:45	1
Barium	**0.052**		0.0020	0.00050	mg/L		11/21/11 09:15	11/21/11 22:45	1
Beryllium	ND		0.0020	0.00030	mg/L		11/21/11 09:15	11/22/11 17:15	1
Cadmium	**0.00041**	**J**	0.0010	0.00033	mg/L		11/21/11 09:15	11/21/11 22:45	1
Calcium	**73.3**		0.50	0.10	mg/L		11/21/11 09:15	11/21/11 22:45	1
Chromium	ND		0.0040	0.00087	mg/L		11/21/11 09:15	11/21/11 22:45	1
Cobalt	**0.00087**	**J**	0.0040	0.00063	mg/L		11/21/11 09:15	11/21/11 22:45	1
Copper	**0.0047**	**J**	0.010	0.0015	mg/L		11/21/11 09:15	11/21/11 22:45	1
Iron	ND		0.050	0.019	mg/L		11/21/11 09:15	11/21/11 22:45	1
Lead	ND		0.0050	0.0030	mg/L		11/21/11 09:15	11/21/11 22:45	1

Client Sample ID: RU19-111711

Date Collected: 11/17/11 12:15
Date Received: 11/18/11 09:30

Lab Sample ID: 480-12940-3
Matrix: Water

Method: 6010B - Metals (ICP) - Dissolved (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Magnesium	**11.2**		0.20	0.043	mg/L		11/21/11 09:15	11/21/11 22:45	1
Manganese	**0.45**	**B**	0.0030	0.00030	mg/L		11/21/11 09:15	11/21/11 22:45	1
Nickel	**0.0024**	**J**	0.010	0.0013	mg/L		11/21/11 09:15	11/21/11 22:45	1
Potassium	**1.7**		0.50	0.20	mg/L		11/21/11 09:15	11/21/11 22:45	1
Selenium	ND		0.015	0.0087	mg/L		11/21/11 09:15	11/21/11 22:45	1
Silver	ND		0.0030	0.0017	mg/L		11/21/11 09:15	11/21/11 22:45	1
Sodium	**13.6**		1.0	0.32	mg/L		11/21/11 09:15	11/21/11 22:45	1
Thallium	ND		0.020	0.010	mg/L		11/21/11 09:15	11/21/11 22:45	1
Vanadium	ND		0.0050	0.0011	mg/L		11/21/11 09:15	11/21/11 22:45	1
Zinc	**0.0038**	**J**	0.010	0.0017	mg/L		11/21/11 09:15	11/21/11 22:45	1

Method: 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020	0.00012	mg/L		11/23/11 11:20	11/23/11 15:28	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**17.0**		0.50	0.28	mg/L			12/02/11 05:07	1
Sulfate	**38.4**		2.0	0.35	mg/L			12/02/11 05:07	1
Nitrate Nitrite as N	**0.55**		0.050	0.020	mg/L			12/02/11 14:34	1
Total Organic Carbon	**0.95**	**J**	1.0	0.43	mg/L			11/22/11 20:28	1
Acetic acid	ND		1.0	0.15	mg/L			12/04/11 07:28	1
Butyric acid	ND		1.0	0.16	mg/L			12/04/11 07:28	1
Propionic acid	ND		1.0	0.17	mg/L			12/04/11 07:28	1

Client Sample ID: RU8-111711

Date Collected: 11/17/11 14:30
Date Received: 11/18/11 09:30

Lab Sample ID: 480-12940-4
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			12/01/11 02:49	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			12/01/11 02:49	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			12/01/11 02:49	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			12/01/11 02:49	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			12/01/11 02:49	1
1,1-Dichloroethene	ND		1.0	0.29	ug/L			12/01/11 02:49	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			12/01/11 02:49	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			12/01/11 02:49	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			12/01/11 02:49	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			12/01/11 02:49	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			12/01/11 02:49	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			12/01/11 02:49	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			12/01/11 02:49	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			12/01/11 02:49	1
2-Hexanone	ND		5.0	1.2	ug/L			12/01/11 02:49	1
2-Butanone (MEK)	ND		10	1.3	ug/L			12/01/11 02:49	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			12/01/11 02:49	1
Acetone	ND		10	3.0	ug/L			12/01/11 02:49	1
Benzene	ND		1.0	0.41	ug/L			12/01/11 02:49	1

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

Client Sample ID: RU8-111711
Date Collected: 11/17/11 14:30
Date Received: 11/18/11 09:30

Lab Sample ID: 480-12940-4
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromodichloromethane	ND		1.0	0.39	ug/L			12/01/11 02:49	1
Bromoform	ND		1.0	0.26	ug/L			12/01/11 02:49	1
Bromomethane	ND	*	1.0	0.69	ug/L			12/01/11 02:49	1
Carbon disulfide	ND		1.0	0.19	ug/L			12/01/11 02:49	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			12/01/11 02:49	1
Chlorobenzene	ND		1.0	0.75	ug/L			12/01/11 02:49	1
Dibromochloromethane	ND		1.0	0.32	ug/L			12/01/11 02:49	1
Chloroethane	ND		1.0	0.32	ug/L			12/01/11 02:49	1
Chloroform	ND		1.0	0.34	ug/L			12/01/11 02:49	1
Chloromethane	ND		1.0	0.35	ug/L			12/01/11 02:49	1
cis-1,2-Dichloroethene	**12**		1.0	0.81	ug/L			12/01/11 02:49	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			12/01/11 02:49	1
Cyclohexane	ND		1.0	0.18	ug/L			12/01/11 02:49	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			12/01/11 02:49	1
Ethylbenzene	ND		1.0	0.74	ug/L			12/01/11 02:49	1
Isopropylbenzene	ND		1.0	0.79	ug/L			12/01/11 02:49	1
Methyl acetate	ND		1.0	0.50	ug/L			12/01/11 02:49	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			12/01/11 02:49	1
Methylcyclohexane	ND		1.0	0.16	ug/L			12/01/11 02:49	1
Methylene Chloride	ND		1.0	0.44	ug/L			12/01/11 02:49	1
Styrene	ND		1.0	0.73	ug/L			12/01/11 02:49	1
Tetrachloroethene	**0.52**	**J**	1.0	0.36	ug/L			12/01/11 02:49	1
Toluene	ND		1.0	0.51	ug/L			12/01/11 02:49	1
trans-1,2-Dichloroethene	ND		1.0	0.90	ug/L			12/01/11 02:49	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			12/01/11 02:49	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			12/01/11 02:49	1
Vinyl chloride	**1.7**		1.0	0.90	ug/L			12/01/11 02:49	1
Xylenes, Total	ND		2.0	0.66	ug/L			12/01/11 02:49	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*113*		*66 - 137*		*12/01/11 02:49*	*1*
Toluene-d8 (Surr)	*108*		*71 - 126*		*12/01/11 02:49*	*1*
4-Bromofluorobenzene (Surr)	*101*		*73 - 120*		*12/01/11 02:49*	*1*

Method: 8260B - Volatile Organic Compounds (GC/MS) - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Trichloroethene	**280**		5.0	2.3	ug/L			12/01/11 14:19	5

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*112*		*66 - 137*		*12/01/11 14:19*	*5*
Toluene-d8 (Surr)	*108*		*71 - 126*		*12/01/11 14:19*	*5*
4-Bromofluorobenzene (Surr)	*107*		*73 - 120*		*12/01/11 14:19*	*5*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethane	**2.6**		1.5	0.49	ug/L			11/22/11 11:20	1
Ethene	**1.5**		1.5	0.52	ug/L			11/22/11 11:20	1
Methane	**37**		1.0	0.22	ug/L			11/22/11 11:20	1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Client Sample ID: RU8-111711

Date Collected: 11/17/11 14:30
Date Received: 11/18/11 09:30

Lab Sample ID: 480-12940-4
Matrix: Water

Method: 6010B - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.20	0.060	mg/L		11/21/11 09:15	11/21/11 23:00	1
Antimony	ND		0.020	0.0068	mg/L		11/21/11 09:15	11/21/11 23:00	1
Arsenic	ND		0.010	0.0056	mg/L		11/21/11 09:15	11/21/11 23:00	1
Barium	**0.11**		0.0020	0.00050	mg/L		11/21/11 09:15	11/21/11 23:00	1
Beryllium	ND		0.0020	0.00030	mg/L		11/21/11 09:15	11/22/11 17:27	1
Cadmium	ND		0.0010	0.00033	mg/L		11/21/11 09:15	11/21/11 23:00	1
Calcium	**104**		0.50	0.10	mg/L		11/21/11 09:15	11/21/11 23:00	1
Chromium	ND		0.0040	0.00087	mg/L		11/21/11 09:15	11/21/11 23:00	1
Cobalt	ND		0.0040	0.00063	mg/L		11/21/11 09:15	11/21/11 23:00	1
Copper	**0.0019**	**J**	0.010	0.0015	mg/L		11/21/11 09:15	11/21/11 23:00	1
Iron	ND		0.050	0.019	mg/L		11/21/11 09:15	11/21/11 23:00	1
Lead	ND		0.0050	0.0030	mg/L		11/21/11 09:15	11/21/11 23:00	1
Magnesium	**21.5**		0.20	0.043	mg/L		11/21/11 09:15	11/21/11 23:00	1
Manganese	**0.28**	**B**	0.0030	0.00030	mg/L		11/21/11 09:15	11/21/11 23:00	1
Nickel	ND		0.010	0.0013	mg/L		11/21/11 09:15	11/21/11 23:00	1
Potassium	**1.7**		0.50	0.20	mg/L		11/21/11 09:15	11/21/11 23:00	1
Selenium	ND		0.015	0.0087	mg/L		11/21/11 09:15	11/21/11 23:00	1
Silver	ND		0.0030	0.0017	mg/L		11/21/11 09:15	11/21/11 23:00	1
Sodium	**17.6**		1.0	0.32	mg/L		11/21/11 09:15	11/21/11 23:00	1
Thallium	ND		0.020	0.010	mg/L		11/21/11 09:15	11/21/11 23:00	1
Vanadium	ND		0.0050	0.0011	mg/L		11/21/11 09:15	11/21/11 23:00	1
Zinc	**0.0058**	**J**	0.010	0.0017	mg/L		11/21/11 09:15	11/21/11 23:00	1

Method: 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020	0.00012	mg/L		11/23/11 11:20	11/23/11 15:29	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**10.5**		0.50	0.28	mg/L			12/02/11 05:17	1
Sulfate	**42.7**		2.0	0.35	mg/L			12/02/11 05:17	1
Nitrate Nitrite as N	**0.59**		0.050	0.020	mg/L			12/02/11 14:35	1
Total Organic Carbon	**0.50**	**J**	1.0	0.43	mg/L			11/22/11 20:48	1
Acetic acid	ND		1.0	0.15	mg/L			12/04/11 07:57	1
Butyric acid	ND		1.0	0.16	mg/L			12/04/11 07:57	1
Propionic acid	ND		1.0	0.17	mg/L			12/04/11 07:57	1

Client Sample ID: RU21-111711

Date Collected: 11/17/11 15:30
Date Received: 11/18/11 09:30

Lab Sample ID: 480-12940-5
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			12/01/11 03:12	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			12/01/11 03:12	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			12/01/11 03:12	1
1,1,2-Trichloro-1,2,2-trifluoroethane	**0.88**	**J**	1.0	0.31	ug/L			12/01/11 03:12	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			12/01/11 03:12	1
1,1-Dichloroethene	**3.6**		1.0	0.29	ug/L			12/01/11 03:12	1

Client: Camp Dresser & McKee Inc
Project/Site: Olean Pilot Study

TestAmerica Job ID: 480-12940-1

Client Sample ID: RU21-111711
Date Collected: 11/17/11 15:30
Date Received: 11/18/11 09:30

Lab Sample ID: 480-12940-5
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			12/01/11 03:12	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			12/01/11 03:12	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			12/01/11 03:12	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			12/01/11 03:12	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			12/01/11 03:12	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			12/01/11 03:12	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			12/01/11 03:12	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			12/01/11 03:12	1
2-Hexanone	ND		5.0	1.2	ug/L			12/01/11 03:12	1
2-Butanone (MEK)	ND		10	1.3	ug/L			12/01/11 03:12	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			12/01/11 03:12	1
Acetone	ND		10	3.0	ug/L			12/01/11 03:12	1
Benzene	ND		1.0	0.41	ug/L			12/01/11 03:12	1
Bromodichloromethane	ND		1.0	0.39	ug/L			12/01/11 03:12	1
Bromoform	ND		1.0	0.26	ug/L			12/01/11 03:12	1
Bromomethane	ND	*	1.0	0.69	ug/L			12/01/11 03:12	1
Carbon disulfide	ND		1.0	0.19	ug/L			12/01/11 03:12	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			12/01/11 03:12	1
Chlorobenzene	ND		1.0	0.75	ug/L			12/01/11 03:12	1
Dibromochloromethane	ND		1.0	0.32	ug/L			12/01/11 03:12	1
Chloroethane	ND		1.0	0.32	ug/L			12/01/11 03:12	1
Chloroform	ND		1.0	0.34	ug/L			12/01/11 03:12	1
Chloromethane	ND		1.0	0.35	ug/L			12/01/11 03:12	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			12/01/11 03:12	1
Cyclohexane	**0.59**	**J**	1.0	0.18	ug/L			12/01/11 03:12	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			12/01/11 03:12	1
Ethylbenzene	ND		1.0	0.74	ug/L			12/01/11 03:12	1
Isopropylbenzene	ND		1.0	0.79	ug/L			12/01/11 03:12	1
Methyl acetate	ND		1.0	0.50	ug/L			12/01/11 03:12	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			12/01/11 03:12	1
Methylcyclohexane	ND		1.0	0.16	ug/L			12/01/11 03:12	1
Methylene Chloride	ND		1.0	0.44	ug/L			12/01/11 03:12	1
Styrene	ND		1.0	0.73	ug/L			12/01/11 03:12	1
Tetrachloroethene	**2.6**		1.0	0.36	ug/L			12/01/11 03:12	1
Toluene	ND		1.0	0.51	ug/L			12/01/11 03:12	1
trans-1,2-Dichloroethene	**6.2**		1.0	0.90	ug/L			12/01/11 03:12	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			12/01/11 03:12	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			12/01/11 03:12	1
Vinyl chloride	**58**		1.0	0.90	ug/L			12/01/11 03:12	1
Xylenes, Total	ND		2.0	0.66	ug/L			12/01/11 03:12	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*117*		*66 - 137*		*12/01/11 03:12*	*1*
Toluene-d8 (Surr)	*110*		*71 - 126*		*12/01/11 03:12*	*1*
4-Bromofluorobenzene (Surr)	*102*		*73 - 120*		*12/01/11 03:12*	*1*

Method: 8260B - Volatile Organic Compounds (GC/MS) - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**490**		25	20	ug/L			12/01/11 14:42	25
Trichloroethene	**1500**		25	12	ug/L			12/01/11 14:42	25

Client Sample ID: RU21-111711 | **Lab Sample ID: 480-12940-5**

Date Collected: 11/17/11 15:30 | **Matrix: Water**

Date Received: 11/18/11 09:30

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	115		66 - 137		12/01/11 14:42	25
Toluene-d8 (Surr)	106		71 - 126		12/01/11 14:42	25
4-Bromofluorobenzene (Surr)	104		73 - 120		12/01/11 14:42	25

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethane	**12**		1.5	0.49	ug/L			11/22/11 11:37	1
Ethene	**1.7**		1.5	0.52	ug/L			11/22/11 11:37	1
Methane	**190**		10	2.2	ug/L			11/22/11 13:11	10

Method: 6010B - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.20	0.060	mg/L		11/21/11 09:15	11/21/11 23:02	1
Antimony	ND		0.020	0.0068	mg/L		11/21/11 09:15	11/21/11 23:02	1
Arsenic	ND		0.010	0.0056	mg/L		11/21/11 09:15	11/21/11 23:02	1
Barium	**0.060**		0.0020	0.00050	mg/L		11/21/11 09:15	11/21/11 23:02	1
Beryllium	ND		0.0020	0.00030	mg/L		11/21/11 09:15	11/22/11 17:29	1
Cadmium	**0.00043**	**J**	0.0010	0.00033	mg/L		11/21/11 09:15	11/21/11 23:02	1
Calcium	**114**		0.50	0.10	mg/L		11/21/11 09:15	11/21/11 23:02	1
Chromium	ND		0.0040	0.00087	mg/L		11/21/11 09:15	11/21/11 23:02	1
Cobalt	**0.0011**	**J**	0.0040	0.00063	mg/L		11/21/11 09:15	11/21/11 23:02	1
Copper	**0.0043**	**J**	0.010	0.0015	mg/L		11/21/11 09:15	11/21/11 23:02	1
Iron	ND		0.050	0.019	mg/L		11/21/11 09:15	11/21/11 23:02	1
Lead	ND		0.0050	0.0030	mg/L		11/21/11 09:15	11/21/11 23:02	1
Magnesium	**16.7**		0.20	0.043	mg/L		11/21/11 09:15	11/21/11 23:02	1
Manganese	**0.45**	**B**	0.0030	0.00030	mg/L		11/21/11 09:15	11/21/11 23:02	1
Nickel	**0.0032**	**J**	0.010	0.0013	mg/L		11/21/11 09:15	11/21/11 23:02	1
Potassium	**2.3**		0.50	0.20	mg/L		11/21/11 09:15	11/21/11 23:02	1
Selenium	ND		0.015	0.0087	mg/L		11/21/11 09:15	11/21/11 23:02	1
Silver	ND		0.0030	0.0017	mg/L		11/21/11 09:15	11/21/11 23:02	1
Sodium	**20.0**		1.0	0.32	mg/L		11/21/11 09:15	11/21/11 23:02	1
Thallium	ND		0.020	0.010	mg/L		11/21/11 09:15	11/21/11 23:02	1
Vanadium	ND		0.0050	0.0011	mg/L		11/21/11 09:15	11/21/11 23:02	1
Zinc	**0.0032**	**J**	0.010	0.0017	mg/L		11/21/11 09:15	11/21/11 23:02	1

Method: 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020	0.00012	mg/L		11/23/11 11:20	11/23/11 15:31	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**26.6**		0.50	0.28	mg/L			12/02/11 06:08	1
Sulfate	**61.1**		2.0	0.35	mg/L			12/02/11 06:08	1
Nitrate Nitrite as N	**0.026**	**J**	0.050	0.020	mg/L			12/02/11 14:36	1
Total Organic Carbon	**2.0**		1.0	0.43	mg/L			11/22/11 21:47	1
Acetic acid	ND		1.0	0.15	mg/L			12/04/11 08:26	1
Butyric acid	ND		1.0	0.16	mg/L			12/04/11 08:26	1
Propionic acid	ND		1.0	0.17	mg/L			12/04/11 08:26	1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Client Sample Results

Client: Camp Dresser & McKee Inc
Project/Site: Olean Pilot Study

TestAmerica Job ID: 480-12940-1

Client Sample ID: DUP-111711
Date Collected: 11/17/11 11:30
Date Received: 11/18/11 09:30

Lab Sample ID: 480-12940-6
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			12/01/11 03:35	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			12/01/11 03:35	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			12/01/11 03:35	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			12/01/11 03:35	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			12/01/11 03:35	1
1,1-Dichloroethene	ND		1.0	0.29	ug/L			12/01/11 03:35	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			12/01/11 03:35	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			12/01/11 03:35	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			12/01/11 03:35	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			12/01/11 03:35	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			12/01/11 03:35	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			12/01/11 03:35	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			12/01/11 03:35	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			12/01/11 03:35	1
2-Hexanone	ND		5.0	1.2	ug/L			12/01/11 03:35	1
2-Butanone (MEK)	ND		10	1.3	ug/L			12/01/11 03:35	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			12/01/11 03:35	1
Acetone	ND		10	3.0	ug/L			12/01/11 03:35	1
Benzene	ND		1.0	0.41	ug/L			12/01/11 03:35	1
Bromodichloromethane	ND		1.0	0.39	ug/L			12/01/11 03:35	1
Bromoform	ND		1.0	0.26	ug/L			12/01/11 03:35	1
Bromomethane	ND	*	1.0	0.69	ug/L			12/01/11 03:35	1
Carbon disulfide	ND		1.0	0.19	ug/L			12/01/11 03:35	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			12/01/11 03:35	1
Chlorobenzene	ND		1.0	0.75	ug/L			12/01/11 03:35	1
Dibromochloromethane	ND		1.0	0.32	ug/L			12/01/11 03:35	1
Chloroethane	ND		1.0	0.32	ug/L			12/01/11 03:35	1
Chloroform	ND		1.0	0.34	ug/L			12/01/11 03:35	1
Chloromethane	ND		1.0	0.35	ug/L			12/01/11 03:35	1
cis-1,2-Dichloroethene	**24**		1.0	0.81	ug/L			12/01/11 03:35	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			12/01/11 03:35	1
Cyclohexane	ND		1.0	0.18	ug/L			12/01/11 03:35	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			12/01/11 03:35	1
Ethylbenzene	ND		1.0	0.74	ug/L			12/01/11 03:35	1
Isopropylbenzene	ND		1.0	0.79	ug/L			12/01/11 03:35	1
Methyl acetate	ND		1.0	0.50	ug/L			12/01/11 03:35	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			12/01/11 03:35	1
Methylcyclohexane	ND		1.0	0.16	ug/L			12/01/11 03:35	1
Methylene Chloride	ND		1.0	0.44	ug/L			12/01/11 03:35	1
Styrene	ND		1.0	0.73	ug/L			12/01/11 03:35	1
Tetrachloroethene	ND		1.0	0.36	ug/L			12/01/11 03:35	1
Toluene	ND		1.0	0.51	ug/L			12/01/11 03:35	1
trans-1,2-Dichloroethene	ND		1.0	0.90	ug/L			12/01/11 03:35	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			12/01/11 03:35	1
Trichloroethene	**72**		1.0	0.46	ug/L			12/01/11 03:35	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			12/01/11 03:35	1
Vinyl chloride	**2.4**		1.0	0.90	ug/L			12/01/11 03:35	1
Xylenes, Total	ND		2.0	0.66	ug/L			12/01/11 03:35	1

Client Sample Results

Client: Camp Dresser & McKee Inc — TestAmerica Job ID: 480-12940-1
Project/Site: Olean Pilot Study

Client Sample ID: DUP-111711 — **Lab Sample ID: 480-12940-6**
Date Collected: 11/17/11 11:30 — **Matrix: Water**
Date Received: 11/18/11 09:30

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*114*		*66 - 137*		*12/01/11 03:35*	*1*
Toluene-d8 (Surr)	*106*		*71 - 126*		*12/01/11 03:35*	*1*
4-Bromofluorobenzene (Surr)	*103*		*73 - 120*		*12/01/11 03:35*	*1*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethane	ND		1.5	0.49	ug/L			11/22/11 11:54	1
Ethene	ND		1.5	0.52	ug/L			11/22/11 11:54	1
Methane	**8.1**		1.0	0.22	ug/L			11/22/11 11:54	1

Method: 6010B - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.20	0.060	mg/L		11/21/11 09:15	11/21/11 23:04	1
Antimony	ND		0.020	0.0068	mg/L		11/21/11 09:15	11/21/11 23:04	1
Arsenic	ND		0.010	0.0056	mg/L		11/21/11 09:15	11/21/11 23:04	1
Barium	**0.052**		0.0020	0.00050	mg/L		11/21/11 09:15	11/21/11 23:04	1
Beryllium	ND		0.0020	0.00030	mg/L		11/21/11 09:15	11/22/11 17:31	1
Cadmium	ND		0.0010	0.00033	mg/L		11/21/11 09:15	11/21/11 23:04	1
Calcium	**22.9**		0.50	0.10	mg/L		11/21/11 09:15	11/21/11 23:04	1
Chromium	ND		0.0040	0.00087	mg/L		11/21/11 09:15	11/21/11 23:04	1
Cobalt	ND		0.0040	0.00063	mg/L		11/21/11 09:15	11/21/11 23:04	1
Copper	**0.0029**	**J**	0.010	0.0015	mg/L		11/21/11 09:15	11/21/11 23:04	1
Iron	ND		0.050	0.019	mg/L		11/21/11 09:15	11/21/11 23:04	1
Lead	ND		0.0050	0.0030	mg/L		11/21/11 09:15	11/21/11 23:04	1
Magnesium	**3.7**		0.20	0.043	mg/L		11/21/11 09:15	11/21/11 23:04	1
Manganese	**0.0063**	**B**	0.0030	0.00030	mg/L		11/21/11 09:15	11/21/11 23:04	1
Nickel	ND		0.010	0.0013	mg/L		11/21/11 09:15	11/21/11 23:04	1
Potassium	**0.54**		0.50	0.20	mg/L		11/21/11 09:15	11/21/11 23:04	1
Selenium	ND		0.015	0.0087	mg/L		11/21/11 09:15	11/21/11 23:04	1
Silver	ND		0.0030	0.0017	mg/L		11/21/11 09:15	11/21/11 23:04	1
Sodium	**2.5**		1.0	0.32	mg/L		11/21/11 09:15	11/21/11 23:04	1
Thallium	ND		0.020	0.010	mg/L		11/21/11 09:15	11/21/11 23:04	1
Vanadium	ND		0.0050	0.0011	mg/L		11/21/11 09:15	11/21/11 23:04	1
Zinc	**0.0020**	**J**	0.010	0.0017	mg/L		11/21/11 09:15	11/21/11 23:04	1

Method: 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020	0.00012	mg/L		11/23/11 11:20	11/23/11 15:33	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**1.9**		0.50	0.28	mg/L			12/02/11 06:18	1
Sulfate	**11.9**		2.0	0.35	mg/L			12/02/11 06:18	1
Nitrate Nitrite as N	**1.3**		0.050	0.020	mg/L			12/02/11 14:37	1
Total Organic Carbon	ND		1.0	0.43	mg/L			11/22/11 22:07	1
Acetic acid	ND		1.0	0.15	mg/L			12/04/11 08:55	1
Butyric acid	ND		1.0	0.16	mg/L			12/04/11 08:55	1
Propionic acid	ND		1.0	0.17	mg/L			12/04/11 08:55	1

Client Sample ID: RB-111711
Lab Sample ID: 480-12940-7
Date Collected: 11/17/11 16:30
Matrix: Water
Date Received: 11/18/11 09:30

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			12/01/11 03:59	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			12/01/11 03:59	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			12/01/11 03:59	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			12/01/11 03:59	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			12/01/11 03:59	1
1,1-Dichloroethene	ND		1.0	0.29	ug/L			12/01/11 03:59	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			12/01/11 03:59	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			12/01/11 03:59	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			12/01/11 03:59	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			12/01/11 03:59	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			12/01/11 03:59	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			12/01/11 03:59	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			12/01/11 03:59	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			12/01/11 03:59	1
2-Hexanone	ND		5.0	1.2	ug/L			12/01/11 03:59	1
2-Butanone (MEK)	ND		10	1.3	ug/L			12/01/11 03:59	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			12/01/11 03:59	1
Acetone	ND		10	3.0	ug/L			12/01/11 03:59	1
Benzene	ND		1.0	0.41	ug/L			12/01/11 03:59	1
Bromodichloromethane	ND		1.0	0.39	ug/L			12/01/11 03:59	1
Bromoform	ND		1.0	0.26	ug/L			12/01/11 03:59	1
Bromomethane	ND	*	1.0	0.69	ug/L			12/01/11 03:59	1
Carbon disulfide	ND		1.0	0.19	ug/L			12/01/11 03:59	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			12/01/11 03:59	1
Chlorobenzene	ND		1.0	0.75	ug/L			12/01/11 03:59	1
Dibromochloromethane	ND		1.0	0.32	ug/L			12/01/11 03:59	1
Chloroethane	ND		1.0	0.32	ug/L			12/01/11 03:59	1
Chloroform	ND		1.0	0.34	ug/L			12/01/11 03:59	1
Chloromethane	ND		1.0	0.35	ug/L			12/01/11 03:59	1
cis-1,2-Dichloroethene	ND		1.0	0.81	ug/L			12/01/11 03:59	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			12/01/11 03:59	1
Cyclohexane	ND		1.0	0.18	ug/L			12/01/11 03:59	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			12/01/11 03:59	1
Ethylbenzene	ND		1.0	0.74	ug/L			12/01/11 03:59	1
Isopropylbenzene	ND		1.0	0.79	ug/L			12/01/11 03:59	1
Methyl acetate	ND		1.0	0.50	ug/L			12/01/11 03:59	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			12/01/11 03:59	1
Methylcyclohexane	ND		1.0	0.16	ug/L			12/01/11 03:59	1
Methylene Chloride	ND		1.0	0.44	ug/L			12/01/11 03:59	1
Styrene	ND		1.0	0.73	ug/L			12/01/11 03:59	1
Tetrachloroethene	ND		1.0	0.36	ug/L			12/01/11 03:59	1
Toluene	ND		1.0	0.51	ug/L			12/01/11 03:59	1
trans-1,2-Dichloroethene	ND		1.0	0.90	ug/L			12/01/11 03:59	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			12/01/11 03:59	1
Trichloroethene	ND		1.0	0.46	ug/L			12/01/11 03:59	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			12/01/11 03:59	1
Vinyl chloride	ND		1.0	0.90	ug/L			12/01/11 03:59	1
Xylenes, Total	ND		2.0	0.66	ug/L			12/01/11 03:59	1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Client Sample ID: RB-111711 | **Lab Sample ID: 480-12940-7**
Date Collected: 11/17/11 16:30 | **Matrix: Water**
Date Received: 11/18/11 09:30

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	*113*		*66 - 137*		*12/01/11 03:59*	*1*
Toluene-d8 (Surr)	*108*		*71 - 126*		*12/01/11 03:59*	*1*
4-Bromofluorobenzene (Surr)	*103*		*73 - 120*		*12/01/11 03:59*	*1*

Client Sample ID: TRIP BLANK | **Lab Sample ID: 480-12940-8**
Date Collected: 11/17/11 00:00 | **Matrix: Water**
Date Received: 11/18/11 09:30

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			12/01/11 04:22	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			12/01/11 04:22	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			12/01/11 04:22	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			12/01/11 04:22	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			12/01/11 04:22	1
1,1-Dichloroethene	ND		1.0	0.29	ug/L			12/01/11 04:22	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			12/01/11 04:22	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			12/01/11 04:22	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			12/01/11 04:22	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			12/01/11 04:22	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			12/01/11 04:22	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			12/01/11 04:22	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			12/01/11 04:22	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			12/01/11 04:22	1
2-Hexanone	ND		5.0	1.2	ug/L			12/01/11 04:22	1
2-Butanone (MEK)	ND		10	1.3	ug/L			12/01/11 04:22	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			12/01/11 04:22	1
Acetone	ND		10	3.0	ug/L			12/01/11 04:22	1
Benzene	ND		1.0	0.41	ug/L			12/01/11 04:22	1
Bromodichloromethane	ND		1.0	0.39	ug/L			12/01/11 04:22	1
Bromoform	ND		1.0	0.26	ug/L			12/01/11 04:22	1
Bromomethane	ND	*	1.0	0.69	ug/L			12/01/11 04:22	1
Carbon disulfide	ND		1.0	0.19	ug/L			12/01/11 04:22	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			12/01/11 04:22	1
Chlorobenzene	ND		1.0	0.75	ug/L			12/01/11 04:22	1
Dibromochloromethane	ND		1.0	0.32	ug/L			12/01/11 04:22	1
Chloroethane	ND		1.0	0.32	ug/L			12/01/11 04:22	1
Chloroform	ND		1.0	0.34	ug/L			12/01/11 04:22	1
Chloromethane	ND		1.0	0.35	ug/L			12/01/11 04:22	1
cis-1,2-Dichloroethene	ND		1.0	0.81	ug/L			12/01/11 04:22	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			12/01/11 04:22	1
Cyclohexane	ND		1.0	0.18	ug/L			12/01/11 04:22	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			12/01/11 04:22	1
Ethylbenzene	ND		1.0	0.74	ug/L			12/01/11 04:22	1
Isopropylbenzene	ND		1.0	0.79	ug/L			12/01/11 04:22	1
Methyl acetate	ND		1.0	0.50	ug/L			12/01/11 04:22	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			12/01/11 04:22	1
Methylcyclohexane	ND		1.0	0.16	ug/L			12/01/11 04:22	1
Methylene Chloride	ND		1.0	0.44	ug/L			12/01/11 04:22	1
Styrene	ND		1.0	0.73	ug/L			12/01/11 04:22	1

Client Sample ID: TRIP BLANK
Date Collected: 11/17/11 00:00
Date Received: 11/18/11 09:30

Lab Sample ID: 480-12940-8
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Tetrachloroethene	ND		1.0	0.36	ug/L			12/01/11 04:22	1
Toluene	ND		1.0	0.51	ug/L			12/01/11 04:22	1
trans-1,2-Dichloroethene	ND		1.0	0.90	ug/L			12/01/11 04:22	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			12/01/11 04:22	1
Trichloroethene	ND		1.0	0.46	ug/L			12/01/11 04:22	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			12/01/11 04:22	1
Vinyl chloride	ND		1.0	0.90	ug/L			12/01/11 04:22	1
Xylenes, Total	ND		2.0	0.66	ug/L			12/01/11 04:22	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*118*		*66 - 137*		*12/01/11 04:22*	*1*
Toluene-d8 (Surr)	*107*		*71 - 126*		*12/01/11 04:22*	*1*
4-Bromofluorobenzene (Surr)	*102*		*73 - 120*		*12/01/11 04:22*	*1*

Client: Camp Dresser & McKee Inc
Project/Site: Olean Pilot Study

TestAmerica Job ID: 480-12940-1

Method: 8260B - Volatile Organic Compounds (GC/MS)

Matrix: Water **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)		
		12DCE	TOL	BFB
Lab Sample ID	Client Sample ID	(66-137)	(71-126)	(73-120)
480-12940-1	RU20-111711	112	106	100
480-12940-1 - DL	RU20-111711	116	108	102
480-12940-2	RU10-111711	112	104	98
480-12940-3	RU19-111711	116	108	101
480-12940-3 - DL	RU19-111711	115	110	106
480-12940-4	RU8-111711	113	108	101
480-12940-4 - DL	RU8-111711	112	108	107
480-12940-5	RU21-111711	117	110	102
480-12940-5 - DL	RU21-111711	115	106	104
480-12940-6	DUP-111711	114	106	103
480-12940-7	RB-111711	113	108	103
480-12940-8	TRIP BLANK	118	107	102
LCS 480-42381/4	Lab Control Sample	109	110	101
LCS 480-42419/4	Lab Control Sample	110	109	102
LCS 480-42630/4	Lab Control Sample	112	108	102
MB 480-42381/5	Method Blank	113	108	106
MB 480-42419/5	Method Blank	106	109	107
MB 480-42630/5	Method Blank	110	105	101

Surrogate Legend

12DCE = 1,2-Dichloroethane-d4 (Surr)
TOL = Toluene-d8 (Surr)
BFB = 4-Bromofluorobenzene (Surr)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Method: 8260B - Volatile Organic Compounds (GC/MS)

Lab Sample ID: MB 480-42381/5
Matrix: Water
Analysis Batch: 42381

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			11/30/11 23:50	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			11/30/11 23:50	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			11/30/11 23:50	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			11/30/11 23:50	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			11/30/11 23:50	1
1,1-Dichloroethene	ND		1.0	0.29	ug/L			11/30/11 23:50	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			11/30/11 23:50	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			11/30/11 23:50	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			11/30/11 23:50	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			11/30/11 23:50	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			11/30/11 23:50	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			11/30/11 23:50	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			11/30/11 23:50	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			11/30/11 23:50	1
2-Hexanone	ND		5.0	1.2	ug/L			11/30/11 23:50	1
2-Butanone (MEK)	ND		10	1.3	ug/L			11/30/11 23:50	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			11/30/11 23:50	1
Acetone	ND		10	3.0	ug/L			11/30/11 23:50	1
Benzene	ND		1.0	0.41	ug/L			11/30/11 23:50	1
Bromodichloromethane	ND		1.0	0.39	ug/L			11/30/11 23:50	1
Bromoform	ND		1.0	0.26	ug/L			11/30/11 23:50	1
Bromomethane	ND		1.0	0.69	ug/L			11/30/11 23:50	1
Carbon disulfide	ND		1.0	0.19	ug/L			11/30/11 23:50	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			11/30/11 23:50	1
Chlorobenzene	ND		1.0	0.75	ug/L			11/30/11 23:50	1
Dibromochloromethane	ND		1.0	0.32	ug/L			11/30/11 23:50	1
Chloroethane	ND		1.0	0.32	ug/L			11/30/11 23:50	1
Chloroform	ND		1.0	0.34	ug/L			11/30/11 23:50	1
Chloromethane	ND		1.0	0.35	ug/L			11/30/11 23:50	1
cis-1,2-Dichloroethene	ND		1.0	0.81	ug/L			11/30/11 23:50	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			11/30/11 23:50	1
Cyclohexane	ND		1.0	0.18	ug/L			11/30/11 23:50	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			11/30/11 23:50	1
Ethylbenzene	ND		1.0	0.74	ug/L			11/30/11 23:50	1
Isopropylbenzene	ND		1.0	0.79	ug/L			11/30/11 23:50	1
Methyl acetate	ND		1.0	0.50	ug/L			11/30/11 23:50	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			11/30/11 23:50	1
Methylcyclohexane	ND		1.0	0.16	ug/L			11/30/11 23:50	1
Methylene Chloride	ND		1.0	0.44	ug/L			11/30/11 23:50	1
Styrene	ND		1.0	0.73	ug/L			11/30/11 23:50	1
Tetrachloroethene	ND		1.0	0.36	ug/L			11/30/11 23:50	1
Toluene	ND		1.0	0.51	ug/L			11/30/11 23:50	1
trans-1,2-Dichloroethene	ND		1.0	0.90	ug/L			11/30/11 23:50	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			11/30/11 23:50	1
Trichloroethene	ND		1.0	0.46	ug/L			11/30/11 23:50	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			11/30/11 23:50	1
Vinyl chloride	ND		1.0	0.90	ug/L			11/30/11 23:50	1
Xylenes, Total	ND		2.0	0.66	ug/L			11/30/11 23:50	1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 480-42381/5 — **Client Sample ID: Method Blank**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 42381

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*113*		*66 - 137*		*11/30/11 23:50*	*1*
Toluene-d8 (Surr)	*108*		*71 - 126*		*11/30/11 23:50*	*1*
4-Bromofluorobenzene (Surr)	*106*		*73 - 120*		*11/30/11 23:50*	*1*

Lab Sample ID: LCS 480-42381/4 — **Client Sample ID: Lab Control Sample**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 42381

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1-Dichloroethane	25.0	25.0		ug/L		100	71 - 129
1,1-Dichloroethene	25.0	27.7		ug/L		111	65 - 138
1,2-Dichlorobenzene	25.0	23.5		ug/L		94	77 - 120
1,2-Dichloroethane	25.0	25.0		ug/L		100	75 - 127
Benzene	25.0	25.0		ug/L		100	71 - 124
Chlorobenzene	25.0	23.3		ug/L		93	72 - 120
cis-1,2-Dichloroethene	25.0	24.5		ug/L		98	74 - 124
Ethylbenzene	25.0	23.6		ug/L		94	77 - 123
Methyl tert-butyl ether	25.0	21.2		ug/L		85	64 - 127
Tetrachloroethene	25.0	24.0		ug/L		96	74 - 122
Toluene	25.0	24.1		ug/L		96	70 - 122
trans-1,2-Dichloroethene	25.0	24.0		ug/L		96	73 - 127
Trichloroethene	25.0	23.8		ug/L		95	74 - 123

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
1,2-Dichloroethane-d4 (Surr)	*109*		*66 - 137*
Toluene-d8 (Surr)	*110*		*71 - 126*
4-Bromofluorobenzene (Surr)	*101*		*73 - 120*

Lab Sample ID: MB 480-42419/5 — **Client Sample ID: Method Blank**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 42419

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			12/01/11 11:58	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			12/01/11 11:58	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			12/01/11 11:58	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			12/01/11 11:58	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			12/01/11 11:58	1
1,1-Dichloroethene	ND		1.0	0.29	ug/L			12/01/11 11:58	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			12/01/11 11:58	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			12/01/11 11:58	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			12/01/11 11:58	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			12/01/11 11:58	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			12/01/11 11:58	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			12/01/11 11:58	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			12/01/11 11:58	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			12/01/11 11:58	1
2-Hexanone	ND		5.0	1.2	ug/L			12/01/11 11:58	1
2-Butanone (MEK)	ND		10	1.3	ug/L			12/01/11 11:58	1

Client: Camp Dresser & McKee Inc
Project/Site: Olean Pilot Study

TestAmerica Job ID: 480-12940-1

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 480-42419/5
Matrix: Water
Analysis Batch: 42419

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			12/01/11 11:58	1
Acetone	ND		10	3.0	ug/L			12/01/11 11:58	1
Benzene	ND		1.0	0.41	ug/L			12/01/11 11:58	1
Bromodichloromethane	ND		1.0	0.39	ug/L			12/01/11 11:58	1
Bromoform	ND		1.0	0.26	ug/L			12/01/11 11:58	1
Bromomethane	ND		1.0	0.69	ug/L			12/01/11 11:58	1
Carbon disulfide	ND		1.0	0.19	ug/L			12/01/11 11:58	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			12/01/11 11:58	1
Chlorobenzene	ND		1.0	0.75	ug/L			12/01/11 11:58	1
Dibromochloromethane	ND		1.0	0.32	ug/L			12/01/11 11:58	1
Chloroethane	ND		1.0	0.32	ug/L			12/01/11 11:58	1
Chloroform	0.968	J	1.0	0.34	ug/L			12/01/11 11:58	1
Chloromethane	ND		1.0	0.35	ug/L			12/01/11 11:58	1
cis-1,2-Dichloroethene	ND		1.0	0.81	ug/L			12/01/11 11:58	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			12/01/11 11:58	1
Cyclohexane	ND		1.0	0.18	ug/L			12/01/11 11:58	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			12/01/11 11:58	1
Ethylbenzene	ND		1.0	0.74	ug/L			12/01/11 11:58	1
Isopropylbenzene	ND		1.0	0.79	ug/L			12/01/11 11:58	1
Methyl acetate	ND		1.0	0.50	ug/L			12/01/11 11:58	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			12/01/11 11:58	1
Methylcyclohexane	ND		1.0	0.16	ug/L			12/01/11 11:58	1
Methylene Chloride	ND		1.0	0.44	ug/L			12/01/11 11:58	1
Styrene	ND		1.0	0.73	ug/L			12/01/11 11:58	1
Tetrachloroethene	ND		1.0	0.36	ug/L			12/01/11 11:58	1
Toluene	ND		1.0	0.51	ug/L			12/01/11 11:58	1
trans-1,2-Dichloroethene	ND		1.0	0.90	ug/L			12/01/11 11:58	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			12/01/11 11:58	1
Trichloroethene	ND		1.0	0.46	ug/L			12/01/11 11:58	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			12/01/11 11:58	1
Vinyl chloride	ND		1.0	0.90	ug/L			12/01/11 11:58	1
Xylenes, Total	ND		2.0	0.66	ug/L			12/01/11 11:58	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*106*		*66 - 137*		*12/01/11 11:58*	*1*
Toluene-d8 (Surr)	*109*		*71 - 126*		*12/01/11 11:58*	*1*
4-Bromofluorobenzene (Surr)	*107*		*73 - 120*		*12/01/11 11:58*	*1*

Lab Sample ID: LCS 480-42419/4
Matrix: Water
Analysis Batch: 42419

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1-Dichloroethane	25.0	24.3		ug/L		97	71 - 129
1,1-Dichloroethene	25.0	24.0		ug/L		96	65 - 138
1,2-Dichlorobenzene	25.0	23.3		ug/L		93	77 - 120
1,2-Dichloroethane	25.0	24.1		ug/L		96	75 - 127
Benzene	25.0	24.2		ug/L		97	71 - 124
Chlorobenzene	25.0	22.9		ug/L		92	72 - 120

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 480-42419/4
Matrix: Water
Analysis Batch: 42419

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
cis-1,2-Dichloroethene	25.0	23.7		ug/L		95	74 - 124
Ethylbenzene	25.0	23.1		ug/L		92	77 - 123
Methyl tert-butyl ether	25.0	21.1		ug/L		84	64 - 127
Tetrachloroethene	25.0	23.1		ug/L		92	74 - 122
Toluene	25.0	23.4		ug/L		94	70 - 122
trans-1,2-Dichloroethene	25.0	24.0		ug/L		96	73 - 127
Trichloroethene	25.0	23.9		ug/L		96	74 - 123

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
1,2-Dichloroethane-d4 (Surr)	*110*		*66 - 137*
Toluene-d8 (Surr)	*109*		*71 - 126*
4-Bromofluorobenzene (Surr)	*102*		*73 - 120*

Lab Sample ID: MB 480-42630/5
Matrix: Water
Analysis Batch: 42630

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			12/02/11 12:41	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			12/02/11 12:41	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			12/02/11 12:41	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			12/02/11 12:41	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			12/02/11 12:41	1
1,1-Dichloroethene	ND		1.0	0.29	ug/L			12/02/11 12:41	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			12/02/11 12:41	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			12/02/11 12:41	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			12/02/11 12:41	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			12/02/11 12:41	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			12/02/11 12:41	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			12/02/11 12:41	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			12/02/11 12:41	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			12/02/11 12:41	1
2-Hexanone	ND		5.0	1.2	ug/L			12/02/11 12:41	1
2-Butanone (MEK)	ND		10	1.3	ug/L			12/02/11 12:41	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			12/02/11 12:41	1
Acetone	ND		10	3.0	ug/L			12/02/11 12:41	1
Benzene	ND		1.0	0.41	ug/L			12/02/11 12:41	1
Bromodichloromethane	ND		1.0	0.39	ug/L			12/02/11 12:41	1
Bromoform	ND		1.0	0.26	ug/L			12/02/11 12:41	1
Bromomethane	ND		1.0	0.69	ug/L			12/02/11 12:41	1
Carbon disulfide	ND		1.0	0.19	ug/L			12/02/11 12:41	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			12/02/11 12:41	1
Chlorobenzene	ND		1.0	0.75	ug/L			12/02/11 12:41	1
Dibromochloromethane	ND		1.0	0.32	ug/L			12/02/11 12:41	1
Chloroethane	ND		1.0	0.32	ug/L			12/02/11 12:41	1
Chloroform	ND		1.0	0.34	ug/L			12/02/11 12:41	1
Chloromethane	ND		1.0	0.35	ug/L			12/02/11 12:41	1
cis-1,2-Dichloroethene	ND		1.0	0.81	ug/L			12/02/11 12:41	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			12/02/11 12:41	1

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 480-42630/5
Matrix: Water
Analysis Batch: 42630
Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cyclohexane	ND		1.0	0.18	ug/L			12/02/11 12:41	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			12/02/11 12:41	1
Ethylbenzene	ND		1.0	0.74	ug/L			12/02/11 12:41	1
Isopropylbenzene	ND		1.0	0.79	ug/L			12/02/11 12:41	1
Methyl acetate	ND		1.0	0.50	ug/L			12/02/11 12:41	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			12/02/11 12:41	1
Methylcyclohexane	ND		1.0	0.16	ug/L			12/02/11 12:41	1
Methylene Chloride	ND		1.0	0.44	ug/L			12/02/11 12:41	1
Styrene	ND		1.0	0.73	ug/L			12/02/11 12:41	1
Tetrachloroethene	ND		1.0	0.36	ug/L			12/02/11 12:41	1
Toluene	ND		1.0	0.51	ug/L			12/02/11 12:41	1
trans-1,2-Dichloroethene	ND		1.0	0.90	ug/L			12/02/11 12:41	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			12/02/11 12:41	1
Trichloroethene	ND		1.0	0.46	ug/L			12/02/11 12:41	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			12/02/11 12:41	1
Vinyl chloride	ND		1.0	0.90	ug/L			12/02/11 12:41	1
Xylenes, Total	ND		2.0	0.66	ug/L			12/02/11 12:41	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*110*		*66 - 137*		*12/02/11 12:41*	*1*
Toluene-d8 (Surr)	*105*		*71 - 126*		*12/02/11 12:41*	*1*
4-Bromofluorobenzene (Surr)	*101*		*73 - 120*		*12/02/11 12:41*	*1*

Lab Sample ID: LCS 480-42630/4
Matrix: Water
Analysis Batch: 42630
Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1-Dichloroethane	25.0	25.1		ug/L		100	71 - 129
1,1-Dichloroethene	25.0	25.8		ug/L		103	65 - 138
1,2-Dichlorobenzene	25.0	23.0		ug/L		92	77 - 120
1,2-Dichloroethane	25.0	24.2		ug/L		97	75 - 127
Benzene	25.0	24.4		ug/L		98	71 - 124
Chlorobenzene	25.0	22.7		ug/L		91	72 - 120
cis-1,2-Dichloroethene	25.0	23.3		ug/L		93	74 - 124
Ethylbenzene	25.0	22.5		ug/L		90	77 - 123
Methyl tert-butyl ether	25.0	21.9		ug/L		88	64 - 127
Tetrachloroethene	25.0	22.4		ug/L		90	74 - 122
Toluene	25.0	23.4		ug/L		94	70 - 122
trans-1,2-Dichloroethene	25.0	23.1		ug/L		92	73 - 127
Trichloroethene	25.0	23.5		ug/L		94	74 - 123

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
1,2-Dichloroethane-d4 (Surr)	*112*		*66 - 137*
Toluene-d8 (Surr)	*108*		*71 - 126*
4-Bromofluorobenzene (Surr)	*102*		*73 - 120*

Method: RSK-175 - Dissolved Gases (GC)

Lab Sample ID: MB 480-41469/2
Matrix: Water
Analysis Batch: 41469

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethane	ND		1.5	0.49	ug/L			11/22/11 09:06	1
Ethene	ND		1.5	0.52	ug/L			11/22/11 09:06	1
Methane	ND		1.0	0.22	ug/L			11/22/11 09:06	1

Lab Sample ID: LCS 480-41469/3
Matrix: Water
Analysis Batch: 41469

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Ethane	7.21	8.91		ug/L		124	41 - 176
Ethene	6.73	8.44		ug/L		125	62 - 143
Methane	3.88	5.20		ug/L		134	67 - 140

Lab Sample ID: LCSD 480-41469/4
Matrix: Water
Analysis Batch: 41469

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Ethane	7.21	8.59		ug/L		119	41 - 176	4	50
Ethene	6.73	8.16		ug/L		121	62 - 143	3	50
Methane	3.88	5.02		ug/L		129	67 - 140	4	50

Method: 6010B - Metals (ICP)

Lab Sample ID: MB 480-40883/13-B
Matrix: Water
Analysis Batch: 41660

Client Sample ID: Method Blank
Prep Type: Dissolved
Prep Batch: 41171

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Beryllium	ND		0.0020	0.00030	mg/L		11/21/11 09:15	11/22/11 17:02	1

Lab Sample ID: LCS 480-40883/14-B
Matrix: Water
Analysis Batch: 41660

Client Sample ID: Lab Control Sample
Prep Type: Dissolved
Prep Batch: 41171

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Beryllium	0.200	0.203		mg/L		101	80 - 120

Lab Sample ID: 480-12940-3 MS
Matrix: Water
Analysis Batch: 41538

Client Sample ID: RU19-111711
Prep Type: Dissolved
Prep Batch: 41171

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	ND		10.0	10.52		mg/L		105	75 - 125
Antimony	ND		0.200	0.208		mg/L		104	75 - 125
Arsenic	ND		0.200	0.208		mg/L		104	75 - 125
Barium	0.052		0.200	0.262		mg/L		105	75 - 125
Cadmium	0.00041	J	0.200	0.208		mg/L		104	75 - 125
Calcium	73.3		10.0	86.15	4	mg/L		128	75 - 125
Chromium	ND		0.200	0.205		mg/L		103	75 - 125

Method: 6010B - Metals (ICP) (Continued)

Lab Sample ID: 480-12940-3 MS
Matrix: Water
Analysis Batch: 41538

Client Sample ID: RU19-111711
Prep Type: Dissolved
Prep Batch: 41171

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Cobalt	0.00087	J	0.200	0.197		mg/L		98	75 - 125
Copper	0.0047	J	0.200	0.208		mg/L		102	75 - 125
Iron	ND		10.0	10.33		mg/L		103	75 - 125
Lead	ND		0.200	0.201		mg/L		101	75 - 125
Magnesium	11.2		10.0	21.28		mg/L		101	75 - 125
Manganese	0.45	B	0.200	0.636		mg/L		95	75 - 125
Nickel	0.0024	J	0.200	0.215		mg/L		106	75 - 125
Potassium	1.7		10.0	12.15		mg/L		104	75 - 125
Selenium	ND		0.200	0.199		mg/L		100	75 - 125
Silver	ND		0.0500	0.0510		mg/L		102	75 - 125
Sodium	13.6		10.0	24.00		mg/L		104	75 - 125
Thallium	ND		0.200	0.204		mg/L		102	75 - 125
Vanadium	ND		0.200	0.200		mg/L		100	75 - 125
Zinc	0.0038	J	0.200	0.211		mg/L		104	75 - 125

Lab Sample ID: 480-12940-3 MS
Matrix: Water
Analysis Batch: 41660

Client Sample ID: RU19-111711
Prep Type: Dissolved
Prep Batch: 41171

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Beryllium	ND		0.200	0.202		mg/L		101	75 - 125

Lab Sample ID: 480-12940-3 MSD
Matrix: Water
Analysis Batch: 41538

Client Sample ID: RU19-111711
Prep Type: Dissolved
Prep Batch: 41171

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum	ND		10.0	10.48		mg/L		105	75 - 125	0	20
Antimony	ND		0.200	0.210		mg/L		105	75 - 125	1	20
Arsenic	ND		0.200	0.212		mg/L		106	75 - 125	2	20
Barium	0.052		0.200	0.261		mg/L		105	75 - 125	0	20
Cadmium	0.00041	J	0.200	0.209		mg/L		104	75 - 125	0	20
Calcium	73.3		10.0	85.20	4	mg/L		119	75 - 125	1	20
Chromium	ND		0.200	0.208		mg/L		104	75 - 125	1	20
Cobalt	0.00087	J	0.200	0.197		mg/L		98	75 - 125	0	20
Copper	0.0047	J	0.200	0.209		mg/L		102	75 - 125	1	20
Iron	ND		10.0	10.31		mg/L		103	75 - 125	0	20
Lead	ND		0.200	0.202		mg/L		101	75 - 125	0	20
Magnesium	11.2		10.0	21.29		mg/L		101	75 - 125	0	20
Manganese	0.45	B	0.200	0.634		mg/L		94	75 - 125	0	20
Nickel	0.0024	J	0.200	0.215		mg/L		106	75 - 125	0	20
Potassium	1.7		10.0	12.05		mg/L		103	75 - 125	1	20
Selenium	ND		0.200	0.204		mg/L		102	75 - 125	2	20
Silver	ND		0.0500	0.0508		mg/L		102	75 - 125	0	20
Sodium	13.6		10.0	23.58		mg/L		100	75 - 125	2	20
Thallium	ND		0.200	0.205		mg/L		103	75 - 125	1	20
Vanadium	ND		0.200	0.203		mg/L		101	75 - 125	1	20
Zinc	0.0038	J	0.200	0.212		mg/L		104	75 - 125	1	20

Method: 6010B - Metals (ICP) (Continued)

Lab Sample ID: 480-12940-3 MSD
Matrix: Water
Analysis Batch: 41660

Client Sample ID: RU19-111711
Prep Type: Dissolved
Prep Batch: 41171

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Beryllium	ND		0.200	0.200		mg/L		100	75 - 125	1	20

Method: 7470A - Mercury (CVAA)

Lab Sample ID: MB 480-41430/1-C
Matrix: Water
Analysis Batch: 41761

Client Sample ID: Method Blank
Prep Type: Dissolved
Prep Batch: 41702

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.000137	J	0.00020	0.00012	mg/L		11/23/11 11:20	11/23/11 14:47	1

Lab Sample ID: LCS 480-41430/2-C
Matrix: Water
Analysis Batch: 41761

Client Sample ID: Lab Control Sample
Prep Type: Dissolved
Prep Batch: 41702

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.00667	0.00690		mg/L		103	80 - 120

Method: 300.0 - Anions, Ion Chromatography

Lab Sample ID: MB 480-42462/52
Matrix: Water
Analysis Batch: 42462

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND		0.50	0.28	mg/L			12/02/11 01:55	1
Sulfate	ND		2.0	0.35	mg/L			12/02/11 01:55	1

Lab Sample ID: LCS 480-42462/51
Matrix: Water
Analysis Batch: 42462

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	20.0	20.20		mg/L		101	90 - 110
Sulfate	20.0	20.00		mg/L		100	90 - 110

Lab Sample ID: MB 480-42464/76
Matrix: Water
Analysis Batch: 42464

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND		0.50	0.28	mg/L			12/02/11 05:58	1
Sulfate	ND		2.0	0.35	mg/L			12/02/11 05:58	1

Lab Sample ID: LCS 480-42464/75
Matrix: Water
Analysis Batch: 42464

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	20.0	20.20		mg/L		101	90 - 110

Method: 300.0 - Anions, Ion Chromatography (Continued)

Lab Sample ID: LCS 480-42464/75
Matrix: Water
Analysis Batch: 42464

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Sulfate	20.0	19.80		mg/L		99	90 - 110

Method: 353.2 - Nitrogen, Nitrate-Nitrite

Lab Sample ID: MB 480-42696/4
Matrix: Water
Analysis Batch: 42696

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Nitrate Nitrite as N	ND		0.050	0.020	mg/L			12/02/11 14:30	1

Lab Sample ID: LCS 480-42696/5
Matrix: Water
Analysis Batch: 42696

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate Nitrite as N	1.50	1.50		mg/L		100	90 - 110

Method: SM 5310D - Organic Carbon, Total (TOC)

Lab Sample ID: MB 480-41694/3
Matrix: Water
Analysis Batch: 41694

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Organic Carbon	ND		1.0	0.43	mg/L			11/22/11 17:48	1

Lab Sample ID: LCS 480-41694/4
Matrix: Water
Analysis Batch: 41694

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Total Organic Carbon	30.0	28.58		mg/L		95	90 - 110

Method: VFA-IC - Volatile Fatty Acids, Ion Chromatography

Lab Sample ID: MB 480-42700/28
Matrix: Water
Analysis Batch: 42700

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetic acid	ND		1.0	0.15	mg/L			12/04/11 01:38	1
Butyric acid	ND		1.0	0.16	mg/L			12/04/11 01:38	1
Propionic acid	ND		1.0	0.17	mg/L			12/04/11 01:38	1

Client: Camp Dresser & McKee Inc
Project/Site: Olean Pilot Study

TestAmerica Job ID: 480-12940-1

Method: VFA-IC - Volatile Fatty Acids, Ion Chromatography (Continued)

Lab Sample ID: LCS 480-42700/27
Matrix: Water
Analysis Batch: 42700

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acetic acid	10.0	9.92		mg/L		99	80 - 120
Butyric acid	10.0	9.97		mg/L		100	80 - 120
Propionic acid	10.0	9.92		mg/L		99	80 - 120

QC Association Summary

Client: Camp Dresser & McKee Inc
Project/Site: Olean Pilot Study

TestAmerica Job ID: 480-12940-1

GC/MS VOA

Analysis Batch: 42381

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-12940-1	RU20-111711	Total/NA	Water	8260B	
480-12940-2	RU10-111711	Total/NA	Water	8260B	
480-12940-3	RU19-111711	Total/NA	Water	8260B	
480-12940-4	RU8-111711	Total/NA	Water	8260B	
480-12940-5	RU21-111711	Total/NA	Water	8260B	
480-12940-6	DUP-111711	Total/NA	Water	8260B	
480-12940-7	RB-111711	Total/NA	Water	8260B	
480-12940-8	TRIP BLANK	Total/NA	Water	8260B	
LCS 480-42381/4	Lab Control Sample	Total/NA	Water	8260B	
MB 480-42381/5	Method Blank	Total/NA	Water	8260B	

Analysis Batch: 42419

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-12940-3 - DL	RU19-111711	Total/NA	Water	8260B	
480-12940-4 - DL	RU8-111711	Total/NA	Water	8260B	
480-12940-5 - DL	RU21-111711	Total/NA	Water	8260B	
LCS 480-42419/4	Lab Control Sample	Total/NA	Water	8260B	
MB 480-42419/5	Method Blank	Total/NA	Water	8260B	

Analysis Batch: 42630

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-12940-1 - DL	RU20-111711	Total/NA	Water	8260B	
LCS 480-42630/4	Lab Control Sample	Total/NA	Water	8260B	
MB 480-42630/5	Method Blank	Total/NA	Water	8260B	

GC VOA

Analysis Batch: 41469

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-12940-1	RU20-111711	Total/NA	Water	RSK-175	
480-12940-2	RU10-111711	Total/NA	Water	RSK-175	
480-12940-3	RU19-111711	Total/NA	Water	RSK-175	
480-12940-3	RU19-111711	Total/NA	Water	RSK-175	
480-12940-4	RU8-111711	Total/NA	Water	RSK-175	
480-12940-5	RU21-111711	Total/NA	Water	RSK-175	
480-12940-5	RU21-111711	Total/NA	Water	RSK-175	
480-12940-6	DUP-111711	Total/NA	Water	RSK-175	
LCS 480-41469/3	Lab Control Sample	Total/NA	Water	RSK-175	
LCSD 480-41469/4	Lab Control Sample Dup	Total/NA	Water	RSK-175	
MB 480-41469/2	Method Blank	Total/NA	Water	RSK-175	

Metals

Prep Batch: 41171

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-12940-1	RU20-111711	Dissolved	Water	3005A	
480-12940-2	RU10-111711	Dissolved	Water	3005A	
480-12940-3	RU19-111711	Dissolved	Water	3005A	
480-12940-3 MS	RU19-111711	Dissolved	Water	3005A	
480-12940-3 MSD	RU19-111711	Dissolved	Water	3005A	
480-12940-4	RU8-111711	Dissolved	Water	3005A	
480-12940-5	RU21-111711	Dissolved	Water	3005A	

Metals (Continued)

Prep Batch: 41171 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-12940-6	DUP-111711	Dissolved	Water	3005A	
LCS 480-40883/14-B	Lab Control Sample	Dissolved	Water	3005A	
MB 480-40883/13-B	Method Blank	Dissolved	Water	3005A	

Analysis Batch: 41538

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-12940-1	RU20-111711	Dissolved	Water	6010B	41171
480-12940-2	RU10-111711	Dissolved	Water	6010B	41171
480-12940-3	RU19-111711	Dissolved	Water	6010B	41171
480-12940-3 MS	RU19-111711	Dissolved	Water	6010B	41171
480-12940-3 MSD	RU19-111711	Dissolved	Water	6010B	41171
480-12940-4	RU8-111711	Dissolved	Water	6010B	41171
480-12940-5	RU21-111711	Dissolved	Water	6010B	41171
480-12940-6	DUP-111711	Dissolved	Water	6010B	41171

Analysis Batch: 41660

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-12940-1	RU20-111711	Dissolved	Water	6010B	41171
480-12940-2	RU10-111711	Dissolved	Water	6010B	41171
480-12940-3	RU19-111711	Dissolved	Water	6010B	41171
480-12940-3 MS	RU19-111711	Dissolved	Water	6010B	41171
480-12940-3 MSD	RU19-111711	Dissolved	Water	6010B	41171
480-12940-4	RU8-111711	Dissolved	Water	6010B	41171
480-12940-5	RU21-111711	Dissolved	Water	6010B	41171
480-12940-6	DUP-111711	Dissolved	Water	6010B	41171
LCS 480-40883/14-B	Lab Control Sample	Dissolved	Water	6010B	41171
MB 480-40883/13-B	Method Blank	Dissolved	Water	6010B	41171

Prep Batch: 41702

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-12940-1	RU20-111711	Dissolved	Water	7470A	
480-12940-2	RU10-111711	Dissolved	Water	7470A	
480-12940-3	RU19-111711	Dissolved	Water	7470A	
480-12940-4	RU8-111711	Dissolved	Water	7470A	
480-12940-5	RU21-111711	Dissolved	Water	7470A	
480-12940-6	DUP-111711	Dissolved	Water	7470A	
LCS 480-41430/2-C	Lab Control Sample	Dissolved	Water	7470A	
MB 480-41430/1-C	Method Blank	Dissolved	Water	7470A	

Analysis Batch: 41761

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-12940-1	RU20-111711	Dissolved	Water	7470A	41702
480-12940-2	RU10-111711	Dissolved	Water	7470A	41702
480-12940-3	RU19-111711	Dissolved	Water	7470A	41702
480-12940-4	RU8-111711	Dissolved	Water	7470A	41702
480-12940-5	RU21-111711	Dissolved	Water	7470A	41702
480-12940-6	DUP-111711	Dissolved	Water	7470A	41702
LCS 480-41430/2-C	Lab Control Sample	Dissolved	Water	7470A	41702
MB 480-41430/1-C	Method Blank	Dissolved	Water	7470A	41702

General Chemistry

Analysis Batch: 41694

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-12940-1	RU20-111711	Total/NA	Water	SM 5310D	
480-12940-2	RU10-111711	Total/NA	Water	SM 5310D	
480-12940-3	RU19-111711	Total/NA	Water	SM 5310D	
480-12940-4	RU8-111711	Total/NA	Water	SM 5310D	
480-12940-5	RU21-111711	Total/NA	Water	SM 5310D	
480-12940-6	DUP-111711	Total/NA	Water	SM 5310D	
LCS 480-41694/4	Lab Control Sample	Total/NA	Water	SM 5310D	
MB 480-41694/3	Method Blank	Total/NA	Water	SM 5310D	

Analysis Batch: 42462

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-12940-1	RU20-111711	Total/NA	Water	300.0	
480-12940-2	RU10-111711	Total/NA	Water	300.0	
480-12940-3	RU19-111711	Total/NA	Water	300.0	
480-12940-4	RU8-111711	Total/NA	Water	300.0	
LCS 480-42462/51	Lab Control Sample	Total/NA	Water	300.0	
MB 480-42462/52	Method Blank	Total/NA	Water	300.0	

Analysis Batch: 42464

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-12940-5	RU21-111711	Total/NA	Water	300.0	
480-12940-6	DUP-111711	Total/NA	Water	300.0	
LCS 480-42464/75	Lab Control Sample	Total/NA	Water	300.0	
MB 480-42464/76	Method Blank	Total/NA	Water	300.0	

Analysis Batch: 42696

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-12940-1	RU20-111711	Total/NA	Water	353.2	
480-12940-2	RU10-111711	Total/NA	Water	353.2	
480-12940-3	RU19-111711	Total/NA	Water	353.2	
480-12940-4	RU8-111711	Total/NA	Water	353.2	
480-12940-5	RU21-111711	Total/NA	Water	353.2	
480-12940-6	DUP-111711	Total/NA	Water	353.2	
LCS 480-42696/5	Lab Control Sample	Total/NA	Water	353.2	
MB 480-42696/4	Method Blank	Total/NA	Water	353.2	

Analysis Batch: 42700

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-12940-1	RU20-111711	Total/NA	Water	VFA-IC	
480-12940-2	RU10-111711	Total/NA	Water	VFA-IC	
480-12940-3	RU19-111711	Total/NA	Water	VFA-IC	
480-12940-4	RU8-111711	Total/NA	Water	VFA-IC	
480-12940-5	RU21-111711	Total/NA	Water	VFA-IC	
480-12940-6	DUP-111711	Total/NA	Water	VFA-IC	
LCS 480-42700/27	Lab Control Sample	Total/NA	Water	VFA-IC	
MB 480-42700/28	Method Blank	Total/NA	Water	VFA-IC	

Client Sample ID: RU20-111711

Lab Sample ID: 480-12940-1

Date Collected: 11/17/11 09:50
Matrix: Water
Date Received: 11/18/11 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	42381	12/01/11 01:38	LH	TAL BUF
Total/NA	Analysis	8260B	DL	50	42630	12/02/11 13:16	LH	TAL BUF
Total/NA	Analysis	RSK-175		1	41469	11/22/11 10:29	JM	TAL BUF
Dissolved	Prep	3005A			41171	11/21/11 09:15	SS	TAL BUF
Dissolved	Analysis	6010B		1	41538	11/21/11 22:40	JRK	TAL BUF
Dissolved	Analysis	6010B		1	41660	11/22/11 17:11	JRK	TAL BUF
Dissolved	Prep	7470A			41702	11/23/11 11:20	MM	TAL BUF
Dissolved	Analysis	7470A		1	41761	11/23/11 15:20	MM	TAL BUF
Total/NA	Analysis	SM 5310D		1	41694	11/22/11 19:48	KAC	TAL BUF
Total/NA	Analysis	300.0		1	42462	12/02/11 04:47	KAC	TAL BUF
Total/NA	Analysis	353.2		1	42696	12/02/11 14:32	JR	TAL BUF
Total/NA	Analysis	VFA-IC		1	42700	12/04/11 05:31	KAC	TAL BUF

Client Sample ID: RU10-111711

Lab Sample ID: 480-12940-2

Date Collected: 11/17/11 11:00
Matrix: Water
Date Received: 11/18/11 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	42381	12/01/11 02:01	LH	TAL BUF
Total/NA	Analysis	RSK-175		1	41469	11/22/11 10:46	JM	TAL BUF
Dissolved	Prep	3005A			41171	11/21/11 09:15	SS	TAL BUF
Dissolved	Analysis	6010B		1	41538	11/21/11 22:42	JRK	TAL BUF
Dissolved	Analysis	6010B		1	41660	11/22/11 17:13	JRK	TAL BUF
Dissolved	Prep	7470A			41702	11/23/11 11:20	MM	TAL BUF
Dissolved	Analysis	7470A		1	41761	11/23/11 15:22	MM	TAL BUF
Total/NA	Analysis	SM 5310D		1	41694	11/22/11 20:08	KAC	TAL BUF
Total/NA	Analysis	300.0		1	42462	12/02/11 04:57	KAC	TAL BUF
Total/NA	Analysis	353.2		1	42696	12/02/11 14:33	JR	TAL BUF
Total/NA	Analysis	VFA-IC		1	42700	12/04/11 06:59	KAC	TAL BUF

Client Sample ID: RU19-111711

Lab Sample ID: 480-12940-3

Date Collected: 11/17/11 12:15
Matrix: Water
Date Received: 11/18/11 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	42381	12/01/11 02:25	LH	TAL BUF
Total/NA	Analysis	8260B	DL	10	42419	12/01/11 13:55	LH	TAL BUF
Total/NA	Analysis	RSK-175		10	41469	11/22/11 12:20	JM	TAL BUF
Total/NA	Analysis	RSK-175		1	41469	11/22/11 11:03	JM	TAL BUF
Dissolved	Prep	3005A			41171	11/21/11 09:15	SS	TAL BUF
Dissolved	Analysis	6010B		1	41538	11/21/11 22:45	JRK	TAL BUF
Dissolved	Analysis	6010B		1	41660	11/22/11 17:15	JRK	TAL BUF

Client Sample ID: RU19-111711

Lab Sample ID: 480-12940-3

Date Collected: 11/17/11 12:15

Matrix: Water

Date Received: 11/18/11 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Prep	7470A			41702	11/23/11 11:20	MM	TAL BUF
Dissolved	Analysis	7470A		1	41761	11/23/11 15:28	MM	TAL BUF
Total/NA	Analysis	SM 5310D		1	41694	11/22/11 20:28	KAC	TAL BUF
Total/NA	Analysis	300.0		1	42462	12/02/11 05:07	KAC	TAL BUF
Total/NA	Analysis	353.2		1	42696	12/02/11 14:34	JR	TAL BUF
Total/NA	Analysis	VFA-IC		1	42700	12/04/11 07:28	KAC	TAL BUF

Client Sample ID: RU8-111711

Lab Sample ID: 480-12940-4

Date Collected: 11/17/11 14:30

Matrix: Water

Date Received: 11/18/11 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	42381	12/01/11 02:49	LH	TAL BUF
Total/NA	Analysis	8260B	DL	5	42419	12/01/11 14:19	LH	TAL BUF
Total/NA	Analysis	RSK-175		1	41469	11/22/11 11:20	JM	TAL BUF
Dissolved	Prep	3005A			41171	11/21/11 09:15	SS	TAL BUF
Dissolved	Analysis	6010B		1	41538	11/21/11 23:00	JRK	TAL BUF
Dissolved	Analysis	6010B		1	41660	11/22/11 17:27	JRK	TAL BUF
Dissolved	Prep	7470A			41702	11/23/11 11:20	MM	TAL BUF
Dissolved	Analysis	7470A		1	41761	11/23/11 15:29	MM	TAL BUF
Total/NA	Analysis	SM 5310D		1	41694	11/22/11 20:48	KAC	TAL BUF
Total/NA	Analysis	300.0		1	42462	12/02/11 05:17	KAC	TAL BUF
Total/NA	Analysis	353.2		1	42696	12/02/11 14:35	JR	TAL BUF
Total/NA	Analysis	VFA-IC		1	42700	12/04/11 07:57	KAC	TAL BUF

Client Sample ID: RU21-111711

Lab Sample ID: 480-12940-5

Date Collected: 11/17/11 15:30

Matrix: Water

Date Received: 11/18/11 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	42381	12/01/11 03:12	LH	TAL BUF
Total/NA	Analysis	8260B	DL	25	42419	12/01/11 14:42	LH	TAL BUF
Total/NA	Analysis	RSK-175		10	41469	11/22/11 13:11	JM	TAL BUF
Total/NA	Analysis	RSK-175		1	41469	11/22/11 11:37	JM	TAL BUF
Dissolved	Prep	3005A			41171	11/21/11 09:15	SS	TAL BUF
Dissolved	Analysis	6010B		1	41538	11/21/11 23:02	JRK	TAL BUF
Dissolved	Analysis	6010B		1	41660	11/22/11 17:29	JRK	TAL BUF
Dissolved	Prep	7470A			41702	11/23/11 11:20	MM	TAL BUF
Dissolved	Analysis	7470A		1	41761	11/23/11 15:31	MM	TAL BUF
Total/NA	Analysis	SM 5310D		1	41694	11/22/11 21:47	KAC	TAL BUF
Total/NA	Analysis	300.0		1	42464	12/02/11 06:08	KAC	TAL BUF
Total/NA	Analysis	353.2		1	42696	12/02/11 14:36	JR	TAL BUF

Client Sample ID: RU21-111711

Lab Sample ID: 480-12940-5

Date Collected: 11/17/11 15:30
Matrix: Water
Date Received: 11/18/11 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	VFA-IC		1	42700	12/04/11 08:26	KAC	TAL BUF

Client Sample ID: DUP-111711

Lab Sample ID: 480-12940-6

Date Collected: 11/17/11 11:30
Matrix: Water
Date Received: 11/18/11 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	42381	12/01/11 03:35	LH	TAL BUF
Total/NA	Analysis	RSK-175		1	41469	11/22/11 11:54	JM	TAL BUF
Dissolved	Prep	3005A			41171	11/21/11 09:15	SS	TAL BUF
Dissolved	Analysis	6010B		1	41538	11/21/11 23:04	JRK	TAL BUF
Dissolved	Analysis	6010B		1	41660	11/22/11 17:31	JRK	TAL BUF
Dissolved	Prep	7470A			41702	11/23/11 11:20	MM	TAL BUF
Dissolved	Analysis	7470A		1	41761	11/23/11 15:33	MM	TAL BUF
Total/NA	Analysis	SM 5310D		1	41694	11/22/11 22:07	KAC	TAL BUF
Total/NA	Analysis	300.0		1	42464	12/02/11 06:18	KAC	TAL BUF
Total/NA	Analysis	353.2		1	42696	12/02/11 14:37	JR	TAL BUF
Total/NA	Analysis	VFA-IC		1	42700	12/04/11 08:55	KAC	TAL BUF

Client Sample ID: RB-111711

Lab Sample ID: 480-12940-7

Date Collected: 11/17/11 16:30
Matrix: Water
Date Received: 11/18/11 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	42381	12/01/11 03:59	LH	TAL BUF

Client Sample ID: TRIP BLANK

Lab Sample ID: 480-12940-8

Date Collected: 11/17/11 00:00
Matrix: Water
Date Received: 11/18/11 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	42381	12/01/11 04:22	LH	TAL BUF

Laboratory References:

TAL BUF = TestAmerica Buffalo, 10 Hazelwood Drive, Amherst, NY 14228-2298, TEL (716)691-2600

Certification Summary

Client: Camp Dresser & McKee Inc
Project/Site: Olean Pilot Study

TestAmerica Job ID: 480-12940-1

Laboratory	Authority	Program	EPA Region	Certification ID
TestAmerica Buffalo	Arkansas	State Program	6	88-0686
TestAmerica Buffalo	California	NELAC	9	1169CA
TestAmerica Buffalo	Connecticut	State Program	1	PH-0568
TestAmerica Buffalo	Florida	NELAC	4	E87672
TestAmerica Buffalo	Georgia	Georgia EPD	4	N/A
TestAmerica Buffalo	Georgia	State Program	4	956
TestAmerica Buffalo	Illinois	NELAC	5	100325 / 200003
TestAmerica Buffalo	Iowa	State Program	7	374
TestAmerica Buffalo	Kansas	NELAC	7	E-10187
TestAmerica Buffalo	Kentucky	Kentucky UST	4	30
TestAmerica Buffalo	Kentucky	State Program	4	90029
TestAmerica Buffalo	Louisiana	NELAC	6	02031
TestAmerica Buffalo	Maine	State Program	1	NY0044
TestAmerica Buffalo	Maryland	State Program	3	294
TestAmerica Buffalo	Massachusetts	State Program	1	M-NY044
TestAmerica Buffalo	Michigan	State Program	5	9937
TestAmerica Buffalo	Minnesota	NELAC	5	036-999-337
TestAmerica Buffalo	New Hampshire	NELAC	1	2337
TestAmerica Buffalo	New Hampshire	NELAC	1	68-00281
TestAmerica Buffalo	New Jersey	NELAC	2	NY455
TestAmerica Buffalo	New York	NELAC	2	10026
TestAmerica Buffalo	North Dakota	State Program	8	R-176
TestAmerica Buffalo	Oklahoma	State Program	6	9421
TestAmerica Buffalo	Oregon	NELAC	10	NY200003
TestAmerica Buffalo	Pennsylvania	NELAC	3	68-00281
TestAmerica Buffalo	Tennessee	State Program	4	TN02970
TestAmerica Buffalo	Texas	NELAC	6	T104704412-08-TX
TestAmerica Buffalo	USDA	USDA		P330-08-00242
TestAmerica Buffalo	Virginia	NELAC Secondary AB	3	460185
TestAmerica Buffalo	Virginia	State Program	3	278
TestAmerica Buffalo	Washington	State Program	10	C1677
TestAmerica Buffalo	Wisconsin	State Program	5	998310390

Accreditation may not be offered or required for all methods and analytes reported in this package. Please contact your project manager for the laboratory's current list of certified methods and analytes.

Method	Method Description	Protocol	Laboratory
8260B	Volatile Organic Compounds (GC/MS)	SW846	TAL BUF
RSK-175	Dissolved Gases (GC)	RSK	TAL BUF
6010B	Metals (ICP)	SW846	TAL BUF
7470A	Mercury (CVAA)	SW846	TAL BUF
300.0	Anions, Ion Chromatography	MCAWW	TAL BUF
353.2	Nitrogen, Nitrate-Nitrite	MCAWW	TAL BUF
SM 5310D	Organic Carbon, Total (TOC)	SM	TAL BUF
VFA-IC	Volatile Fatty Acids, Ion Chromatography	TestAmerica SOP	TAL BUF

Protocol References:

MCAWW = "Methods For Chemical Analysis Of Water And Wastes", EPA-600/4-79-020, March 1983 And Subsequent Revisions.

RSK = Sample Prep And Calculations For Dissolved Gas Analysis In Water Samples Using A GC Headspace Equilibration Technique, RSKSOP-175, Rev. 0, 8/11/94, USEPA Research Lab

SM = "Standard Methods For The Examination Of Water And Wastewater",

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

TestAmerica SOP = TestAmerica, Inc., Standard Operating Procedure

Laboratory References:

TAL BUF = TestAmerica Buffalo, 10 Hazelwood Drive, Amherst, NY 14228-2298, TEL (716)691-2600

Sample Summary

Client: Camp Dresser & McKee Inc
Project/Site: Olean Pilot Study

TestAmerica Job ID: 480-12940-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
480-12940-1	RU20-111711	Water	11/17/11 09:50	11/18/11 09:30
480-12940-2	RU10-111711	Water	11/17/11 11:00	11/18/11 09:30
480-12940-3	RU19-111711	Water	11/17/11 12:15	11/18/11 09:30
480-12940-4	RU8-111711	Water	11/17/11 14:30	11/18/11 09:30
480-12940-5	RU21-111711	Water	11/17/11 15:30	11/18/11 09:30
480-12940-6	DUP-111711	Water	11/17/11 11:30	11/18/11 09:30
480-12940-7	RB-111711	Water	11/17/11 16:30	11/18/11 09:30
480-12940-8	TRIP BLANK	Water	11/17/11 00:00	11/18/11 09:30

TestAmerica Buffalo
10 Hazelwood Drive
Amherst, NY 14228-2298
Phone (716) 691-2600 Fax (716) 691-7991

Chain of Custody Record

TC

TestAmerica

Client Information			
Client Contact: Neil Smith	Sampler: Neil Smith	Lab PM: Gray-Erdmann, Peggy	Carrier Tracking No(s):
	Phone: 303 870 5600	E-Mail: peggy.gray-erdmann@testamericainc.com	
Company: Camp Dresser & McKee Inc			COC No: 480-19072-4745.1
Address: 555 17th Street Suite 1100	Due Date Requested:		Page: Page 1 of 2
City: Denver	TAT Requested (days): Standard		Job #:
State, Zip: CO, 80202	PO #: Purchase Order not requir		
Phone: 303-383-2447(Tel)	WO #:		
Email: SmithNL@cdm.com	Project #: 48005099		
Project Name: ~~New York state project~~ Olean Pilot Study	SSOW#:		
Site: Olean			

Analysis Requested

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix	Field Filtered Sample (Yes or No)	Perform [illegible]	VFA_IC - (MOD) Standard VFA Compounds	300.0 28D - (MOD) Local Method	6010B, 7470A	8260B - TCL list OLM04.2	SM5310D - Total Organic Carbon	RSK_175 - (MOD) Local Method	353.2, 353.2 Nitrate, Nitrite Calc	8260B - TCLP Volatiles	6010B, 7470A, 8081A, 8151A, 8270C	Total Number of containers	Special Instructions/Note:
			Preservation Code:				N	N	D	A	A	A	N	N	N		
RW20-111711	11/17/11	950	G	Water			X	X	X	X	X	X	X				Metals Field Filtered
RW10-111711		1100		Water			X	X	X	X	X	X	X				
RW19-111711		1215		Water			X	X	X	X	X	X	X				
RW8-111711		1430		Water			X	X	X	X	X	X	X				
RW21-111711		1530		Water			X	X	X	X	X	X	X				
DUP-111711		1130		Water			X	X	X	X	X	X	X				
RB-111711		1630		Water ~~Solid~~			~~X~~			X							
Trip Blank				Water ~~Solid~~						X							
				Solid													
				Solid													
				Solid													

Preservation Codes:
A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA
M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2SO3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Z - other (specify)
Other:

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

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

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:	
Relinquished by: [signature]	Date/Time: 11/17/11 2000	Company: CDM	Received by: Fedex	Date/Time:	Company:
Relinquished by:	Date/Time:	Company:	Received by: [signature]	Date/Time: 11/18/11 0930	Company: TAL
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:

Custody Seals Intact: Δ Yes Δ No | Custody Seal No.: | Cooler Temperature(s) °C and Other Remarks: 2.7

Login Sample Receipt Checklist

Client: Camp Dresser & McKee Inc

Job Number: 480-12940-1

Login Number: 12940

List Source: TestAmerica Buffalo

List Number: 1

Creator: Janish, Carl

Question	Answer	Comment
Radioactivity either was not measured or, if measured, is at or below background	True	
The cooler's custody seal, if present, is intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	True	
If necessary, staff have been informed of any short hold time or quick TAT needs	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Sampling Company provided.	True	CDM
Samples received within 48 hours of sampling.	True	
Samples requiring field filtration have been filtered in the field.	True	
Chlorine Residual checked.	N/A	

Alcoa Site in Olean, New York
Quantitative PCR Analytical Summary

December 12, 2011

Overview:

The objective of this project was to quantify the number of *Dehalococcoides sp.* (DHC) 16S rRNA gene copies and reductase functional genes (*tceA*, *vcrA*, and *bvcA* copies) contained in groundwater collected from the Alcoa Site in Olean, New York using quantitative polymerase chain reaction (QPCR). The client is CDM. Table 1 describes the sample matrix and the condition of the samples upon arrival to the analytical laboratory.

Table 1. Description of samples and volume filtered for DNA extraction.

Sample ID	Matrix	Date Sampled	Condition Received	Volume Filtered (L)
RU20-111711	Groundwater	11/17/11	Bottle Intact, 4˚C	0.5
RU10-111711	Groundwater	11/17/11	Bottle Intact, 4˚C	0.5
RU19-111711	Groundwater	11/17/11	Bottle Intact, 4˚C	0.5
RU8-111711	Groundwater	11/17/11	Bottle Intact, 4˚C	0.35
RU21-111711	Groundwater	11/17/11	Bottle Intact, 4˚C	0.5

The samples arrived in good condition at 4 degrees C. Upon arrival, the sample groundwater was filtered. The filter was frozen for storage at -80°C until the DNA extraction was performed. Following DNA extraction, the sample was first subjected to polymerase chain reaction (PCR) using probes in order to verify that amplifiable DNA was present in the sample. The results of these studies are described in this report.

Methods:

DNA Extraction: For groundwater shipped to the laboratory, the groundwater volume indicated in Table 1 was filtered using a sterile 0.2-μm acetate filter. The filter was frozen at -80°C and then shattered. Next, the sample tube was amended with 2 mL of DNA-free water, vortexed vigorously for 5 minutes, and the liquid volume was partitioned into DNA extraction tubes. The DNA extraction was performed using the Bio101 DNA Extraction Kit according to the manufacturer's instructions. DNA product was cleaned with ethanol precipitation. Community DNA was eluted in 100 μL of 0.1x Tris HCL and stored at -20°C.

Detection of Dehalococcoides: The QPCR methods for assessing the 16S rRNA gene, and the reductase genes *tceA*, *bvcA*, and *vcrA*, are very sensitive in detecting specific DNA fragments. A mixed laboratory culture containing *Dehalococcoides* was used to obtain the quantitative standards used in these analyses. Plasmid DNA containing DNA inserts of targets 16S rRNA gene, *tceA*, *bvcA*, and *vcrA* from *Dehalococcoides* were purified and quantified fluorometrically. Based on the known size of the plasmid and insert, DNA concentrations were converted to insert copy numbers. A dilution series spanning seven orders of magnitude was generated using known concentrations of each plasmid. Amplification and detection of the DNA was performed using a BIO-RAD Chromo4 Real Time Detector System. The acceptance criterion for the standard curve is a linear R^2 value of greater than 0.995.

TaqMan Protocol. The 16S rRNA gene, and reductase genes *tceA*, *bvcA*, and *vcrA*, QPCR reactions were performed using TaqMan chemistry. The Taqman probes for the 16S rRNA gene and for the *tceA* gene were synthesized using the FAM label on the 5-foot end and the BHQ quencher (Biosearch Technologies). For the *bvcA* gene probe, a Cy5 label is used on the 5-foot end and for the *vcrA* gene probe, a HEX label is used on the 5-foot end, both are coupled to the BHQ quencher. Reaction volumes of 25 µL contained forward and reverse primers at a concentration of 700 nM, a probe at a concentrations of 200 nM, 1 x TaqMan Universal PCR Master Mix(Roche) and 5 µL of sample DNA. The BIO-RAD Chromo 4 Real Time Detector System was used for all reactions. The settings for cycle number and reaction conditions used for all runs were 95°C for 10 minutes, and 45 cycles of 95°C for 15 seconds and 58°C for 1 minute. Standards and unknowns were run in triplicate to ensure reproducibility. Cycle thresholds (C_t) were set to minimize the standard deviation of standard curve triplicate C_t values, and also to obtain a standard curve slope as close to negative 3.5 as possible.

Amplification of Bacteria: For samples that did not amplify during QPCR reactions, universal PCR was used to amplify nearly full-length 16S rDNA genes from *Bacteria* in order to verify that amplifiable DNA was present. Each 25-µL PCR reaction includes a final reagent concentration of: 1X GoTaq Hot Start Green Master Mix (Promega), 0.25µM 8F and 0.25µM 1492R primers (Invitrogen), 1µL genomic DNA, and molecular-grade water (Promega). Each reaction was repeated using 5µL of genomic DNA with 20µL of PCR master mix and a third time with 1µL of genomic DNA, 1µL of 8F/1492R plasmid DNA as a matrix spike and 23µL of PCR master mix. Amplification was performed on a BIO-RAD DNA Engine Dyad and Disciple Peltier Thermal Cycler using the following regime: 94°C (5 min) followed by 40 cycles of 94°C (1 min), 53.5°C (1 min), and 72°C (1 min). The reaction was finished with an additional 7 minutes at 72°C. PCR products were examined in a 1.0% agarose gel stained with ethidium bromide to confirm specificity of the amplification reactions.

Results:

Table 2 summarizes the QPCR analysis of the samples. The DNA extraction negative control and all PCR negative controls did not amplify any product. In addition, all calibration control checks were within acceptable values.

Table 2. Results of molecular analyses for the samples.

Sample ID	DNA (ng/L ground water)	Universal PCR#	*Dehalococcoides* 16S rRNA (copy/L groundwater)			*Dehalococcoides* tceA (copy/L groundwater)			*Dehalococcoides* bvcA (copy/L groundwater)			*Dehalococcoides* vcrA (copy/L groundwater)		
RU20-111711	294	+	7.15E+02*	±	8.72E+01	0.0	±		1.23E+02*	±	4.40E+01	0.0	±	
RU10-111711	694	+	2.06E+03*	±	3.19E+02	0.0	±		0.0	±		0.0	±	
RU19-111711	346	+	7.30E+02*	±	2.32E+02	0.0	±		0.0	±		0.0	±	
RU8-111711	631	+	0.0	±		0.0	±		0.0	±		0.0	±	
RU21-111711	360	+	0.0	±		0.0	±		0.0	±		0.0	±	

***: indicates that the value presented is below the reporting limit**

#: a '+' sign indicates that amplification of *Bacteria* was successful, and a '-' sign indicates that amplification was not successful, N/A: (not applicable) means the analysis wasn't performed.

The DNA concentration of the DNA extraction (in ng/L of groundwater) is reported as an indicator of relative biomass levels for the samples so that relative comparisons can be made. *Dehalococcoides* 16S was detected below the reporting limit in three samples RU20-111711, RU10-111711 and RU19-111711. The reductase gene bvcA was detected below the reporting limit for sample RU20-111711.

The data presented in this report are produced using lab-specific methods. All results are intended to be used as a screening tool and should not be used as definitive data. Users should verify the suitability of the data for their own specific purpose.

North Wind

North Wind

NORTH WIND, INC.
CHAIN-OF-CUSTODY RECORD

Company Name: CDM	Sampler: Neil Smith		Analyses Requested	Page 1 of 1
Address: 555 17th St Ste 1100	Phone: 303-383-2447	Fax:	DHC + 3 Functional Genes	Date:
City: Denver	Email: Smithnl@cdm.com			COC #:
State: CO Zip: 80202	Project Manager: Neil Smith			
Project Name: Olean	Phone:	Fax:		Carrier/Airbill #:
Project Location: Olean NY	Email:			

Sample Number	Sample Location	Date	Time	Depth	Sample Preservative	Sample Matrix	DHC + 3 Functional Genes					Type, Volume, and No. of Containers	Remarks/Special Instructions:
2 RU20-111711		11/17/11	950	-	-	Water	X						
2 RU10-111711		11/17/11	1100	-	-		X						
RU19-111711 → 1 broken		11/17/11	1215	-	-		X						
2 RU8-111711		11/17/11	1430	-	-		X						
2 RU21-111711		11/17/11	1530	-	-		X						

Possible Hazard Identification
☐ Non-Hazardous ☐ Skin Irritant ☐ Rad ☐ Flammable ☐ Poison ☐ Unknown

Sample Disposal
☐ Return to Client ☒ Disposal by Lab

Other Comments

Relinquished by: (Signature/Company)	Received By: (Signature/Company)	Date	Time	Ship to:
	Fedex	11/17/11	2000	
Relinquished by: (Signature/Company) Ted Ex	Received By: (Signature/Company)	11-18-11	10:35	
Relinquished by: (Signature/Company)	Received By: (Signature/Company)			

Distribution: White copy accompanies samples during transfer of custody; Yellow copy is retained by customer.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Buffalo
10 Hazelwood Drive
Amherst, NY 14228-2298
Tel: (716)691-2600

TestAmerica Job ID: 480-14696-1
Client Project/Site: New York state project

For:
CDM Smith, Inc.
555 17th Street
Suite 1100
Denver, Colorado 80202

Attn: Neil Smith

EBerry

Authorized for release by:
1/12/2012 8:53:50 AM
Eve Berry
Project Administrator
eve.berry@testamericainc.com

Designee for

Peggy Gray-Erdmann
Project Manager II
peggy.gray-erdmann@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Table of Contents

Qualifiers

GC/MS VOA

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

GC VOA

Qualifier	Qualifier Description
B	Compound was found in the blank and sample.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

General Chemistry

Qualifier	Qualifier Description
H	Sample was prepped or analyzed beyond the specified holding time
E	Result exceeded calibration range.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
☼	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DL, RA, RE, IN	Indicates a Dilution, Reanalysis, Re-extraction, or additional Initial metals/anion analysis of the sample
EDL	Estimated Detection Limit
EPA	United States Environmental Protection Agency
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RL	Reporting Limit
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 480-14696-1

Laboratory: TestAmerica Buffalo

Narrative

Job Narrative
480-14696-1

Receipt
All samples were received in good condition within temperature requirements.

GC/MS VOA
Method(s) 8260B: The following samples were diluted due to the abundance of target analytes: DUP-010412 (480-14696-6), RU-10-010412 (480-14696-4), RU-19-010412 (480-14696-1), RU-20-010412 (480-14696-2), RU-21-010412 (480-14696-3). Elevated reporting limits (RLs) are provided.

Method(s) 8260B: The following sample submitted for volatiles analysis was received with insufficient preservation (pH >2): RU-21-010412 (480-14696-3). Analysis occurred within the seven day holding time for unpreserved volatiles samples.

No other analytical or quality issues were noted.

Ion Chromatography
Method(s) 300.0: In batch 47318, the following sample was diluted due to the abundance of non-target analytes: RU-21-010412 (480-14696-3). Elevated reporting limits (RLs) are provided.

Method(s) VFA-IC: Due to the high concentration of Acetic Acid, the matrix spike / matrix spike duplicate (MS/MSD) for batch 47126 could not be evaluated for accuracy and precision. The associated laboratory control sample (LCS) met acceptance criteria.

Method(s) VFA-IC: In batch 47492, the following samples were diluted due to the abundance of target analytes: DUP-010412 (480-14696-6), RU-10-010412 (480-14696-4), RU-21-010412 (480-14696-3). Elevated reporting limits (RLs) are provided.

No other analytical or quality issues were noted.

GC VOA
Method(s) RSK-175: The following samples were diluted due to the abundance of target analytes: RU-19-010412 (480-14696-1), RU-21-010412 (480-14696-3). Elevated reporting limits (RLs) are provided.

Method(s) RSK-175: The following sample submitted for volatiles analysis was received with insufficient preservation (pH >2): RU-21-010412 (480-14696-3).

No other analytical or quality issues were noted.

General Chemistry
Method(s) 353.2: The following samples were received outside of holding time: DUP-010412 (480-14696-6), RU-10-010412 (480-14696-4).

Method(s) 353.2: The following samples were received with greater than 50% of holding time expired: RU-19-010412 (480-14696-1), RU-20-010412 (480-14696-2), RU-21-010412 (480-14696-3). As such, the laboratory had insufficient time remaining to perform the analysis within holding time.

Method(s) Nitrate by calc: The following samples were received with greater than 50% of holding time expired: RU-19-010412 (480-14696-1), RU-20-010412 (480-14696-2), RU-21-010412 (480-14696-3). As such, the laboratory had insufficient time remaining to perform the analysis within holding time.

Method(s) Nitrate by calc: The following samples were received outside of holding time: DUP-010412 (480-14696-6), RU-10-010412 (480-14696-4).

No other analytical or quality issues were noted.

Detection Summary

Client: CDM Smith, Inc.
Project/Site: New York state project

TestAmerica Job ID: 480-14696-1

Client Sample ID: RU-19-010412 — Lab Sample ID: 480-14696-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,1-Dichloroethene	1.4		1.0	0.29	ug/L	1		8260B	Total/NA
Tetrachloroethene	1.3		1.0	0.36	ug/L	1		8260B	Total/NA
trans-1,2-Dichloroethene	2.8		1.0	0.90	ug/L	1		8260B	Total/NA
Vinyl chloride	24		1.0	0.90	ug/L	1		8260B	Total/NA
cis-1,2-Dichloroethene - DL	230		10	8.1	ug/L	10		8260B	Total/NA
Trichloroethene - DL	580		10	4.6	ug/L	10		8260B	Total/NA
Ethane	7.0		1.5	0.49	ug/L	1		RSK-175	Total/NA
Methane	190		50	11	ug/L	50		RSK-175	Total/NA
Chloride	14.3		0.50	0.28	mg/L	1		300.0	Total/NA
Sulfate	30.0		2.0	0.35	mg/L	1		300.0	Total/NA
Nitrate as N	0.68	H	0.050	0.011	mg/L	1		353.2	Total/NA
Total Organic Carbon	7.1		1.0	0.43	mg/L	1		SM 5310D	Total/NA
Acetic acid	2.7		1.0	0.15	mg/L	1		VFA-IC	Total/NA
Propionic acid	3.7		1.0	0.17	mg/L	1		VFA-IC	Total/NA

Client Sample ID: RU-20-010412 — Lab Sample ID: 480-14696-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,1-Dichloroethene	0.95	J	1.0	0.29	ug/L	1		8260B	Total/NA
2-Butanone (MEK)	1.3	J	10	1.3	ug/L	1		8260B	Total/NA
Acetone	7.2	J	10	3.0	ug/L	1		8260B	Total/NA
cis-1,2-Dichloroethene	86		1.0	0.81	ug/L	1		8260B	Total/NA
Tetrachloroethene	2.2		1.0	0.36	ug/L	1		8260B	Total/NA
trans-1,2-Dichloroethene	1.3		1.0	0.90	ug/L	1		8260B	Total/NA
Trichloroethene - DL	2100		40	18	ug/L	40		8260B	Total/NA
Ethane	2.6		1.5	0.49	ug/L	1		RSK-175	Total/NA
Ethene	7.3		1.5	0.52	ug/L	1		RSK-175	Total/NA
Methane	6.9	B	1.0	0.22	ug/L	1		RSK-175	Total/NA
Chloride	79.6		0.50	0.28	mg/L	1		300.0	Total/NA
Sulfate	50.6		2.0	0.35	mg/L	1		300.0	Total/NA
Nitrate as N	0.26	H	0.050	0.011	mg/L	1		353.2	Total/NA
Total Organic Carbon	48.5		1.0	0.43	mg/L	1		SM 5310D	Total/NA
Acetic acid	11.3		1.0	0.15	mg/L	1		VFA-IC	Total/NA
Propionic acid	7.6		1.0	0.17	mg/L	1		VFA-IC	Total/NA

Client Sample ID: RU-21-010412 — Lab Sample ID: 480-14696-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
2-Hexanone	60		10	2.5	ug/L	2		8260B	Total/NA
2-Butanone (MEK)	66		20	2.6	ug/L	2		8260B	Total/NA
Acetone	82		20	6.0	ug/L	2		8260B	Total/NA
Carbon disulfide	1.7	J	2.0	0.38	ug/L	2		8260B	Total/NA
cis-1,2-Dichloroethene	52		2.0	1.6	ug/L	2		8260B	Total/NA
Trichloroethene	41		2.0	0.92	ug/L	2		8260B	Total/NA
Vinyl chloride	120		2.0	1.8	ug/L	2		8260B	Total/NA
Ethane	11		1.5	0.49	ug/L	1		RSK-175	Total/NA
Ethene	26		1.5	0.52	ug/L	1		RSK-175	Total/NA
Methane	210		50	11	ug/L	50		RSK-175	Total/NA
Chloride	23.8		2.5	1.4	mg/L	5		300.0	Total/NA
Sulfate	23.7		10.0	1.7	mg/L	5		300.0	Total/NA
Total Organic Carbon	2040		40.0	17.4	mg/L	40		SM 5310D	Total/NA
Acetic acid	920		50.0	7.5	mg/L	50		VFA-IC	Total/NA
Butyric acid	10.9		1.0	0.16	mg/L	1		VFA-IC	Total/NA
Propionic acid	1690		50.0	8.5	mg/L	50		VFA-IC	Total/NA

Detection Summary

Client: CDM Smith, Inc. TestAmerica Job ID: 480-14696-1

Project/Site: New York state project

Client Sample ID: RU-10-010412 Lab Sample ID: 480-14696-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,1-Dichloroethene	0.59	J	1.0	0.29	ug/L	1		8260B	Total/NA
2-Butanone (MEK)	4.4	J	10	1.3	ug/L	1		8260B	Total/NA
Acetone	18		10	3.0	ug/L	1		8260B	Total/NA
cis-1,2-Dichloroethene	94		1.0	0.81	ug/L	1		8260B	Total/NA
trans-1,2-Dichloroethene	1.1		1.0	0.90	ug/L	1		8260B	Total/NA
Vinyl chloride	12		1.0	0.90	ug/L	1		8260B	Total/NA
Trichloroethene - DL	120		2.0	0.92	ug/L	2		8260B	Total/NA
Ethane	4.0		1.5	0.49	ug/L	1		RSK-175	Total/NA
Methane	120	B	1.0	0.22	ug/L	1		RSK-175	Total/NA
Chloride	9.3		0.50	0.28	mg/L	1		300.0	Total/NA
Sulfate	29.9		2.0	0.35	mg/L	1		300.0	Total/NA
Nitrate as N	0.47	H	0.050	0.011	mg/L	1		353.2	Total/NA
Total Organic Carbon	205		10.0	4.3	mg/L	10		SM 5310D	Total/NA
Acetic acid	39.6		1.0	0.15	mg/L	1		VFA-IC	Total/NA
Propionic acid	57.0		2.0	0.34	mg/L	2		VFA-IC	Total/NA

Client Sample ID: TRIP BLANK-010412 Lab Sample ID: 480-14696-5

No Detections

Client Sample ID: DUP-010412 Lab Sample ID: 480-14696-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
2-Butanone (MEK)	4.3	J	10	1.3	ug/L	1		8260B	Total/NA
Acetone	17		10	3.0	ug/L	1		8260B	Total/NA
cis-1,2-Dichloroethene	89		1.0	0.81	ug/L	1		8260B	Total/NA
trans-1,2-Dichloroethene	0.95	J	1.0	0.90	ug/L	1		8260B	Total/NA
Vinyl chloride	12		1.0	0.90	ug/L	1		8260B	Total/NA
Trichloroethene - DL	120		2.0	0.92	ug/L	2		8260B	Total/NA
Ethane	3.9		1.5	0.49	ug/L	1		RSK-175	Total/NA
Methane	120	B	1.0	0.22	ug/L	1		RSK-175	Total/NA
Chloride	9.5		0.50	0.28	mg/L	1		300.0	Total/NA
Sulfate	29.9		2.0	0.35	mg/L	1		300.0	Total/NA
Nitrate as N	0.48	H	0.050	0.011	mg/L	1		353.2	Total/NA
Total Organic Carbon	213		10.0	4.3	mg/L	10		SM 5310D	Total/NA
Acetic acid	39.7		1.0	0.15	mg/L	1		VFA-IC	Total/NA
Propionic acid	77.0		20.0	3.4	mg/L	20		VFA-IC	Total/NA

Client Sample ID: FIIELD BLANK-010412 Lab Sample ID: 480-14696-7

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	4.3	J	10	3.0	ug/L	1		8260B	Total/NA

Client Sample ID: RU-19-010412
Date Collected: 01/04/12 13:00
Date Received: 01/06/12 09:30

Lab Sample ID: 480-14696-1
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			01/06/12 23:55	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			01/06/12 23:55	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			01/06/12 23:55	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			01/06/12 23:55	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			01/06/12 23:55	1
1,1-Dichloroethene	**1.4**		1.0	0.29	ug/L			01/06/12 23:55	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			01/06/12 23:55	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			01/06/12 23:55	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			01/06/12 23:55	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			01/06/12 23:55	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			01/06/12 23:55	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			01/06/12 23:55	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			01/06/12 23:55	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			01/06/12 23:55	1
2-Hexanone	ND		5.0	1.2	ug/L			01/06/12 23:55	1
2-Butanone (MEK)	ND		10	1.3	ug/L			01/06/12 23:55	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			01/06/12 23:55	1
Acetone	ND		10	3.0	ug/L			01/06/12 23:55	1
Benzene	ND		1.0	0.41	ug/L			01/06/12 23:55	1
Bromodichloromethane	ND		1.0	0.39	ug/L			01/06/12 23:55	1
Bromoform	ND		1.0	0.26	ug/L			01/06/12 23:55	1
Bromomethane	ND		1.0	0.69	ug/L			01/06/12 23:55	1
Carbon disulfide	ND		1.0	0.19	ug/L			01/06/12 23:55	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			01/06/12 23:55	1
Chlorobenzene	ND		1.0	0.75	ug/L			01/06/12 23:55	1
Dibromochloromethane	ND		1.0	0.32	ug/L			01/06/12 23:55	1
Chloroethane	ND		1.0	0.32	ug/L			01/06/12 23:55	1
Chloroform	ND		1.0	0.34	ug/L			01/06/12 23:55	1
Chloromethane	ND		1.0	0.35	ug/L			01/06/12 23:55	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			01/06/12 23:55	1
Cyclohexane	ND		1.0	0.18	ug/L			01/06/12 23:55	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			01/06/12 23:55	1
Ethylbenzene	ND		1.0	0.74	ug/L			01/06/12 23:55	1
Isopropylbenzene	ND		1.0	0.79	ug/L			01/06/12 23:55	1
Methyl acetate	ND		1.0	0.50	ug/L			01/06/12 23:55	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			01/06/12 23:55	1
Methylcyclohexane	ND		1.0	0.16	ug/L			01/06/12 23:55	1
Methylene Chloride	ND		1.0	0.44	ug/L			01/06/12 23:55	1
Styrene	ND		1.0	0.73	ug/L			01/06/12 23:55	1
Tetrachloroethene	**1.3**		1.0	0.36	ug/L			01/06/12 23:55	1
Toluene	ND		1.0	0.51	ug/L			01/06/12 23:55	1
trans-1,2-Dichloroethene	**2.8**		1.0	0.90	ug/L			01/06/12 23:55	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			01/06/12 23:55	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			01/06/12 23:55	1
Vinyl chloride	**24**		1.0	0.90	ug/L			01/06/12 23:55	1
Xylenes, Total	ND		2.0	0.66	ug/L			01/06/12 23:55	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*90*		*66 - 137*		*01/06/12 23:55*	*1*
Toluene-d8 (Surr)	*101*		*71 - 126*		*01/06/12 23:55*	*1*

Client Sample ID: RU-19-010412 — Lab Sample ID: 480-14696-1

Date Collected: 01/04/12 13:00 — **Matrix: Water**
Date Received: 01/06/12 09:30

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	102		73 - 120		01/06/12 23:55	1

Method: 8260B - Volatile Organic Compounds (GC/MS) - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	230		10	8.1	ug/L			01/07/12 13:56	10
Trichloroethene	580		10	4.6	ug/L			01/07/12 13:56	10

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	90		66 - 137		01/07/12 13:56	10
Toluene-d8 (Surr)	102		71 - 126		01/07/12 13:56	10
4-Bromofluorobenzene (Surr)	104		73 - 120		01/07/12 13:56	10

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethane	7.0		1.5	0.49	ug/L			01/06/12 17:19	1
Ethene	ND		1.5	0.52	ug/L			01/06/12 17:19	1
Methane	190		50	11	ug/L			01/10/12 16:09	50

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	14.3		0.50	0.28	mg/L			01/09/12 18:47	1
Sulfate	30.0		2.0	0.35	mg/L			01/09/12 18:47	1
Nitrate as N	0.68	H	0.050	0.011	mg/L			01/06/12 19:05	1
Total Organic Carbon	7.1		1.0	0.43	mg/L			01/10/12 15:39	1
Acetic acid	2.7		1.0	0.15	mg/L			01/06/12 17:36	1
Butyric acid	ND		1.0	0.16	mg/L			01/06/12 17:36	1
Propionic acid	3.7		1.0	0.17	mg/L			01/06/12 17:36	1

Client Sample ID: RU-20-010412 — Lab Sample ID: 480-14696-2

Date Collected: 01/04/12 15:15 — **Matrix: Water**
Date Received: 01/06/12 09:30

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			01/07/12 00:18	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			01/07/12 00:18	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			01/07/12 00:18	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			01/07/12 00:18	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			01/07/12 00:18	1
1,1-Dichloroethene	0.95	J	1.0	0.29	ug/L			01/07/12 00:18	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			01/07/12 00:18	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			01/07/12 00:18	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			01/07/12 00:18	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			01/07/12 00:18	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			01/07/12 00:18	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			01/07/12 00:18	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			01/07/12 00:18	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			01/07/12 00:18	1
2-Hexanone	ND		5.0	1.2	ug/L			01/07/12 00:18	1
2-Butanone (MEK)	1.3	J	10	1.3	ug/L			01/07/12 00:18	1

Client: CDM Smith, Inc. TestAmerica Job ID: 480-14696-1
Project/Site: New York state project

Client Sample ID: RU-20-010412 **Lab Sample ID: 480-14696-2**
Date Collected: 01/04/12 15:15 **Matrix: Water**
Date Received: 01/06/12 09:30

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			01/07/12 00:18	1
Acetone	**7.2**	**J**	10	3.0	ug/L			01/07/12 00:18	1
Benzene	ND		1.0	0.41	ug/L			01/07/12 00:18	1
Bromodichloromethane	ND		1.0	0.39	ug/L			01/07/12 00:18	1
Bromoform	ND		1.0	0.26	ug/L			01/07/12 00:18	1
Bromomethane	ND		1.0	0.69	ug/L			01/07/12 00:18	1
Carbon disulfide	ND		1.0	0.19	ug/L			01/07/12 00:18	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			01/07/12 00:18	1
Chlorobenzene	ND		1.0	0.75	ug/L			01/07/12 00:18	1
Dibromochloromethane	ND		1.0	0.32	ug/L			01/07/12 00:18	1
Chloroethane	ND		1.0	0.32	ug/L			01/07/12 00:18	1
Chloroform	ND		1.0	0.34	ug/L			01/07/12 00:18	1
Chloromethane	ND		1.0	0.35	ug/L			01/07/12 00:18	1
cis-1,2-Dichloroethene	**86**		1.0	0.81	ug/L			01/07/12 00:18	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			01/07/12 00:18	1
Cyclohexane	ND		1.0	0.18	ug/L			01/07/12 00:18	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			01/07/12 00:18	1
Ethylbenzene	ND		1.0	0.74	ug/L			01/07/12 00:18	1
Isopropylbenzene	ND		1.0	0.79	ug/L			01/07/12 00:18	1
Methyl acetate	ND		1.0	0.50	ug/L			01/07/12 00:18	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			01/07/12 00:18	1
Methylcyclohexane	ND		1.0	0.16	ug/L			01/07/12 00:18	1
Methylene Chloride	ND		1.0	0.44	ug/L			01/07/12 00:18	1
Styrene	ND		1.0	0.73	ug/L			01/07/12 00:18	1
Tetrachloroethene	**2.2**		1.0	0.36	ug/L			01/07/12 00:18	1
Toluene	ND		1.0	0.51	ug/L			01/07/12 00:18	1
trans-1,2-Dichloroethene	**1.3**		1.0	0.90	ug/L			01/07/12 00:18	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			01/07/12 00:18	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			01/07/12 00:18	1
Vinyl chloride	ND		1.0	0.90	ug/L			01/07/12 00:18	1
Xylenes, Total	ND		2.0	0.66	ug/L			01/07/12 00:18	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*90*		*66 - 137*		*01/07/12 00:18*	*1*
Toluene-d8 (Surr)	*102*		*71 - 126*		*01/07/12 00:18*	*1*
4-Bromofluorobenzene (Surr)	*104*		*73 - 120*		*01/07/12 00:18*	*1*

Method: 8260B - Volatile Organic Compounds (GC/MS) - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Trichloroethene	**2100**		40	18	ug/L			01/07/12 14:18	40

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*91*		*66 - 137*		*01/07/12 14:18*	*40*
Toluene-d8 (Surr)	*104*		*71 - 126*		*01/07/12 14:18*	*40*
4-Bromofluorobenzene (Surr)	*104*		*73 - 120*		*01/07/12 14:18*	*40*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethane	**2.6**		1.5	0.49	ug/L			01/06/12 17:36	1
Ethene	**7.3**		1.5	0.52	ug/L			01/06/12 17:36	1
Methane	**6.9**	**B**	1.0	0.22	ug/L			01/06/12 17:36	1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Client Sample ID: RU-20-010412
Lab Sample ID: 480-14696-2
Date Collected: 01/04/12 15:15
Matrix: Water
Date Received: 01/06/12 09:30

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**79.6**		0.50	0.28	mg/L			01/09/12 18:57	1
Sulfate	**50.6**		2.0	0.35	mg/L			01/09/12 18:57	1
Nitrate as N	**0.26**	**H**	0.050	0.011	mg/L			01/06/12 19:07	1
Total Organic Carbon	**48.5**		1.0	0.43	mg/L			01/10/12 15:56	1
Acetic acid	**11.3**		1.0	0.15	mg/L			01/06/12 18:05	1
Butyric acid	ND		1.0	0.16	mg/L			01/06/12 18:05	1
Propionic acid	**7.6**		1.0	0.17	mg/L			01/06/12 18:05	1

Client Sample ID: RU-21-010412
Lab Sample ID: 480-14696-3
Date Collected: 01/04/12 11:30
Matrix: Water
Date Received: 01/06/12 09:30

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		2.0	1.6	ug/L			01/07/12 14:40	2
1,1,2,2-Tetrachloroethane	ND		2.0	0.42	ug/L			01/07/12 14:40	2
1,1,2-Trichloroethane	ND		2.0	0.46	ug/L			01/07/12 14:40	2
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		2.0	0.62	ug/L			01/07/12 14:40	2
1,1-Dichloroethane	ND		2.0	0.76	ug/L			01/07/12 14:40	2
1,1-Dichloroethene	ND		2.0	0.58	ug/L			01/07/12 14:40	2
1,2,4-Trichlorobenzene	ND		2.0	0.82	ug/L			01/07/12 14:40	2
1,2-Dibromo-3-Chloropropane	ND		2.0	0.78	ug/L			01/07/12 14:40	2
1,2-Dibromoethane	ND		2.0	1.5	ug/L			01/07/12 14:40	2
1,2-Dichlorobenzene	ND		2.0	1.6	ug/L			01/07/12 14:40	2
1,2-Dichloroethane	ND		2.0	0.42	ug/L			01/07/12 14:40	2
1,2-Dichloropropane	ND		2.0	1.4	ug/L			01/07/12 14:40	2
1,3-Dichlorobenzene	ND		2.0	1.6	ug/L			01/07/12 14:40	2
1,4-Dichlorobenzene	ND		2.0	1.7	ug/L			01/07/12 14:40	2
2-Hexanone	**60**		10	2.5	ug/L			01/07/12 14:40	2
2-Butanone (MEK)	**66**		20	2.6	ug/L			01/07/12 14:40	2
4-Methyl-2-pentanone (MIBK)	ND		10	4.2	ug/L			01/07/12 14:40	2
Acetone	**82**		20	6.0	ug/L			01/07/12 14:40	2
Benzene	ND		2.0	0.82	ug/L			01/07/12 14:40	2
Bromodichloromethane	ND		2.0	0.78	ug/L			01/07/12 14:40	2
Bromoform	ND		2.0	0.52	ug/L			01/07/12 14:40	2
Bromomethane	ND		2.0	1.4	ug/L			01/07/12 14:40	2
Carbon disulfide	**1.7**	**J**	2.0	0.38	ug/L			01/07/12 14:40	2
Carbon tetrachloride	ND		2.0	0.54	ug/L			01/07/12 14:40	2
Chlorobenzene	ND		2.0	1.5	ug/L			01/07/12 14:40	2
Dibromochloromethane	ND		2.0	0.64	ug/L			01/07/12 14:40	2
Chloroethane	ND		2.0	0.64	ug/L			01/07/12 14:40	2
Chloroform	ND		2.0	0.68	ug/L			01/07/12 14:40	2
Chloromethane	ND		2.0	0.70	ug/L			01/07/12 14:40	2
cis-1,2-Dichloroethene	**52**		2.0	1.6	ug/L			01/07/12 14:40	2
cis-1,3-Dichloropropene	ND		2.0	0.72	ug/L			01/07/12 14:40	2
Cyclohexane	ND		2.0	0.36	ug/L			01/07/12 14:40	2
Dichlorodifluoromethane	ND		2.0	1.4	ug/L			01/07/12 14:40	2
Ethylbenzene	ND		2.0	1.5	ug/L			01/07/12 14:40	2
Isopropylbenzene	ND		2.0	1.6	ug/L			01/07/12 14:40	2

Client Sample ID: RU-21-010412

Lab Sample ID: 480-14696-3

Date Collected: 01/04/12 11:30
Matrix: Water
Date Received: 01/06/12 09:30

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acetate	ND		2.0	1.0	ug/L			01/07/12 14:40	2
Methyl tert-butyl ether	ND		2.0	0.32	ug/L			01/07/12 14:40	2
Methylcyclohexane	ND		2.0	0.32	ug/L			01/07/12 14:40	2
Methylene Chloride	ND		2.0	0.88	ug/L			01/07/12 14:40	2
Styrene	ND		2.0	1.5	ug/L			01/07/12 14:40	2
Tetrachloroethene	ND		2.0	0.72	ug/L			01/07/12 14:40	2
Toluene	ND		2.0	1.0	ug/L			01/07/12 14:40	2
trans-1,2-Dichloroethene	ND		2.0	1.8	ug/L			01/07/12 14:40	2
trans-1,3-Dichloropropene	ND		2.0	0.74	ug/L			01/07/12 14:40	2
Trichloroethene	**41**		2.0	0.92	ug/L			01/07/12 14:40	2
Trichlorofluoromethane	ND		2.0	1.8	ug/L			01/07/12 14:40	2
Vinyl chloride	**120**		2.0	1.8	ug/L			01/07/12 14:40	2
Xylenes, Total	ND		4.0	1.3	ug/L			01/07/12 14:40	2

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*90*		*66 - 137*		*01/07/12 14:40*	*2*
Toluene-d8 (Surr)	*102*		*71 - 126*		*01/07/12 14:40*	*2*
4-Bromofluorobenzene (Surr)	*104*		*73 - 120*		*01/07/12 14:40*	*2*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethane	**11**		1.5	0.49	ug/L			01/06/12 17:53	1
Ethene	**26**		1.5	0.52	ug/L			01/06/12 17:53	1
Methane	**210**		50	11	ug/L			01/10/12 16:26	50

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**23.8**		2.5	1.4	mg/L			01/09/12 19:07	5
Sulfate	**23.7**		10.0	1.7	mg/L			01/09/12 19:07	5
Nitrate as N	ND	H	0.050	0.011	mg/L			01/06/12 19:09	1
Total Organic Carbon	**2040**		40.0	17.4	mg/L			01/10/12 16:14	40
Acetic acid	**920**		50.0	7.5	mg/L			01/10/12 17:57	50
Butyric acid	**10.9**		1.0	0.16	mg/L			01/06/12 18:35	1
Propionic acid	**1690**		50.0	8.5	mg/L			01/10/12 17:57	50

Client Sample ID: RU-10-010412

Lab Sample ID: 480-14696-4

Date Collected: 01/04/12 09:30
Matrix: Water
Date Received: 01/06/12 09:30

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			01/07/12 01:02	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			01/07/12 01:02	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			01/07/12 01:02	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			01/07/12 01:02	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			01/07/12 01:02	1
1,1-Dichloroethene	**0.59**	**J**	1.0	0.29	ug/L			01/07/12 01:02	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			01/07/12 01:02	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			01/07/12 01:02	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			01/07/12 01:02	1

Client: CDM Smith, Inc. TestAmerica Job ID: 480-14696-1
Project/Site: New York state project

Client Sample ID: RU-10-010412 **Lab Sample ID: 480-14696-4**
Date Collected: 01/04/12 09:30 **Matrix: Water**
Date Received: 01/06/12 09:30

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			01/07/12 01:02	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			01/07/12 01:02	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			01/07/12 01:02	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			01/07/12 01:02	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			01/07/12 01:02	1
2-Hexanone	ND		5.0	1.2	ug/L			01/07/12 01:02	1
2-Butanone (MEK)	**4.4**	**J**	10	1.3	ug/L			01/07/12 01:02	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			01/07/12 01:02	1
Acetone	**18**		10	3.0	ug/L			01/07/12 01:02	1
Benzene	ND		1.0	0.41	ug/L			01/07/12 01:02	1
Bromodichloromethane	ND		1.0	0.39	ug/L			01/07/12 01:02	1
Bromoform	ND		1.0	0.26	ug/L			01/07/12 01:02	1
Bromomethane	ND		1.0	0.69	ug/L			01/07/12 01:02	1
Carbon disulfide	ND		1.0	0.19	ug/L			01/07/12 01:02	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			01/07/12 01:02	1
Chlorobenzene	ND		1.0	0.75	ug/L			01/07/12 01:02	1
Dibromochloromethane	ND		1.0	0.32	ug/L			01/07/12 01:02	1
Chloroethane	ND		1.0	0.32	ug/L			01/07/12 01:02	1
Chloroform	ND		1.0	0.34	ug/L			01/07/12 01:02	1
Chloromethane	ND		1.0	0.35	ug/L			01/07/12 01:02	1
cis-1,2-Dichloroethene	**94**		1.0	0.81	ug/L			01/07/12 01:02	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			01/07/12 01:02	1
Cyclohexane	ND		1.0	0.18	ug/L			01/07/12 01:02	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			01/07/12 01:02	1
Ethylbenzene	ND		1.0	0.74	ug/L			01/07/12 01:02	1
Isopropylbenzene	ND		1.0	0.79	ug/L			01/07/12 01:02	1
Methyl acetate	ND		1.0	0.50	ug/L			01/07/12 01:02	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			01/07/12 01:02	1
Methylcyclohexane	ND		1.0	0.16	ug/L			01/07/12 01:02	1
Methylene Chloride	ND		1.0	0.44	ug/L			01/07/12 01:02	1
Styrene	ND		1.0	0.73	ug/L			01/07/12 01:02	1
Tetrachloroethene	ND		1.0	0.36	ug/L			01/07/12 01:02	1
Toluene	ND		1.0	0.51	ug/L			01/07/12 01:02	1
trans-1,2-Dichloroethene	**1.1**		1.0	0.90	ug/L			01/07/12 01:02	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			01/07/12 01:02	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			01/07/12 01:02	1
Vinyl chloride	**12**		1.0	0.90	ug/L			01/07/12 01:02	1
Xylenes, Total	ND		2.0	0.66	ug/L			01/07/12 01:02	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*90*		*66 - 137*		*01/07/12 01:02*	*1*
Toluene-d8 (Surr)	*101*		*71 - 126*		*01/07/12 01:02*	*1*
4-Bromofluorobenzene (Surr)	*103*		*73 - 120*		*01/07/12 01:02*	*1*

Method: 8260B - Volatile Organic Compounds (GC/MS) - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Trichloroethene	**120**		2.0	0.92	ug/L			01/07/12 15:03	2

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*91*		*66 - 137*		*01/07/12 15:03*	*2*
Toluene-d8 (Surr)	*103*		*71 - 126*		*01/07/12 15:03*	*2*

Client Sample ID: RU-10-010412
Lab Sample ID: 480-14696-4

Date Collected: 01/04/12 09:30
Matrix: Water

Date Received: 01/06/12 09:30

Method: 8260B - Volatile Organic Compounds (GC/MS) - DL (Continued)

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*104*		*73 - 120*		*01/07/12 15:03*	*2*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethane	**4.0**		1.5	0.49	ug/L			01/06/12 18:10	1
Ethene	ND		1.5	0.52	ug/L			01/06/12 18:10	1
Methane	**120**	**B**	1.0	0.22	ug/L			01/06/12 18:10	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**9.3**		0.50	0.28	mg/L			01/09/12 19:17	1
Sulfate	**29.9**		2.0	0.35	mg/L			01/09/12 19:17	1
Nitrate as N	**0.47**	**H**	0.050	0.011	mg/L			01/06/12 19:11	1
Total Organic Carbon	**205**		10.0	4.3	mg/L			01/10/12 16:32	10
Acetic acid	**39.6**		1.0	0.15	mg/L			01/06/12 19:04	1
Butyric acid	ND		1.0	0.16	mg/L			01/06/12 19:04	1
Propionic acid	**57.0**		2.0	0.34	mg/L			01/10/12 18:55	2

Client Sample ID: TRIP BLANK-010412
Lab Sample ID: 480-14696-5

Date Collected: 01/04/12 00:00
Matrix: Water

Date Received: 01/06/12 09:30

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			01/07/12 01:24	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			01/07/12 01:24	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			01/07/12 01:24	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			01/07/12 01:24	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			01/07/12 01:24	1
1,1-Dichloroethene	ND		1.0	0.29	ug/L			01/07/12 01:24	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			01/07/12 01:24	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			01/07/12 01:24	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			01/07/12 01:24	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			01/07/12 01:24	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			01/07/12 01:24	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			01/07/12 01:24	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			01/07/12 01:24	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			01/07/12 01:24	1
2-Hexanone	ND		5.0	1.2	ug/L			01/07/12 01:24	1
2-Butanone (MEK)	ND		10	1.3	ug/L			01/07/12 01:24	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			01/07/12 01:24	1
Acetone	ND		10	3.0	ug/L			01/07/12 01:24	1
Benzene	ND		1.0	0.41	ug/L			01/07/12 01:24	1
Bromodichloromethane	ND		1.0	0.39	ug/L			01/07/12 01:24	1
Bromoform	ND		1.0	0.26	ug/L			01/07/12 01:24	1
Bromomethane	ND		1.0	0.69	ug/L			01/07/12 01:24	1
Carbon disulfide	ND		1.0	0.19	ug/L			01/07/12 01:24	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			01/07/12 01:24	1
Chlorobenzene	ND		1.0	0.75	ug/L			01/07/12 01:24	1

Client Sample ID: TRIP BLANK-010412 Lab Sample ID: 480-14696-5

Date Collected: 01/04/12 00:00 **Matrix: Water**
Date Received: 01/06/12 09:30

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Dibromochloromethane	ND		1.0	0.32	ug/L			01/07/12 01:24	1
Chloroethane	ND		1.0	0.32	ug/L			01/07/12 01:24	1
Chloroform	ND		1.0	0.34	ug/L			01/07/12 01:24	1
Chloromethane	ND		1.0	0.35	ug/L			01/07/12 01:24	1
cis-1,2-Dichloroethene	ND		1.0	0.81	ug/L			01/07/12 01:24	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			01/07/12 01:24	1
Cyclohexane	ND		1.0	0.18	ug/L			01/07/12 01:24	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			01/07/12 01:24	1
Ethylbenzene	ND		1.0	0.74	ug/L			01/07/12 01:24	1
Isopropylbenzene	ND		1.0	0.79	ug/L			01/07/12 01:24	1
Methyl acetate	ND		1.0	0.50	ug/L			01/07/12 01:24	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			01/07/12 01:24	1
Methylcyclohexane	ND		1.0	0.16	ug/L			01/07/12 01:24	1
Methylene Chloride	ND		1.0	0.44	ug/L			01/07/12 01:24	1
Styrene	ND		1.0	0.73	ug/L			01/07/12 01:24	1
Tetrachloroethene	ND		1.0	0.36	ug/L			01/07/12 01:24	1
Toluene	ND		1.0	0.51	ug/L			01/07/12 01:24	1
trans-1,2-Dichloroethene	ND		1.0	0.90	ug/L			01/07/12 01:24	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			01/07/12 01:24	1
Trichloroethene	ND		1.0	0.46	ug/L			01/07/12 01:24	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			01/07/12 01:24	1
Vinyl chloride	ND		1.0	0.90	ug/L			01/07/12 01:24	1
Xylenes, Total	ND		2.0	0.66	ug/L			01/07/12 01:24	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*88*		*66 - 137*		*01/07/12 01:24*	*1*
Toluene-d8 (Surr)	*102*		*71 - 126*		*01/07/12 01:24*	*1*
4-Bromofluorobenzene (Surr)	*103*		*73 - 120*		*01/07/12 01:24*	*1*

Client Sample ID: DUP-010412 Lab Sample ID: 480-14696-6

Date Collected: 01/04/12 00:00 **Matrix: Water**
Date Received: 01/06/12 09:30

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			01/07/12 01:46	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			01/07/12 01:46	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			01/07/12 01:46	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			01/07/12 01:46	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			01/07/12 01:46	1
1,1-Dichloroethene	ND		1.0	0.29	ug/L			01/07/12 01:46	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			01/07/12 01:46	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			01/07/12 01:46	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			01/07/12 01:46	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			01/07/12 01:46	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			01/07/12 01:46	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			01/07/12 01:46	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			01/07/12 01:46	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			01/07/12 01:46	1
2-Hexanone	ND		5.0	1.2	ug/L			01/07/12 01:46	1

Client Sample ID: DUP-010412
Lab Sample ID: 480-14696-6

Date Collected: 01/04/12 00:00
Matrix: Water
Date Received: 01/06/12 09:30

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2-Butanone (MEK)	**4.3**	**J**	10	1.3	ug/L			01/07/12 01:46	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			01/07/12 01:46	1
Acetone	**17**		10	3.0	ug/L			01/07/12 01:46	1
Benzene	ND		1.0	0.41	ug/L			01/07/12 01:46	1
Bromodichloromethane	ND		1.0	0.39	ug/L			01/07/12 01:46	1
Bromoform	ND		1.0	0.26	ug/L			01/07/12 01:46	1
Bromomethane	ND		1.0	0.69	ug/L			01/07/12 01:46	1
Carbon disulfide	ND		1.0	0.19	ug/L			01/07/12 01:46	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			01/07/12 01:46	1
Chlorobenzene	ND		1.0	0.75	ug/L			01/07/12 01:46	1
Dibromochloromethane	ND		1.0	0.32	ug/L			01/07/12 01:46	1
Chloroethane	ND		1.0	0.32	ug/L			01/07/12 01:46	1
Chloroform	ND		1.0	0.34	ug/L			01/07/12 01:46	1
Chloromethane	ND		1.0	0.35	ug/L			01/07/12 01:46	1
cis-1,2-Dichloroethene	**89**		1.0	0.81	ug/L			01/07/12 01:46	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			01/07/12 01:46	1
Cyclohexane	ND		1.0	0.18	ug/L			01/07/12 01:46	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			01/07/12 01:46	1
Ethylbenzene	ND		1.0	0.74	ug/L			01/07/12 01:46	1
Isopropylbenzene	ND		1.0	0.79	ug/L			01/07/12 01:46	1
Methyl acetate	ND		1.0	0.50	ug/L			01/07/12 01:46	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			01/07/12 01:46	1
Methylcyclohexane	ND		1.0	0.16	ug/L			01/07/12 01:46	1
Methylene Chloride	ND		1.0	0.44	ug/L			01/07/12 01:46	1
Styrene	ND		1.0	0.73	ug/L			01/07/12 01:46	1
Tetrachloroethene	ND		1.0	0.36	ug/L			01/07/12 01:46	1
Toluene	ND		1.0	0.51	ug/L			01/07/12 01:46	1
trans-1,2-Dichloroethene	**0.95**	**J**	1.0	0.90	ug/L			01/07/12 01:46	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			01/07/12 01:46	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			01/07/12 01:46	1
Vinyl chloride	**12**		1.0	0.90	ug/L			01/07/12 01:46	1
Xylenes, Total	ND		2.0	0.66	ug/L			01/07/12 01:46	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*90*		*66 - 137*		*01/07/12 01:46*	*1*
Toluene-d8 (Surr)	*100*		*71 - 126*		*01/07/12 01:46*	*1*
4-Bromofluorobenzene (Surr)	*101*		*73 - 120*		*01/07/12 01:46*	*1*

Method: 8260B - Volatile Organic Compounds (GC/MS) - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Trichloroethene	**120**		2.0	0.92	ug/L			01/07/12 15:25	2

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*88*		*66 - 137*		*01/07/12 15:25*	*2*
Toluene-d8 (Surr)	*102*		*71 - 126*		*01/07/12 15:25*	*2*
4-Bromofluorobenzene (Surr)	*102*		*73 - 120*		*01/07/12 15:25*	*2*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethane	**3.9**		1.5	0.49	ug/L			01/06/12 18:27	1
Ethene	ND		1.5	0.52	ug/L			01/06/12 18:27	1

Client Sample ID: DUP-010412 — **Lab Sample ID: 480-14696-6**
Date Collected: 01/04/12 00:00 — **Matrix: Water**
Date Received: 01/06/12 09:30

Method: RSK-175 - Dissolved Gases (GC) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methane	120	B	1.0	0.22	ug/L			01/06/12 18:27	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	9.5		0.50	0.28	mg/L			01/09/12 19:27	1
Sulfate	29.9		2.0	0.35	mg/L			01/09/12 19:27	1
Nitrate as N	0.48	H	0.050	0.011	mg/L			01/06/12 19:13	1
Total Organic Carbon	213		10.0	4.3	mg/L			01/10/12 16:49	10
Acetic acid	39.7		1.0	0.15	mg/L			01/06/12 19:33	1
Butyric acid	ND		1.0	0.16	mg/L			01/06/12 19:33	1
Propionic acid	77.0		20.0	3.4	mg/L			01/10/12 19:53	20

Client Sample ID: FIIELD BLANK-010412 — **Lab Sample ID: 480-14696-7**
Date Collected: 01/04/12 16:30 — **Matrix: Water**
Date Received: 01/06/12 09:30

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			01/07/12 02:08	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			01/07/12 02:08	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			01/07/12 02:08	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			01/07/12 02:08	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			01/07/12 02:08	1
1,1-Dichloroethene	ND		1.0	0.29	ug/L			01/07/12 02:08	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			01/07/12 02:08	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			01/07/12 02:08	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			01/07/12 02:08	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			01/07/12 02:08	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			01/07/12 02:08	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			01/07/12 02:08	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			01/07/12 02:08	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			01/07/12 02:08	1
2-Hexanone	ND		5.0	1.2	ug/L			01/07/12 02:08	1
2-Butanone (MEK)	ND		10	1.3	ug/L			01/07/12 02:08	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			01/07/12 02:08	1
Acetone	4.3	J	10	3.0	ug/L			01/07/12 02:08	1
Benzene	ND		1.0	0.41	ug/L			01/07/12 02:08	1
Bromodichloromethane	ND		1.0	0.39	ug/L			01/07/12 02:08	1
Bromoform	ND		1.0	0.26	ug/L			01/07/12 02:08	1
Bromomethane	ND		1.0	0.69	ug/L			01/07/12 02:08	1
Carbon disulfide	ND		1.0	0.19	ug/L			01/07/12 02:08	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			01/07/12 02:08	1
Chlorobenzene	ND		1.0	0.75	ug/L			01/07/12 02:08	1
Dibromochloromethane	ND		1.0	0.32	ug/L			01/07/12 02:08	1
Chloroethane	ND		1.0	0.32	ug/L			01/07/12 02:08	1
Chloroform	ND		1.0	0.34	ug/L			01/07/12 02:08	1
Chloromethane	ND		1.0	0.35	ug/L			01/07/12 02:08	1
cis-1,2-Dichloroethene	ND		1.0	0.81	ug/L			01/07/12 02:08	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			01/07/12 02:08	1
Cyclohexane	ND		1.0	0.18	ug/L			01/07/12 02:08	1

Client Sample ID: FIIELD BLANK-010412

Lab Sample ID: 480-14696-7

Date Collected: 01/04/12 16:30
Matrix: Water
Date Received: 01/06/12 09:30

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			01/07/12 02:08	1
Ethylbenzene	ND		1.0	0.74	ug/L			01/07/12 02:08	1
Isopropylbenzene	ND		1.0	0.79	ug/L			01/07/12 02:08	1
Methyl acetate	ND		1.0	0.50	ug/L			01/07/12 02:08	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			01/07/12 02:08	1
Methylcyclohexane	ND		1.0	0.16	ug/L			01/07/12 02:08	1
Methylene Chloride	ND		1.0	0.44	ug/L			01/07/12 02:08	1
Styrene	ND		1.0	0.73	ug/L			01/07/12 02:08	1
Tetrachloroethene	ND		1.0	0.36	ug/L			01/07/12 02:08	1
Toluene	ND		1.0	0.51	ug/L			01/07/12 02:08	1
trans-1,2-Dichloroethene	ND		1.0	0.90	ug/L			01/07/12 02:08	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			01/07/12 02:08	1
Trichloroethene	ND		1.0	0.46	ug/L			01/07/12 02:08	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			01/07/12 02:08	1
Vinyl chloride	ND		1.0	0.90	ug/L			01/07/12 02:08	1
Xylenes, Total	ND		2.0	0.66	ug/L			01/07/12 02:08	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*89*		*66 - 137*		*01/07/12 02:08*	*1*
Toluene-d8 (Surr)	*101*		*71 - 126*		*01/07/12 02:08*	*1*
4-Bromofluorobenzene (Surr)	*102*		*73 - 120*		*01/07/12 02:08*	*1*

Surrogate Summary

Client: CDM Smith, Inc. TestAmerica Job ID: 480-14696-1
Project/Site: New York state project

Method: 8260B - Volatile Organic Compounds (GC/MS)

Matrix: Water **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)		
		12DCE	TOL	BFB
Lab Sample ID	Client Sample ID	(66-137)	(71-126)	(73-120)
480-14696-1	RU-19-010412	90	101	102
480-14696-1 - DL	RU-19-010412	90	102	104
480-14696-2	RU-20-010412	90	102	104
480-14696-2 - DL	RU-20-010412	91	104	104
480-14696-3	RU-21-010412	90	102	104
480-14696-4	RU-10-010412	90	101	103
480-14696-4 - DL	RU-10-010412	91	103	104
480-14696-5	TRIP BLANK-010412	88	102	103
480-14696-6	DUP-010412	90	100	101
480-14696-6 - DL	DUP-010412	88	102	102
480-14696-7	FIIELD BLANK-010412	89	101	102
LCS 480-47185/4	Lab Control Sample	91	100	103
LCS 480-47214/4	Lab Control Sample	89	102	104
MB 480-47185/5	Method Blank	91	102	102
MB 480-47214/5	Method Blank	89	102	103

Surrogate Legend

12DCE = 1,2-Dichloroethane-d4 (Surr)
TOL = Toluene-d8 (Surr)
BFB = 4-Bromofluorobenzene (Surr)

Client: CDM Smith, Inc.
Project/Site: New York state project

TestAmerica Job ID: 480-14696-1

Method: 8260B - Volatile Organic Compounds (GC/MS)

Lab Sample ID: MB 480-47185/5
Matrix: Water
Analysis Batch: 47185

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			01/06/12 19:41	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			01/06/12 19:41	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			01/06/12 19:41	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			01/06/12 19:41	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			01/06/12 19:41	1
1,1-Dichloroethene	ND		1.0	0.29	ug/L			01/06/12 19:41	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			01/06/12 19:41	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			01/06/12 19:41	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			01/06/12 19:41	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			01/06/12 19:41	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			01/06/12 19:41	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			01/06/12 19:41	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			01/06/12 19:41	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			01/06/12 19:41	1
2-Hexanone	ND		5.0	1.2	ug/L			01/06/12 19:41	1
2-Butanone (MEK)	ND		10	1.3	ug/L			01/06/12 19:41	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			01/06/12 19:41	1
Acetone	ND		10	3.0	ug/L			01/06/12 19:41	1
Benzene	ND		1.0	0.41	ug/L			01/06/12 19:41	1
Bromodichloromethane	ND		1.0	0.39	ug/L			01/06/12 19:41	1
Bromoform	ND		1.0	0.26	ug/L			01/06/12 19:41	1
Bromomethane	ND		1.0	0.69	ug/L			01/06/12 19:41	1
Carbon disulfide	ND		1.0	0.19	ug/L			01/06/12 19:41	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			01/06/12 19:41	1
Chlorobenzene	ND		1.0	0.75	ug/L			01/06/12 19:41	1
Dibromochloromethane	ND		1.0	0.32	ug/L			01/06/12 19:41	1
Chloroethane	ND		1.0	0.32	ug/L			01/06/12 19:41	1
Chloroform	ND		1.0	0.34	ug/L			01/06/12 19:41	1
Chloromethane	ND		1.0	0.35	ug/L			01/06/12 19:41	1
cis-1,2-Dichloroethene	ND		1.0	0.81	ug/L			01/06/12 19:41	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			01/06/12 19:41	1
Cyclohexane	ND		1.0	0.18	ug/L			01/06/12 19:41	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			01/06/12 19:41	1
Ethylbenzene	ND		1.0	0.74	ug/L			01/06/12 19:41	1
Isopropylbenzene	ND		1.0	0.79	ug/L			01/06/12 19:41	1
Methyl acetate	ND		1.0	0.50	ug/L			01/06/12 19:41	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			01/06/12 19:41	1
Methylcyclohexane	ND		1.0	0.16	ug/L			01/06/12 19:41	1
Methylene Chloride	ND		1.0	0.44	ug/L			01/06/12 19:41	1
Styrene	ND		1.0	0.73	ug/L			01/06/12 19:41	1
Tetrachloroethene	ND		1.0	0.36	ug/L			01/06/12 19:41	1
Toluene	ND		1.0	0.51	ug/L			01/06/12 19:41	1
trans-1,2-Dichloroethene	ND		1.0	0.90	ug/L			01/06/12 19:41	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			01/06/12 19:41	1
Trichloroethene	ND		1.0	0.46	ug/L			01/06/12 19:41	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			01/06/12 19:41	1
Vinyl chloride	ND		1.0	0.90	ug/L			01/06/12 19:41	1
Xylenes, Total	ND		2.0	0.66	ug/L			01/06/12 19:41	1

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 480-47185/5
Matrix: Water
Analysis Batch: 47185

Client Sample ID: Method Blank
Prep Type: Total/NA

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	*91*		*66 - 137*		*01/06/12 19:41*	*1*
Toluene-d8 (Surr)	*102*		*71 - 126*		*01/06/12 19:41*	*1*
4-Bromofluorobenzene (Surr)	*102*		*73 - 120*		*01/06/12 19:41*	*1*

Lab Sample ID: LCS 480-47185/4
Matrix: Water
Analysis Batch: 47185

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1-Dichloroethane	25.0	23.5		ug/L		94	71 - 129
1,1-Dichloroethene	25.0	23.5		ug/L		94	65 - 138
1,2-Dichlorobenzene	25.0	25.2		ug/L		101	77 - 120
1,2-Dichloroethane	25.0	23.3		ug/L		93	75 - 127
Benzene	25.0	24.2		ug/L		97	71 - 124
Chlorobenzene	25.0	25.6		ug/L		102	72 - 120
cis-1,2-Dichloroethene	25.0	24.5		ug/L		98	74 - 124
Ethylbenzene	25.0	25.2		ug/L		101	77 - 123
Methyl tert-butyl ether	25.0	23.4		ug/L		94	64 - 127
Tetrachloroethene	25.0	24.9		ug/L		100	74 - 122
Toluene	25.0	25.5		ug/L		102	70 - 122
trans-1,2-Dichloroethene	25.0	25.0		ug/L		100	73 - 127
Trichloroethene	25.0	24.2		ug/L		97	74 - 123

Surrogate	LCS %Recovery	LCS Qualifier	Limits
1,2-Dichloroethane-d4 (Surr)	*91*		*66 - 137*
Toluene-d8 (Surr)	*100*		*71 - 126*
4-Bromofluorobenzene (Surr)	*103*		*73 - 120*

Lab Sample ID: MB 480-47214/5
Matrix: Water
Analysis Batch: 47214

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			01/07/12 12:36	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			01/07/12 12:36	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			01/07/12 12:36	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			01/07/12 12:36	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			01/07/12 12:36	1
1,1-Dichloroethene	ND		1.0	0.29	ug/L			01/07/12 12:36	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			01/07/12 12:36	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			01/07/12 12:36	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			01/07/12 12:36	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			01/07/12 12:36	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			01/07/12 12:36	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			01/07/12 12:36	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			01/07/12 12:36	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			01/07/12 12:36	1
2-Hexanone	ND		5.0	1.2	ug/L			01/07/12 12:36	1
2-Butanone (MEK)	ND		10	1.3	ug/L			01/07/12 12:36	1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 480-47214/5 **Client Sample ID: Method Blank**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 47214

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			01/07/12 12:36	1
Acetone	ND		10	3.0	ug/L			01/07/12 12:36	1
Benzene	ND		1.0	0.41	ug/L			01/07/12 12:36	1
Bromodichloromethane	ND		1.0	0.39	ug/L			01/07/12 12:36	1
Bromoform	ND		1.0	0.26	ug/L			01/07/12 12:36	1
Bromomethane	ND		1.0	0.69	ug/L			01/07/12 12:36	1
Carbon disulfide	ND		1.0	0.19	ug/L			01/07/12 12:36	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			01/07/12 12:36	1
Chlorobenzene	ND		1.0	0.75	ug/L			01/07/12 12:36	1
Dibromochloromethane	ND		1.0	0.32	ug/L			01/07/12 12:36	1
Chloroethane	ND		1.0	0.32	ug/L			01/07/12 12:36	1
Chloroform	ND		1.0	0.34	ug/L			01/07/12 12:36	1
Chloromethane	ND		1.0	0.35	ug/L			01/07/12 12:36	1
cis-1,2-Dichloroethene	ND		1.0	0.81	ug/L			01/07/12 12:36	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			01/07/12 12:36	1
Cyclohexane	ND		1.0	0.18	ug/L			01/07/12 12:36	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			01/07/12 12:36	1
Ethylbenzene	ND		1.0	0.74	ug/L			01/07/12 12:36	1
Isopropylbenzene	ND		1.0	0.79	ug/L			01/07/12 12:36	1
Methyl acetate	ND		1.0	0.50	ug/L			01/07/12 12:36	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			01/07/12 12:36	1
Methylcyclohexane	ND		1.0	0.16	ug/L			01/07/12 12:36	1
Methylene Chloride	ND		1.0	0.44	ug/L			01/07/12 12:36	1
Styrene	ND		1.0	0.73	ug/L			01/07/12 12:36	1
Tetrachloroethene	ND		1.0	0.36	ug/L			01/07/12 12:36	1
Toluene	ND		1.0	0.51	ug/L			01/07/12 12:36	1
trans-1,2-Dichloroethene	ND		1.0	0.90	ug/L			01/07/12 12:36	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			01/07/12 12:36	1
Trichloroethene	ND		1.0	0.46	ug/L			01/07/12 12:36	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			01/07/12 12:36	1
Vinyl chloride	ND		1.0	0.90	ug/L			01/07/12 12:36	1
Xylenes, Total	ND		2.0	0.66	ug/L			01/07/12 12:36	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*89*		*66 - 137*		*01/07/12 12:36*	*1*
Toluene-d8 (Surr)	*102*		*71 - 126*		*01/07/12 12:36*	*1*
4-Bromofluorobenzene (Surr)	*103*		*73 - 120*		*01/07/12 12:36*	*1*

Lab Sample ID: LCS 480-47214/4 **Client Sample ID: Lab Control Sample**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 47214

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1-Dichloroethane	25.0	23.5		ug/L		94	71 - 129
1,1-Dichloroethene	25.0	20.9		ug/L		84	65 - 138
1,2-Dichlorobenzene	25.0	25.3		ug/L		101	77 - 120
1,2-Dichloroethane	25.0	22.6		ug/L		90	75 - 127
Benzene	25.0	24.4		ug/L		98	71 - 124
Chlorobenzene	25.0	26.3		ug/L		105	72 - 120

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 480-47214/4 **Client Sample ID: Lab Control Sample**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 47214

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
cis-1,2-Dichloroethene	25.0	23.8		ug/L		95	74 - 124
Ethylbenzene	25.0	25.6		ug/L		102	77 - 123
Methyl tert-butyl ether	25.0	21.9		ug/L		88	64 - 127
Tetrachloroethene	25.0	25.2		ug/L		101	74 - 122
Toluene	25.0	25.9		ug/L		104	70 - 122
trans-1,2-Dichloroethene	25.0	24.9		ug/L		100	73 - 127
Trichloroethene	25.0	23.5		ug/L		94	74 - 123

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
1,2-Dichloroethane-d4 (Surr)	*89*		*66 - 137*
Toluene-d8 (Surr)	*102*		*71 - 126*
4-Bromofluorobenzene (Surr)	*104*		*73 - 120*

Method: RSK-175 - Dissolved Gases (GC)

Lab Sample ID: MB 480-47160/2 **Client Sample ID: Method Blank**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 47160

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethane	ND		1.5	0.49	ug/L			01/06/12 16:02	1
Ethene	ND		1.5	0.52	ug/L			01/06/12 16:02	1
Methane	0.328	J	1.0	0.22	ug/L			01/06/12 16:02	1

Lab Sample ID: LCS 480-47160/3 **Client Sample ID: Lab Control Sample**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 47160

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Ethane	7.21	7.81		ug/L		108	41 - 176
Ethene	6.73	7.28		ug/L		108	62 - 143
Methane	3.88	5.11		ug/L		132	67 - 140

Lab Sample ID: LCSD 480-47160/4 **Client Sample ID: Lab Control Sample Dup**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 47160

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Ethane	7.21	8.32		ug/L		115	41 - 176	6	50
Ethene	6.73	7.51		ug/L		112	62 - 143	3	50
Methane	3.88	5.25		ug/L		135	67 - 140	3	50

Lab Sample ID: MB 480-47480/2 **Client Sample ID: Method Blank**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 47480

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethane	ND		1.5	0.49	ug/L			01/10/12 15:02	1
Ethene	ND		1.5	0.52	ug/L			01/10/12 15:02	1
Methane	ND		1.0	0.22	ug/L			01/10/12 15:02	1

Method: RSK-175 - Dissolved Gases (GC) (Continued)

Lab Sample ID: LCS 480-47480/3
Matrix: Water
Analysis Batch: 47480

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Ethane	7.21	8.15		ug/L		113	41 - 176
Ethene	6.73	7.54		ug/L		112	62 - 143
Methane	3.88	4.67		ug/L		120	67 - 140

Lab Sample ID: LCSD 480-47480/4
Matrix: Water
Analysis Batch: 47480

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Ethane	7.21	8.61		ug/L		119	41 - 176	5	50
Ethene	6.73	8.08		ug/L		120	62 - 143	7	50
Methane	3.88	5.16		ug/L		133	67 - 140	10	50

Method: 300.0 - Anions, Ion Chromatography

Lab Sample ID: MB 480-47318/28
Matrix: Water
Analysis Batch: 47318

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND		0.50	0.28	mg/L			01/09/12 18:37	1
Sulfate	ND		2.0	0.35	mg/L			01/09/12 18:37	1

Lab Sample ID: LCS 480-47318/27
Matrix: Water
Analysis Batch: 47318

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	20.0	20.50		mg/L		103	90 - 110
Sulfate	20.0	20.90		mg/L		105	90 - 110

Method: SM 5310D - Organic Carbon, Total (TOC)

Lab Sample ID: MB 480-47544/3
Matrix: Water
Analysis Batch: 47544

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Organic Carbon	ND		1.0	0.43	mg/L			01/10/12 14:28	1

Lab Sample ID: LCS 480-47544/4
Matrix: Water
Analysis Batch: 47544

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Total Organic Carbon	60.0	59.69		mg/L		99	90 - 110

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Method: VFA-IC - Volatile Fatty Acids, Ion Chromatography

Lab Sample ID: MB 480-47126/4
Client Sample ID: Method Blank
Matrix: Water
Prep Type: Total/NA
Analysis Batch: 47126

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetic acid	ND		1.0	0.15	mg/L			01/06/12 17:07	1
Butyric acid	ND		1.0	0.16	mg/L			01/06/12 17:07	1
Propionic acid	ND		1.0	0.17	mg/L			01/06/12 17:07	1

Lab Sample ID: LCS 480-47126/3
Client Sample ID: Lab Control Sample
Matrix: Water
Prep Type: Total/NA
Analysis Batch: 47126

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acetic acid	10.0	10.50		mg/L		105	80 - 120
Butyric acid	10.0	10.40		mg/L		104	80 - 120
Propionic acid	10.0	10.70		mg/L		107	80 - 120

Lab Sample ID: 480-14696-6 MS
Client Sample ID: DUP-010412
Matrix: Water
Prep Type: Total/NA
Analysis Batch: 47126

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Acetic acid	39.7		10.0	50.20	E	mg/L		105	80 - 120
Butyric acid	ND		10.0	10.00		mg/L		100	80 - 120

Lab Sample ID: 480-14696-6 MSD
Client Sample ID: DUP-010412
Matrix: Water
Prep Type: Total/NA
Analysis Batch: 47126

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Acetic acid	39.7		10.0	51.20	E	mg/L		115	80 - 120	2	20
Butyric acid	ND		10.0	10.50		mg/L		105	80 - 120	5	20

Lab Sample ID: MB 480-47492/4
Client Sample ID: Method Blank
Matrix: Water
Prep Type: Total/NA
Analysis Batch: 47492

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetic acid	ND		1.0	0.15	mg/L			01/10/12 17:27	1
Butyric acid	ND		1.0	0.16	mg/L			01/10/12 17:27	1
Propionic acid	ND		1.0	0.17	mg/L			01/10/12 17:27	1

Lab Sample ID: LCS 480-47492/3
Client Sample ID: Lab Control Sample
Matrix: Water
Prep Type: Total/NA
Analysis Batch: 47492

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acetic acid	10.0	10.70		mg/L		107	80 - 120
Butyric acid	10.0	10.80		mg/L		108	80 - 120
Propionic acid	10.0	10.80		mg/L		108	80 - 120

GC/MS VOA

Analysis Batch: 47185

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-14696-1	RU-19-010412	Total/NA	Water	8260B	
480-14696-2	RU-20-010412	Total/NA	Water	8260B	
480-14696-4	RU-10-010412	Total/NA	Water	8260B	
480-14696-5	TRIP BLANK-010412	Total/NA	Water	8260B	
480-14696-6	DUP-010412	Total/NA	Water	8260B	
480-14696-7	FIIELD BLANK-010412	Total/NA	Water	8260B	
LCS 480-47185/4	Lab Control Sample	Total/NA	Water	8260B	
MB 480-47185/5	Method Blank	Total/NA	Water	8260B	

Analysis Batch: 47214

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-14696-1 - DL	RU-19-010412	Total/NA	Water	8260B	
480-14696-2 - DL	RU-20-010412	Total/NA	Water	8260B	
480-14696-3	RU-21-010412	Total/NA	Water	8260B	
480-14696-4 - DL	RU-10-010412	Total/NA	Water	8260B	
480-14696-6 - DL	DUP-010412	Total/NA	Water	8260B	
LCS 480-47214/4	Lab Control Sample	Total/NA	Water	8260B	
MB 480-47214/5	Method Blank	Total/NA	Water	8260B	

GC VOA

Analysis Batch: 47160

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-14696-1	RU-19-010412	Total/NA	Water	RSK-175	
480-14696-2	RU-20-010412	Total/NA	Water	RSK-175	
480-14696-3	RU-21-010412	Total/NA	Water	RSK-175	
480-14696-4	RU-10-010412	Total/NA	Water	RSK-175	
480-14696-6	DUP-010412	Total/NA	Water	RSK-175	
LCS 480-47160/3	Lab Control Sample	Total/NA	Water	RSK-175	
LCSD 480-47160/4	Lab Control Sample Dup	Total/NA	Water	RSK-175	
MB 480-47160/2	Method Blank	Total/NA	Water	RSK-175	

Analysis Batch: 47480

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-14696-1	RU-19-010412	Total/NA	Water	RSK-175	
480-14696-3	RU-21-010412	Total/NA	Water	RSK-175	
LCS 480-47480/3	Lab Control Sample	Total/NA	Water	RSK-175	
LCSD 480-47480/4	Lab Control Sample Dup	Total/NA	Water	RSK-175	
MB 480-47480/2	Method Blank	Total/NA	Water	RSK-175	

General Chemistry

Analysis Batch: 47126

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-14696-1	RU-19-010412	Total/NA	Water	VFA-IC	
480-14696-2	RU-20-010412	Total/NA	Water	VFA-IC	
480-14696-3	RU-21-010412	Total/NA	Water	VFA-IC	
480-14696-4	RU-10-010412	Total/NA	Water	VFA-IC	
480-14696-6	DUP-010412	Total/NA	Water	VFA-IC	
480-14696-6 MS	DUP-010412	Total/NA	Water	VFA-IC	
480-14696-6 MSD	DUP-010412	Total/NA	Water	VFA-IC	
LCS 480-47126/3	Lab Control Sample	Total/NA	Water	VFA-IC	

General Chemistry (Continued)

Analysis Batch: 47126 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 480-47126/4	Method Blank	Total/NA	Water	VFA-IC	

Analysis Batch: 47199

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-14696-1	RU-19-010412	Total/NA	Water	353.2	
480-14696-2	RU-20-010412	Total/NA	Water	353.2	
480-14696-3	RU-21-010412	Total/NA	Water	353.2	
480-14696-4	RU-10-010412	Total/NA	Water	353.2	
480-14696-6	DUP-010412	Total/NA	Water	353.2	

Analysis Batch: 47318

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-14696-1	RU-19-010412	Total/NA	Water	300.0	
480-14696-2	RU-20-010412	Total/NA	Water	300.0	
480-14696-3	RU-21-010412	Total/NA	Water	300.0	
480-14696-4	RU-10-010412	Total/NA	Water	300.0	
480-14696-6	DUP-010412	Total/NA	Water	300.0	
LCS 480-47318/27	Lab Control Sample	Total/NA	Water	300.0	
MB 480-47318/28	Method Blank	Total/NA	Water	300.0	

Analysis Batch: 47492

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-14696-3	RU-21-010412	Total/NA	Water	VFA-IC	
480-14696-4	RU-10-010412	Total/NA	Water	VFA-IC	
480-14696-6	DUP-010412	Total/NA	Water	VFA-IC	
LCS 480-47492/3	Lab Control Sample	Total/NA	Water	VFA-IC	
MB 480-47492/4	Method Blank	Total/NA	Water	VFA-IC	

Analysis Batch: 47544

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-14696-1	RU-19-010412	Total/NA	Water	SM 5310D	
480-14696-2	RU-20-010412	Total/NA	Water	SM 5310D	
480-14696-3	RU-21-010412	Total/NA	Water	SM 5310D	
480-14696-4	RU-10-010412	Total/NA	Water	SM 5310D	
480-14696-6	DUP-010412	Total/NA	Water	SM 5310D	
LCS 480-47544/4	Lab Control Sample	Total/NA	Water	SM 5310D	
MB 480-47544/3	Method Blank	Total/NA	Water	SM 5310D	

Client Sample ID: RU-19-010412 Lab Sample ID: 480-14696-1

Date Collected: 01/04/12 13:00 **Matrix: Water**
Date Received: 01/06/12 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	47185	01/06/12 23:55	DC	TAL BUF
Total/NA	Analysis	8260B	DL	10	47214	01/07/12 13:56	TRB	TAL BUF
Total/NA	Analysis	RSK-175		1	47160	01/06/12 17:19	JM	TAL BUF
Total/NA	Analysis	RSK-175		50	47480	01/10/12 16:09	JM	TAL BUF
Total/NA	Analysis	VFA-IC		1	47126	01/06/12 17:36	KAC	TAL BUF
Total/NA	Analysis	353.2		1	47199	01/06/12 19:05	EGN	TAL BUF
Total/NA	Analysis	300.0		1	47318	01/09/12 18:47	KAC	TAL BUF
Total/NA	Analysis	SM 5310D		1	47544	01/10/12 15:39	KAC	TAL BUF

Client Sample ID: RU-20-010412 Lab Sample ID: 480-14696-2

Date Collected: 01/04/12 15:15 **Matrix: Water**
Date Received: 01/06/12 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	47185	01/07/12 00:18	DC	TAL BUF
Total/NA	Analysis	8260B	DL	40	47214	01/07/12 14:18	TRB	TAL BUF
Total/NA	Analysis	RSK-175		1	47160	01/06/12 17:36	JM	TAL BUF
Total/NA	Analysis	VFA-IC		1	47126	01/06/12 18:05	KAC	TAL BUF
Total/NA	Analysis	353.2		1	47199	01/06/12 19:07	EGN	TAL BUF
Total/NA	Analysis	300.0		1	47318	01/09/12 18:57	KAC	TAL BUF
Total/NA	Analysis	SM 5310D		1	47544	01/10/12 15:56	KAC	TAL BUF

Client Sample ID: RU-21-010412 Lab Sample ID: 480-14696-3

Date Collected: 01/04/12 11:30 **Matrix: Water**
Date Received: 01/06/12 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		2	47214	01/07/12 14:40	TRB	TAL BUF
Total/NA	Analysis	RSK-175		1	47160	01/06/12 17:53	JM	TAL BUF
Total/NA	Analysis	RSK-175		50	47480	01/10/12 16:26	JM	TAL BUF
Total/NA	Analysis	VFA-IC		1	47126	01/06/12 18:35	KAC	TAL BUF
Total/NA	Analysis	353.2		1	47199	01/06/12 19:09	EGN	TAL BUF
Total/NA	Analysis	300.0		5	47318	01/09/12 19:07	KAC	TAL BUF
Total/NA	Analysis	VFA-IC		50	47492	01/10/12 17:57	KAC	TAL BUF
Total/NA	Analysis	SM 5310D		40	47544	01/10/12 16:14	KAC	TAL BUF

Client Sample ID: RU-10-010412 Lab Sample ID: 480-14696-4

Date Collected: 01/04/12 09:30 **Matrix: Water**
Date Received: 01/06/12 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	47185	01/07/12 01:02	DC	TAL BUF

Client Sample ID: RU-10-010412 Lab Sample ID: 480-14696-4
Date Collected: 01/04/12 09:30 **Matrix: Water**
Date Received: 01/06/12 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B	DL	2	47214	01/07/12 15:03	TRB	TAL BUF
Total/NA	Analysis	RSK-175		1	47160	01/06/12 18:10	JM	TAL BUF
Total/NA	Analysis	VFA-IC		1	47126	01/06/12 19:04	KAC	TAL BUF
Total/NA	Analysis	353.2		1	47199	01/06/12 19:11	EGN	TAL BUF
Total/NA	Analysis	300.0		1	47318	01/09/12 19:17	KAC	TAL BUF
Total/NA	Analysis	VFA-IC		2	47492	01/10/12 18:55	KAC	TAL BUF
Total/NA	Analysis	SM 5310D		10	47544	01/10/12 16:32	KAC	TAL BUF

Client Sample ID: TRIP BLANK-010412 Lab Sample ID: 480-14696-5
Date Collected: 01/04/12 00:00 **Matrix: Water**
Date Received: 01/06/12 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	47185	01/07/12 01:24	DC	TAL BUF

Client Sample ID: DUP-010412 Lab Sample ID: 480-14696-6
Date Collected: 01/04/12 00:00 **Matrix: Water**
Date Received: 01/06/12 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	47185	01/07/12 01:46	DC	TAL BUF
Total/NA	Analysis	8260B	DL	2	47214	01/07/12 15:25	TRB	TAL BUF
Total/NA	Analysis	RSK-175		1	47160	01/06/12 18:27	JM	TAL BUF
Total/NA	Analysis	VFA-IC		1	47126	01/06/12 19:33	KAC	TAL BUF
Total/NA	Analysis	353.2		1	47199	01/06/12 19:13	EGN	TAL BUF
Total/NA	Analysis	300.0		1	47318	01/09/12 19:27	KAC	TAL BUF
Total/NA	Analysis	VFA-IC		20	47492	01/10/12 19:53	KAC	TAL BUF
Total/NA	Analysis	SM 5310D		10	47544	01/10/12 16:49	KAC	TAL BUF

Client Sample ID: FIIELD BLANK-010412 Lab Sample ID: 480-14696-7
Date Collected: 01/04/12 16:30 **Matrix: Water**
Date Received: 01/06/12 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	47185	01/07/12 02:08	DC	TAL BUF

Laboratory References:

TAL BUF = TestAmerica Buffalo, 10 Hazelwood Drive, Amherst, NY 14228-2298, TEL (716)691-2600

Certification Summary

Client: CDM Smith, Inc.
Project/Site: New York state project

TestAmerica Job ID: 480-14696-1

Laboratory	Authority	Program	EPA Region	Certification ID
TestAmerica Buffalo	Arkansas	State Program	6	88-0686
TestAmerica Buffalo	California	NELAC	9	1169CA
TestAmerica Buffalo	Connecticut	State Program	1	PH-0568
TestAmerica Buffalo	Florida	NELAC	4	E87672
TestAmerica Buffalo	Georgia	Georgia EPD	4	N/A
TestAmerica Buffalo	Georgia	State Program	4	956
TestAmerica Buffalo	Illinois	NELAC	5	100325 / 200003
TestAmerica Buffalo	Iowa	State Program	7	374
TestAmerica Buffalo	Kansas	NELAC	7	E-10187
TestAmerica Buffalo	Kentucky	Kentucky UST	4	30
TestAmerica Buffalo	Kentucky	State Program	4	90029
TestAmerica Buffalo	Louisiana	NELAC	6	02031
TestAmerica Buffalo	Maine	State Program	1	NY0044
TestAmerica Buffalo	Maryland	State Program	3	294
TestAmerica Buffalo	Massachusetts	State Program	1	M-NY044
TestAmerica Buffalo	Michigan	State Program	5	9937
TestAmerica Buffalo	Minnesota	NELAC	5	036-999-337
TestAmerica Buffalo	New Hampshire	NELAC	1	2337
TestAmerica Buffalo	New Hampshire	NELAC	1	68-00281
TestAmerica Buffalo	New Jersey	NELAC	2	NY455
TestAmerica Buffalo	New York	NELAC	2	10026
TestAmerica Buffalo	North Dakota	State Program	8	R-176
TestAmerica Buffalo	Oklahoma	State Program	6	9421
TestAmerica Buffalo	Oregon	NELAC	10	NY200003
TestAmerica Buffalo	Pennsylvania	NELAC	3	68-00281
TestAmerica Buffalo	Tennessee	State Program	4	TN02970
TestAmerica Buffalo	Texas	NELAC	6	T104704412-08-TX
TestAmerica Buffalo	USDA	USDA		P330-08-00242
TestAmerica Buffalo	Virginia	NELAC Secondary AB	3	460185
TestAmerica Buffalo	Virginia	State Program	3	278
TestAmerica Buffalo	Washington	State Program	10	C1677
TestAmerica Buffalo	Wisconsin	State Program	5	998310390

Accreditation may not be offered or required for all methods and analytes reported in this package. Please contact your project manager for the laboratory's current list of certified methods and analytes.

Method Summary

Client: CDM Smith, Inc.
Project/Site: New York state project

TestAmerica Job ID: 480-14696-1

Method	Method Description	Protocol	Laboratory
8260B	Volatile Organic Compounds (GC/MS)	SW846	TAL BUF
RSK-175	Dissolved Gases (GC)	RSK	TAL BUF
300.0	Anions, Ion Chromatography	MCAWW	TAL BUF
353.2	Nitrate	EPA	TAL BUF
SM 5310D	Organic Carbon, Total (TOC)	SM	TAL BUF
VFA-IC	Volatile Fatty Acids, Ion Chromatography	TestAmerica SOP	TAL BUF

Protocol References:

EPA = US Environmental Protection Agency

MCAWW = "Methods For Chemical Analysis Of Water And Wastes", EPA-600/4-79-020, March 1983 And Subsequent Revisions.

RSK = Sample Prep And Calculations For Dissolved Gas Analysis In Water Samples Using A GC Headspace Equilibration Technique, RSKSOP-175, Rev. 0, 8/11/94, USEPA Research Lab

SM = "Standard Methods For The Examination Of Water And Wastewater",

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

TestAmerica SOP = TestAmerica, Inc., Standard Operating Procedure

Laboratory References:

TAL BUF = TestAmerica Buffalo, 10 Hazelwood Drive, Amherst, NY 14228-2298, TEL (716)691-2600

Sample Summary

Client: CDM Smith, Inc.

TestAmerica Job ID: 480-14696-1

Project/Site: New York state project

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
480-14696-1	RU-19-010412	Water	01/04/12 13:00	01/06/12 09:30
480-14696-2	RU-20-010412	Water	01/04/12 15:15	01/06/12 09:30
480-14696-3	RU-21-010412	Water	01/04/12 11:30	01/06/12 09:30
480-14696-4	RU-10-010412	Water	01/04/12 09:30	01/06/12 09:30
480-14696-5	TRIP BLANK-010412	Water	01/04/12 00:00	01/06/12 09:30
480-14696-6	DUP-010412	Water	01/04/12 00:00	01/06/12 09:30
480-14696-7	FIIELD BLANK-010412	Water	01/04/12 16:30	01/06/12 09:30

TestAmerica Buffalo
10 Hazelwood Drive
Amherst, NY 14228-2298
Phone (716) 691-2600 Fax (716) 691-7991

Chain of Custody Record

TestAmerica

Client Information		Sampler: E Rosenzweig	Lab PM: Gray-Erdmann, Peggy	Carrier Tracking No(s):	COC No.: 480-20295-5089.1
Client Contact: Neil Smith		Phone: 518-380-4332	E-Mail: peggy.gray-erdmann@testamericainc.com		Page: Page 1 of 1
Company: Camp Dresser & McKee Inc					Job #:
Address: 555 17th Street Suite 1100		Due Date Requested:			
City: Denver		TAT Requested (days): Standard			
State, Zip: CO, 80202					
Phone: 303-383-2447(Tel)		PO #: Purchase Order not required			
Email: SmithNL@cdm.com		WO #:			
Project Name: New York state project		Project #: 48005039			
Site:		SSOW#:			

Analysis Requested

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8260B - Volatile Organics	VFA_IC - VFA Compounds	300.0_28D - Sulfate,Chloride	SM5310D - Total Organic Carbon	RSK_175 - Methane/Ethane/Ethene	353.2, 353.2_Nitrite, Nitrate_Calc	Total Number of containers	Special Instructions/Note:
			Preservation Code:				A	N	N	A	A	S		
RU-19-010412	1/4/12	1300		Water	N	N	X	X	X	X	X	X		
RU-20-010412		1515		Water			X	X	X	X	X	X		
RU-21-010412		1130		Water			X	X	X	X	X	X		
RU-10-010412		0930		Water			X	X	X	X	X	X		
Trip Blank-010412		—		Water			X							
Dup-010412		—		Water			X	X	X	X	X	X		
Field Blank-010412		1620		Water			X							
				Water										
				Water										
				Water										
				Water										

Preservation Codes:
A - HCL
B - NaOH
C - Zn Acetate
D - Nitric Acid
E - NaHSO4
F - MeOH
G - Amchlor
H - Ascorbic Acid
I - Ice
J - DI Water
K - EDTA
L - EDA
M - Hexane
N - None
O - AsNaO2
P - Na2O4S
Q - Na2SO3
R - Na2S2SO3
S - H2SO4
T - TSP Dodecahydrate
U - Acetone
V - MCAA
W - ph 4-5
Z - other (specify)
Other:

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

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

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:		Date:	Time:		Method of Shipment:	
Relinquished by: E Rosenzweig	Date/Time: 1/5/12 / 11:45	Company: CDM Smith	Received by: R. Engelhardt		Date/Time: 01-05-12 11:45	Company: SYR
Relinquished by: [illegible]	Date/Time: 01-05-12, 16:00	Company: SYR	Received by: [illegible]		Date/Time: 1/6/12 930	Company: [illegible]
Relinquished by:	Date/Time:	Company:	Received by:		Date/Time:	Company:
Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:		Cooler Temperature(s) °C and Other Remarks: 1.7 #1			

Login Sample Receipt Checklist

Client: CDM Smith, Inc.

Job Number: 480-14696-1

Login Number: 14696

List Source: TestAmerica Buffalo

List Number: 1

Creator: Janish, Carl

Question	Answer	Comment
Radioactivity either was not measured or, if measured, is at or below background	True	
The cooler's custody seal, if present, is intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	True	
If necessary, staff have been informed of any short hold time or quick TAT needs	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Sampling Company provided.	True	CDM
Samples received within 48 hours of sampling.	True	
Samples requiring field filtration have been filtered in the field.	N/A	
Chlorine Residual checked.	N/A	

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Buffalo
10 Hazelwood Drive
Amherst, NY 14228-2298
Tel: (716)691-2600

TestAmerica Job ID: 480-16799-1
Client Project/Site: New York state project

For:
CDM Smith, Inc.
555 17th Street
Suite 1100
Denver, Colorado 80202

Attn: Neil Smith

EBerry

Authorized for release by:
3/15/2012 11:04:10 AM
Eve Berry
Project Administrator
eve.berry@testamericainc.com

Designee for

Peggy Gray-Erdmann
Project Manager II
peggy.gray-erdmann@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Qualifiers

GC/MS VOA

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

GC VOA

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

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
☼	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DL, RA, RE, IN	Indicates a Dilution, Reanalysis, Re-extraction, or additional Initial metals/anion analysis of the sample
EDL	Estimated Detection Limit
EPA	United States Environmental Protection Agency
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RL	Reporting Limit
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 480-16799-1

Laboratory: TestAmerica Buffalo

Narrative

Job Narrative
480-16799-1

Receipt
All samples were received in good condition within temperature requirements.

GC/MS VOA
Method(s) 8260B: The following sample was diluted due to the abundance of target analytes: RU-19 (480-16799-1). Elevated reporting limits (RLs) are provided.

Method(s) 8260B: The following samples were diluted due to the abundance of target analytes: DUP-1 (480-16799-5), RU-10 (480-16799-2), RU-19 (480-16799-1), RU-20 (480-16799-3), RU-21 (480-16799-4). Elevated reporting limits (RLs) are provided.

No other analytical or quality issues were noted.

IC
Method(s) 300.0: In batch 54087, the following sample was diluted due to the abundance of target analytes: RU-21 (480-16799-4). Elevated reporting limits (RLs) are provided.

Method(s) 300.0: In batch 54605, the following sample was diluted due to the abundance of target analytes: RU-21 (480-16799-4). Elevated reporting limits (RLs) are provided.

Method(s) VFA-IC: In batch 54385, the following samples were diluted due to the abundance of target analytes: (480-16799-4 MS), (480-16799-4 MSD), RU-20 (480-16799-3), RU-21 (480-16799-4). Elevated reporting limits (RLs) are provided.

No other analytical or quality issues were noted.

GC VOA
Method(s) RSK-175: The following samples were diluted due to the abundance of target analytes: MW-12I (480-16712-12), MW-12I (480-16712-12 MS), MW-12I (480-16712-12 MSD). Elevated reporting limits (RLs) are provided.

Method(s) RSK-175: The following sample was diluted due to the abundance of target analytes: RU-21 (480-16799-4). Elevated reporting limits (RLs) are provided.

No other analytical or quality issues were noted.

General Chemistry
No analytical or quality issues were noted.

Detection Summary

Client: CDM Smith, Inc.
Project/Site: New York state project

TestAmerica Job ID: 480-16799-1

Client Sample ID: RU-19

Lab Sample ID: 480-16799-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	410		10	8.1	ug/L	10		8260B	Total/NA
Vinyl chloride	45		10	9.0	ug/L	10		8260B	Total/NA
Trichloroethene - DL	1100		20	9.2	ug/L	20		8260B	Total/NA
Ethane	4.9		1.5	0.49	ug/L	1		RSK-175	Total/NA
Ethene	0.57	J	1.5	0.52	ug/L	1		RSK-175	Total/NA
Methane	150		1.0	0.22	ug/L	1		RSK-175	Total/NA
Chloride	26.0		0.50	0.28	mg/L	1		300.0	Total/NA
Sulfate	44.9		2.0	0.35	mg/L	1		300.0	Total/NA
Total Organic Carbon	2.4		1.0	0.43	mg/L	1		SM 5310D	Total/NA

Client Sample ID: RU-10

Lab Sample ID: 480-16799-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,1-Dichloroethene	1.3		1.0	0.29	ug/L	1		8260B	Total/NA
Acetone	7.0	J	10	3.0	ug/L	1		8260B	Total/NA
Tetrachloroethene	0.46	J	1.0	0.36	ug/L	1		8260B	Total/NA
trans-1,2-Dichloroethene	2.5		1.0	0.90	ug/L	1		8260B	Total/NA
Vinyl chloride	19		1.0	0.90	ug/L	1		8260B	Total/NA
cis-1,2-Dichloroethene - DL	200		5.0	4.1	ug/L	5		8260B	Total/NA
Trichloroethene - DL	330		5.0	2.3	ug/L	5		8260B	Total/NA
Ethane	5.7		1.5	0.49	ug/L	1		RSK-175	Total/NA
Ethene	0.54	J	1.5	0.52	ug/L	1		RSK-175	Total/NA
Methane	120		1.0	0.22	ug/L	1		RSK-175	Total/NA
Chloride	11.1		0.50	0.28	mg/L	1		300.0	Total/NA
Sulfate	23.2		2.0	0.35	mg/L	1		300.0	Total/NA
Nitrate Nitrite as N	0.56		0.050	0.020	mg/L	1		353.2	Total/NA
Total Organic Carbon	17.2		1.0	0.43	mg/L	1		SM 5310D	Total/NA
Acetic acid	7.4		1.0	0.15	mg/L	1		VFA-IC	Total/NA
Propionic acid	17.7		1.0	0.17	mg/L	1		VFA-IC	Total/NA

Client Sample ID: RU-20

Lab Sample ID: 480-16799-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	75		25	20	ug/L	25		8260B	Total/NA
Methyl acetate	13	J	25	13	ug/L	25		8260B	Total/NA
Trichloroethene	1900		25	12	ug/L	25		8260B	Total/NA
Ethane	1.9		1.5	0.49	ug/L	1		RSK-175	Total/NA
Ethene	3.5		1.5	0.52	ug/L	1		RSK-175	Total/NA
Methane	4.6		1.0	0.22	ug/L	1		RSK-175	Total/NA
Chloride	71.1		0.50	0.28	mg/L	1		300.0	Total/NA
Sulfate	9.9		2.0	0.35	mg/L	1		300.0	Total/NA
Nitrate Nitrite as N	0.24		0.050	0.020	mg/L	1		353.2	Total/NA
Total Organic Carbon	171		10.0	4.3	mg/L	10		SM 5310D	Total/NA
Acetic acid	67.4		2.0	0.30	mg/L	2		VFA-IC	Total/NA
Propionic acid	58.8		2.0	0.34	mg/L	2		VFA-IC	Total/NA

Client Sample ID: RU-21

Lab Sample ID: 480-16799-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
2-Butanone (MEK)	100		20	2.6	ug/L	2		8260B	Total/NA
Acetone	95		20	6.0	ug/L	2		8260B	Total/NA
Chloroethane	0.64	J	2.0	0.64	ug/L	2		8260B	Total/NA
cis-1,2-Dichloroethene	50		2.0	1.6	ug/L	2		8260B	Total/NA
Trichloroethene	55		2.0	0.92	ug/L	2		8260B	Total/NA

Client Sample ID: RU-21 (Continued) Lab Sample ID: 480-16799-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Vinyl chloride	150		2.0	1.8	ug/L	2		8260B	Total/NA
Ethane	8.4		1.5	0.49	ug/L	1		RSK-175	Total/NA
Ethene	23		1.5	0.52	ug/L	1		RSK-175	Total/NA
Methane - DL	300		100	22	ug/L	100		RSK-175	Total/NA
Chloride	18.4		2.5	1.4	mg/L	5		300.0	Total/NA
Sulfate	4.4		2.0	0.35	mg/L	1		300.0	Total/NA
Total Organic Carbon	1070		40.0	17.4	mg/L	40		SM 5310D	Total/NA
Acetic acid	740		50.0	7.5	mg/L	50		VFA-IC	Total/NA
Butyric acid	40.0		1.0	0.16	mg/L	1		VFA-IC	Total/NA
Propionic acid	1370		50.0	8.5	mg/L	50		VFA-IC	Total/NA

Client Sample ID: DUP-1 Lab Sample ID: 480-16799-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	14	J	40	12	ug/L	4		8260B	Total/NA
cis-1,2-Dichloroethene	190		4.0	3.2	ug/L	4		8260B	Total/NA
Trichloroethene	320		4.0	1.8	ug/L	4		8260B	Total/NA
Vinyl chloride	19		4.0	3.6	ug/L	4		8260B	Total/NA
Ethane	6.5		1.5	0.49	ug/L	1		RSK-175	Total/NA
Ethene	0.58	J	1.5	0.52	ug/L	1		RSK-175	Total/NA
Methane	150		1.0	0.22	ug/L	1		RSK-175	Total/NA
Chloride	10.4		0.50	0.28	mg/L	1		300.0	Total/NA
Sulfate	21.7		2.0	0.35	mg/L	1		300.0	Total/NA
Nitrate Nitrite as N	0.47		0.050	0.020	mg/L	1		353.2	Total/NA
Total Organic Carbon	16.0		1.0	0.43	mg/L	1		SM 5310D	Total/NA
Acetic acid	6.5		1.0	0.15	mg/L	1		VFA-IC	Total/NA
Propionic acid	14.6		1.0	0.17	mg/L	1		VFA-IC	Total/NA

Client Sample ID: FB-1 Lab Sample ID: 480-16799-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	4.1	J	10	3.0	ug/L	1		8260B	Total/NA

Client Sample ID: TRIP BLANK Lab Sample ID: 480-16799-7

No Detections

Client Sample Results

Client: CDM Smith, Inc.
Project/Site: New York state project

TestAmerica Job ID: 480-16799-1

Client Sample ID: RU-19
Date Collected: 02/29/12 13:50
Date Received: 03/02/12 11:30

Lab Sample ID: 480-16799-1
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		10	8.2	ug/L			03/06/12 16:29	10
1,1,2,2-Tetrachloroethane	ND		10	2.1	ug/L			03/06/12 16:29	10
1,1,2-Trichloroethane	ND		10	2.3	ug/L			03/06/12 16:29	10
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		10	3.1	ug/L			03/06/12 16:29	10
1,1-Dichloroethane	ND		10	3.8	ug/L			03/06/12 16:29	10
1,1-Dichloroethene	ND		10	2.9	ug/L			03/06/12 16:29	10
1,2,4-Trichlorobenzene	ND		10	4.1	ug/L			03/06/12 16:29	10
1,2-Dibromo-3-Chloropropane	ND		10	3.9	ug/L			03/06/12 16:29	10
1,2-Dibromoethane	ND		10	7.3	ug/L			03/06/12 16:29	10
1,2-Dichlorobenzene	ND		10	7.9	ug/L			03/06/12 16:29	10
1,2-Dichloroethane	ND		10	2.1	ug/L			03/06/12 16:29	10
1,2-Dichloropropane	ND		10	7.2	ug/L			03/06/12 16:29	10
1,3-Dichlorobenzene	ND		10	7.8	ug/L			03/06/12 16:29	10
1,4-Dichlorobenzene	ND		10	8.4	ug/L			03/06/12 16:29	10
2-Hexanone	ND		50	12	ug/L			03/06/12 16:29	10
2-Butanone (MEK)	ND		100	13	ug/L			03/06/12 16:29	10
4-Methyl-2-pentanone (MIBK)	ND		50	21	ug/L			03/06/12 16:29	10
Acetone	ND		100	30	ug/L			03/06/12 16:29	10
Benzene	ND		10	4.1	ug/L			03/06/12 16:29	10
Bromodichloromethane	ND		10	3.9	ug/L			03/06/12 16:29	10
Bromoform	ND		10	2.6	ug/L			03/06/12 16:29	10
Bromomethane	ND		10	6.9	ug/L			03/06/12 16:29	10
Carbon disulfide	ND		10	1.9	ug/L			03/06/12 16:29	10
Carbon tetrachloride	ND		10	2.7	ug/L			03/06/12 16:29	10
Chlorobenzene	ND		10	7.5	ug/L			03/06/12 16:29	10
Dibromochloromethane	ND		10	3.2	ug/L			03/06/12 16:29	10
Chloroethane	ND		10	3.2	ug/L			03/06/12 16:29	10
Chloroform	ND		10	3.4	ug/L			03/06/12 16:29	10
Chloromethane	ND		10	3.5	ug/L			03/06/12 16:29	10
cis-1,2-Dichloroethene	**410**		10	8.1	ug/L			03/06/12 16:29	10
cis-1,3-Dichloropropene	ND		10	3.6	ug/L			03/06/12 16:29	10
Cyclohexane	ND		10	1.8	ug/L			03/06/12 16:29	10
Dichlorodifluoromethane	ND		10	6.8	ug/L			03/06/12 16:29	10
Ethylbenzene	ND		10	7.4	ug/L			03/06/12 16:29	10
Isopropylbenzene	ND		10	7.9	ug/L			03/06/12 16:29	10
Methyl acetate	ND		10	5.0	ug/L			03/06/12 16:29	10
Methyl tert-butyl ether	ND		10	1.6	ug/L			03/06/12 16:29	10
Methylcyclohexane	ND		10	1.6	ug/L			03/06/12 16:29	10
Methylene Chloride	ND		10	4.4	ug/L			03/06/12 16:29	10
Styrene	ND		10	7.3	ug/L			03/06/12 16:29	10
Tetrachloroethene	ND		10	3.6	ug/L			03/06/12 16:29	10
Toluene	ND		10	5.1	ug/L			03/06/12 16:29	10
trans-1,2-Dichloroethene	ND		10	9.0	ug/L			03/06/12 16:29	10
trans-1,3-Dichloropropene	ND		10	3.7	ug/L			03/06/12 16:29	10
Trichlorofluoromethane	ND		10	8.8	ug/L			03/06/12 16:29	10
Vinyl chloride	**45**		10	9.0	ug/L			03/06/12 16:29	10
Xylenes, Total	ND		20	6.6	ug/L			03/06/12 16:29	10

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*110*		*66 - 137*		*03/06/12 16:29*	*10*
Toluene-d8 (Surr)	*120*		*71 - 126*		*03/06/12 16:29*	*10*

Client Sample ID: RU-19
Lab Sample ID: 480-16799-1
Date Collected: 02/29/12 13:50
Matrix: Water
Date Received: 03/02/12 11:30

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	110		73 - 120		03/06/12 16:29	10

Method: 8260B - Volatile Organic Compounds (GC/MS) - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Trichloroethene	**1100**		20	9.2	ug/L			03/07/12 00:12	20

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	111		66 - 137		03/07/12 00:12	20
Toluene-d8 (Surr)	120		71 - 126		03/07/12 00:12	20
4-Bromofluorobenzene (Surr)	108		73 - 120		03/07/12 00:12	20

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethane	**4.9**		1.5	0.49	ug/L			03/04/12 13:38	1
Ethene	**0.57**	**J**	1.5	0.52	ug/L			03/04/12 13:38	1
Methane	**150**		1.0	0.22	ug/L			03/04/12 13:38	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**26.0**		0.50	0.28	mg/L			03/07/12 16:42	1
Sulfate	**44.9**		2.0	0.35	mg/L			03/07/12 16:42	1
Nitrate Nitrite as N	ND		0.050	0.020	mg/L			03/07/12 17:20	1
Total Organic Carbon	**2.4**		1.0	0.43	mg/L			03/08/12 23:43	1
Acetic acid	ND		1.0	0.15	mg/L			03/07/12 22:19	1
Butyric acid	ND		1.0	0.16	mg/L			03/07/12 22:19	1
Propionic acid	ND		1.0	0.17	mg/L			03/07/12 22:19	1

Client Sample ID: RU-10
Lab Sample ID: 480-16799-2
Date Collected: 02/29/12 12:20
Matrix: Water
Date Received: 03/02/12 11:30

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			03/06/12 16:50	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			03/06/12 16:50	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			03/06/12 16:50	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			03/06/12 16:50	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			03/06/12 16:50	1
1,1-Dichloroethene	**1.3**		1.0	0.29	ug/L			03/06/12 16:50	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			03/06/12 16:50	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			03/06/12 16:50	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			03/06/12 16:50	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			03/06/12 16:50	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			03/06/12 16:50	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			03/06/12 16:50	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			03/06/12 16:50	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			03/06/12 16:50	1
2-Hexanone	ND		5.0	1.2	ug/L			03/06/12 16:50	1
2-Butanone (MEK)	ND		10	1.3	ug/L			03/06/12 16:50	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			03/06/12 16:50	1
Acetone	**7.0**	**J**	10	3.0	ug/L			03/06/12 16:50	1
Benzene	ND		1.0	0.41	ug/L			03/06/12 16:50	1

Client: CDM Smith, Inc. TestAmerica Job ID: 480-16799-1
Project/Site: New York state project

Client Sample ID: RU-10 **Lab Sample ID: 480-16799-2**
Date Collected: 02/29/12 12:20 **Matrix: Water**
Date Received: 03/02/12 11:30

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromodichloromethane	ND		1.0	0.39	ug/L			03/06/12 16:50	1
Bromoform	ND		1.0	0.26	ug/L			03/06/12 16:50	1
Bromomethane	ND		1.0	0.69	ug/L			03/06/12 16:50	1
Carbon disulfide	ND		1.0	0.19	ug/L			03/06/12 16:50	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			03/06/12 16:50	1
Chlorobenzene	ND		1.0	0.75	ug/L			03/06/12 16:50	1
Dibromochloromethane	ND		1.0	0.32	ug/L			03/06/12 16:50	1
Chloroethane	ND		1.0	0.32	ug/L			03/06/12 16:50	1
Chloroform	ND		1.0	0.34	ug/L			03/06/12 16:50	1
Chloromethane	ND		1.0	0.35	ug/L			03/06/12 16:50	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			03/06/12 16:50	1
Cyclohexane	ND		1.0	0.18	ug/L			03/06/12 16:50	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			03/06/12 16:50	1
Ethylbenzene	ND		1.0	0.74	ug/L			03/06/12 16:50	1
Isopropylbenzene	ND		1.0	0.79	ug/L			03/06/12 16:50	1
Methyl acetate	ND		1.0	0.50	ug/L			03/06/12 16:50	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			03/06/12 16:50	1
Methylcyclohexane	ND		1.0	0.16	ug/L			03/06/12 16:50	1
Methylene Chloride	ND		1.0	0.44	ug/L			03/06/12 16:50	1
Styrene	ND		1.0	0.73	ug/L			03/06/12 16:50	1
Tetrachloroethene	**0.46**	**J**	1.0	0.36	ug/L			03/06/12 16:50	1
Toluene	ND		1.0	0.51	ug/L			03/06/12 16:50	1
trans-1,2-Dichloroethene	**2.5**		1.0	0.90	ug/L			03/06/12 16:50	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			03/06/12 16:50	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			03/06/12 16:50	1
Vinyl chloride	**19**		1.0	0.90	ug/L			03/06/12 16:50	1
Xylenes, Total	ND		2.0	0.66	ug/L			03/06/12 16:50	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*112*		*66 - 137*		*03/06/12 16:50*	*1*
Toluene-d8 (Surr)	*118*		*71 - 126*		*03/06/12 16:50*	*1*
4-Bromofluorobenzene (Surr)	*110*		*73 - 120*		*03/06/12 16:50*	*1*

Method: 8260B - Volatile Organic Compounds (GC/MS) - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	**200**		5.0	4.1	ug/L			03/07/12 00:34	5
Trichloroethene	**330**		5.0	2.3	ug/L			03/07/12 00:34	5

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*109*		*66 - 137*		*03/07/12 00:34*	*5*
Toluene-d8 (Surr)	*117*		*71 - 126*		*03/07/12 00:34*	*5*
4-Bromofluorobenzene (Surr)	*105*		*73 - 120*		*03/07/12 00:34*	*5*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethane	**5.7**		1.5	0.49	ug/L			03/04/12 13:55	1
Ethene	**0.54**	**J**	1.5	0.52	ug/L			03/04/12 13:55	1
Methane	**120**		1.0	0.22	ug/L			03/04/12 13:55	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**11.1**		0.50	0.28	mg/L			03/07/12 16:53	1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Client Sample ID: RU-10
Lab Sample ID: 480-16799-2
Date Collected: 02/29/12 12:20
Matrix: Water
Date Received: 03/02/12 11:30

General Chemistry (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Sulfate	**23.2**		2.0	0.35	mg/L			03/07/12 16:53	1
Nitrate Nitrite as N	**0.56**		0.050	0.020	mg/L			03/07/12 17:22	1
Total Organic Carbon	**17.2**		1.0	0.43	mg/L			03/09/12 00:00	1
Acetic acid	**7.4**		1.0	0.15	mg/L			03/07/12 22:49	1
Butyric acid	ND		1.0	0.16	mg/L			03/07/12 22:49	1
Propionic acid	**17.7**		1.0	0.17	mg/L			03/07/12 22:49	1

Client Sample ID: RU-20
Lab Sample ID: 480-16799-3
Date Collected: 02/29/12 15:05
Matrix: Water
Date Received: 03/02/12 11:30

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		25	21	ug/L			03/07/12 00:56	25
1,1,2,2-Tetrachloroethane	ND		25	5.3	ug/L			03/07/12 00:56	25
1,1,2-Trichloroethane	ND		25	5.8	ug/L			03/07/12 00:56	25
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		25	7.8	ug/L			03/07/12 00:56	25
1,1-Dichloroethane	ND		25	9.5	ug/L			03/07/12 00:56	25
1,1-Dichloroethene	ND		25	7.3	ug/L			03/07/12 00:56	25
1,2,4-Trichlorobenzene	ND		25	10	ug/L			03/07/12 00:56	25
1,2-Dibromo-3-Chloropropane	ND		25	9.8	ug/L			03/07/12 00:56	25
1,2-Dibromoethane	ND		25	18	ug/L			03/07/12 00:56	25
1,2-Dichlorobenzene	ND		25	20	ug/L			03/07/12 00:56	25
1,2-Dichloroethane	ND		25	5.3	ug/L			03/07/12 00:56	25
1,2-Dichloropropane	ND		25	18	ug/L			03/07/12 00:56	25
1,3-Dichlorobenzene	ND		25	20	ug/L			03/07/12 00:56	25
1,4-Dichlorobenzene	ND		25	21	ug/L			03/07/12 00:56	25
2-Hexanone	ND		130	31	ug/L			03/07/12 00:56	25
2-Butanone (MEK)	ND		250	33	ug/L			03/07/12 00:56	25
4-Methyl-2-pentanone (MIBK)	ND		130	53	ug/L			03/07/12 00:56	25
Acetone	ND		250	75	ug/L			03/07/12 00:56	25
Benzene	ND		25	10	ug/L			03/07/12 00:56	25
Bromodichloromethane	ND		25	9.8	ug/L			03/07/12 00:56	25
Bromoform	ND		25	6.5	ug/L			03/07/12 00:56	25
Bromomethane	ND		25	17	ug/L			03/07/12 00:56	25
Carbon disulfide	ND		25	4.8	ug/L			03/07/12 00:56	25
Carbon tetrachloride	ND		25	6.8	ug/L			03/07/12 00:56	25
Chlorobenzene	ND		25	19	ug/L			03/07/12 00:56	25
Dibromochloromethane	ND		25	8.0	ug/L			03/07/12 00:56	25
Chloroethane	ND		25	8.0	ug/L			03/07/12 00:56	25
Chloroform	ND		25	8.5	ug/L			03/07/12 00:56	25
Chloromethane	ND		25	8.8	ug/L			03/07/12 00:56	25
cis-1,2-Dichloroethene	**75**		25	20	ug/L			03/07/12 00:56	25
cis-1,3-Dichloropropene	ND		25	9.0	ug/L			03/07/12 00:56	25
Cyclohexane	ND		25	4.5	ug/L			03/07/12 00:56	25
Dichlorodifluoromethane	ND		25	17	ug/L			03/07/12 00:56	25
Ethylbenzene	ND		25	19	ug/L			03/07/12 00:56	25
Isopropylbenzene	ND		25	20	ug/L			03/07/12 00:56	25
Methyl acetate	**13**	**J**	25	13	ug/L			03/07/12 00:56	25
Methyl tert-butyl ether	ND		25	4.0	ug/L			03/07/12 00:56	25
Methylcyclohexane	ND		25	4.0	ug/L			03/07/12 00:56	25

Client Sample ID: RU-20

Lab Sample ID: 480-16799-3
Date Collected: 02/29/12 15:05
Matrix: Water
Date Received: 03/02/12 11:30

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methylene Chloride	ND		25	11	ug/L			03/07/12 00:56	25
Styrene	ND		25	18	ug/L			03/07/12 00:56	25
Tetrachloroethene	ND		25	9.0	ug/L			03/07/12 00:56	25
Toluene	ND		25	13	ug/L			03/07/12 00:56	25
trans-1,2-Dichloroethene	ND		25	23	ug/L			03/07/12 00:56	25
trans-1,3-Dichloropropene	ND		25	9.3	ug/L			03/07/12 00:56	25
Trichloroethene	**1900**		25	12	ug/L			03/07/12 00:56	25
Trichlorofluoromethane	ND		25	22	ug/L			03/07/12 00:56	25
Vinyl chloride	ND		25	23	ug/L			03/07/12 00:56	25
Xylenes, Total	ND		50	17	ug/L			03/07/12 00:56	25

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*111*		*66 - 137*		*03/07/12 00:56*	*25*
Toluene-d8 (Surr)	*119*		*71 - 126*		*03/07/12 00:56*	*25*
4-Bromofluorobenzene (Surr)	*108*		*73 - 120*		*03/07/12 00:56*	*25*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethane	**1.9**		1.5	0.49	ug/L			03/04/12 14:12	1
Ethene	**3.5**		1.5	0.52	ug/L			03/04/12 14:12	1
Methane	**4.6**		1.0	0.22	ug/L			03/04/12 14:12	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**71.1**		0.50	0.28	mg/L			03/07/12 17:03	1
Sulfate	**9.9**		2.0	0.35	mg/L			03/07/12 17:03	1
Nitrate Nitrite as N	**0.24**		0.050	0.020	mg/L			03/07/12 17:23	1
Total Organic Carbon	**171**		10.0	4.3	mg/L			03/13/12 21:44	10
Acetic acid	**67.4**		2.0	0.30	mg/L			03/08/12 23:52	2
Butyric acid	ND		1.0	0.16	mg/L			03/07/12 23:18	1
Propionic acid	**58.8**		2.0	0.34	mg/L			03/08/12 23:52	2

Client Sample ID: RU-21

Lab Sample ID: 480-16799-4
Date Collected: 02/29/12 16:40
Matrix: Water
Date Received: 03/02/12 11:30

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		2.0	1.6	ug/L			03/07/12 01:18	2
1,1,2,2-Tetrachloroethane	ND		2.0	0.42	ug/L			03/07/12 01:18	2
1,1,2-Trichloroethane	ND		2.0	0.46	ug/L			03/07/12 01:18	2
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		2.0	0.62	ug/L			03/07/12 01:18	2
1,1-Dichloroethane	ND		2.0	0.76	ug/L			03/07/12 01:18	2
1,1-Dichloroethene	ND		2.0	0.58	ug/L			03/07/12 01:18	2
1,2,4-Trichlorobenzene	ND		2.0	0.82	ug/L			03/07/12 01:18	2
1,2-Dibromo-3-Chloropropane	ND		2.0	0.78	ug/L			03/07/12 01:18	2
1,2-Dibromoethane	ND		2.0	1.5	ug/L			03/07/12 01:18	2
1,2-Dichlorobenzene	ND		2.0	1.6	ug/L			03/07/12 01:18	2
1,2-Dichloroethane	ND		2.0	0.42	ug/L			03/07/12 01:18	2
1,2-Dichloropropane	ND		2.0	1.4	ug/L			03/07/12 01:18	2
1,3-Dichlorobenzene	ND		2.0	1.6	ug/L			03/07/12 01:18	2
1,4-Dichlorobenzene	ND		2.0	1.7	ug/L			03/07/12 01:18	2

Client Sample Results

Client: CDM Smith, Inc.
Project/Site: New York state project

TestAmerica Job ID: 480-16799-1

Client Sample ID: RU-21
Date Collected: 02/29/12 16:40
Date Received: 03/02/12 11:30

Lab Sample ID: 480-16799-4
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2-Hexanone	ND		10	2.5	ug/L			03/07/12 01:18	2
2-Butanone (MEK)	**100**		20	2.6	ug/L			03/07/12 01:18	2
4-Methyl-2-pentanone (MIBK)	ND		10	4.2	ug/L			03/07/12 01:18	2
Acetone	**95**		20	6.0	ug/L			03/07/12 01:18	2
Benzene	ND		2.0	0.82	ug/L			03/07/12 01:18	2
Bromodichloromethane	ND		2.0	0.78	ug/L			03/07/12 01:18	2
Bromoform	ND		2.0	0.52	ug/L			03/07/12 01:18	2
Bromomethane	ND		2.0	1.4	ug/L			03/07/12 01:18	2
Carbon disulfide	ND		2.0	0.38	ug/L			03/07/12 01:18	2
Carbon tetrachloride	ND		2.0	0.54	ug/L			03/07/12 01:18	2
Chlorobenzene	ND		2.0	1.5	ug/L			03/07/12 01:18	2
Dibromochloromethane	ND		2.0	0.64	ug/L			03/07/12 01:18	2
Chloroethane	**0.64**	**J**	2.0	0.64	ug/L			03/07/12 01:18	2
Chloroform	ND		2.0	0.68	ug/L			03/07/12 01:18	2
Chloromethane	ND		2.0	0.70	ug/L			03/07/12 01:18	2
cis-1,2-Dichloroethene	**50**		2.0	1.6	ug/L			03/07/12 01:18	2
cis-1,3-Dichloropropene	ND		2.0	0.72	ug/L			03/07/12 01:18	2
Cyclohexane	ND		2.0	0.36	ug/L			03/07/12 01:18	2
Dichlorodifluoromethane	ND		2.0	1.4	ug/L			03/07/12 01:18	2
Ethylbenzene	ND		2.0	1.5	ug/L			03/07/12 01:18	2
Isopropylbenzene	ND		2.0	1.6	ug/L			03/07/12 01:18	2
Methyl acetate	ND		2.0	1.0	ug/L			03/07/12 01:18	2
Methyl tert-butyl ether	ND		2.0	0.32	ug/L			03/07/12 01:18	2
Methylcyclohexane	ND		2.0	0.32	ug/L			03/07/12 01:18	2
Methylene Chloride	ND		2.0	0.88	ug/L			03/07/12 01:18	2
Styrene	ND		2.0	1.5	ug/L			03/07/12 01:18	2
Tetrachloroethene	ND		2.0	0.72	ug/L			03/07/12 01:18	2
Toluene	ND		2.0	1.0	ug/L			03/07/12 01:18	2
trans-1,2-Dichloroethene	ND		2.0	1.8	ug/L			03/07/12 01:18	2
trans-1,3-Dichloropropene	ND		2.0	0.74	ug/L			03/07/12 01:18	2
Trichloroethene	**55**		2.0	0.92	ug/L			03/07/12 01:18	2
Trichlorofluoromethane	ND		2.0	1.8	ug/L			03/07/12 01:18	2
Vinyl chloride	**150**		2.0	1.8	ug/L			03/07/12 01:18	2
Xylenes, Total	ND		4.0	1.3	ug/L			03/07/12 01:18	2

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*108*		*66 - 137*		*03/07/12 01:18*	*2*
Toluene-d8 (Surr)	*116*		*71 - 126*		*03/07/12 01:18*	*2*
4-Bromofluorobenzene (Surr)	*105*		*73 - 120*		*03/07/12 01:18*	*2*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethane	**8.4**		1.5	0.49	ug/L			03/04/12 14:29	1
Ethene	**23**		1.5	0.52	ug/L			03/04/12 14:29	1

Method: RSK-175 - Dissolved Gases (GC) - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methane	**300**		100	22	ug/L			03/04/12 15:30	100

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**18.4**		2.5	1.4	mg/L			03/07/12 17:43	5

Client Sample ID: RU-21
Lab Sample ID: 480-16799-4
Date Collected: 02/29/12 16:40
Matrix: Water
Date Received: 03/02/12 11:30

General Chemistry (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Sulfate	**4.4**		2.0	0.35	mg/L			03/14/12 12:57	1
Nitrate Nitrite as N	ND		0.050	0.020	mg/L			03/07/12 17:24	1
Total Organic Carbon	**1070**		40.0	17.4	mg/L			03/13/12 22:01	40
Acetic acid	**740**		50.0	7.5	mg/L			03/09/12 00:21	50
Butyric acid	**40.0**		1.0	0.16	mg/L			03/08/12 02:13	1
Propionic acid	**1370**		50.0	8.5	mg/L			03/09/12 00:21	50

Client Sample ID: DUP-1
Lab Sample ID: 480-16799-5
Date Collected: 02/29/12 00:00
Matrix: Water
Date Received: 03/02/12 11:30

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		4.0	3.3	ug/L			03/07/12 01:40	4
1,1,2,2-Tetrachloroethane	ND		4.0	0.84	ug/L			03/07/12 01:40	4
1,1,2-Trichloroethane	ND		4.0	0.92	ug/L			03/07/12 01:40	4
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		4.0	1.2	ug/L			03/07/12 01:40	4
1,1-Dichloroethane	ND		4.0	1.5	ug/L			03/07/12 01:40	4
1,1-Dichloroethene	ND		4.0	1.2	ug/L			03/07/12 01:40	4
1,2,4-Trichlorobenzene	ND		4.0	1.6	ug/L			03/07/12 01:40	4
1,2-Dibromo-3-Chloropropane	ND		4.0	1.6	ug/L			03/07/12 01:40	4
1,2-Dibromoethane	ND		4.0	2.9	ug/L			03/07/12 01:40	4
1,2-Dichlorobenzene	ND		4.0	3.2	ug/L			03/07/12 01:40	4
1,2-Dichloroethane	ND		4.0	0.84	ug/L			03/07/12 01:40	4
1,2-Dichloropropane	ND		4.0	2.9	ug/L			03/07/12 01:40	4
1,3-Dichlorobenzene	ND		4.0	3.1	ug/L			03/07/12 01:40	4
1,4-Dichlorobenzene	ND		4.0	3.4	ug/L			03/07/12 01:40	4
2-Hexanone	ND		20	5.0	ug/L			03/07/12 01:40	4
2-Butanone (MEK)	ND		40	5.3	ug/L			03/07/12 01:40	4
4-Methyl-2-pentanone (MIBK)	ND		20	8.4	ug/L			03/07/12 01:40	4
Acetone	**14**	**J**	40	12	ug/L			03/07/12 01:40	4
Benzene	ND		4.0	1.6	ug/L			03/07/12 01:40	4
Bromodichloromethane	ND		4.0	1.6	ug/L			03/07/12 01:40	4
Bromoform	ND		4.0	1.0	ug/L			03/07/12 01:40	4
Bromomethane	ND		4.0	2.8	ug/L			03/07/12 01:40	4
Carbon disulfide	ND		4.0	0.76	ug/L			03/07/12 01:40	4
Carbon tetrachloride	ND		4.0	1.1	ug/L			03/07/12 01:40	4
Chlorobenzene	ND		4.0	3.0	ug/L			03/07/12 01:40	4
Dibromochloromethane	ND		4.0	1.3	ug/L			03/07/12 01:40	4
Chloroethane	ND		4.0	1.3	ug/L			03/07/12 01:40	4
Chloroform	ND		4.0	1.4	ug/L			03/07/12 01:40	4
Chloromethane	ND		4.0	1.4	ug/L			03/07/12 01:40	4
cis-1,2-Dichloroethene	**190**		4.0	3.2	ug/L			03/07/12 01:40	4
cis-1,3-Dichloropropene	ND		4.0	1.4	ug/L			03/07/12 01:40	4
Cyclohexane	ND		4.0	0.72	ug/L			03/07/12 01:40	4
Dichlorodifluoromethane	ND		4.0	2.7	ug/L			03/07/12 01:40	4
Ethylbenzene	ND		4.0	3.0	ug/L			03/07/12 01:40	4
Isopropylbenzene	ND		4.0	3.2	ug/L			03/07/12 01:40	4
Methyl acetate	ND		4.0	2.0	ug/L			03/07/12 01:40	4
Methyl tert-butyl ether	ND		4.0	0.64	ug/L			03/07/12 01:40	4
Methylcyclohexane	ND		4.0	0.64	ug/L			03/07/12 01:40	4

Client Sample ID: DUP-1 Lab Sample ID: 480-16799-5

Date Collected: 02/29/12 00:00 **Matrix: Water**
Date Received: 03/02/12 11:30

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methylene Chloride	ND		4.0	1.8	ug/L			03/07/12 01:40	4
Styrene	ND		4.0	2.9	ug/L			03/07/12 01:40	4
Tetrachloroethene	ND		4.0	1.4	ug/L			03/07/12 01:40	4
Toluene	ND		4.0	2.0	ug/L			03/07/12 01:40	4
trans-1,2-Dichloroethene	ND		4.0	3.6	ug/L			03/07/12 01:40	4
trans-1,3-Dichloropropene	ND		4.0	1.5	ug/L			03/07/12 01:40	4
Trichloroethene	**320**		4.0	1.8	ug/L			03/07/12 01:40	4
Trichlorofluoromethane	ND		4.0	3.5	ug/L			03/07/12 01:40	4
Vinyl chloride	**19**		4.0	3.6	ug/L			03/07/12 01:40	4
Xylenes, Total	ND		8.0	2.6	ug/L			03/07/12 01:40	4

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*109*		*66 - 137*		*03/07/12 01:40*	*4*
Toluene-d8 (Surr)	*119*		*71 - 126*		*03/07/12 01:40*	*4*
4-Bromofluorobenzene (Surr)	*107*		*73 - 120*		*03/07/12 01:40*	*4*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethane	**6.5**		1.5	0.49	ug/L			03/04/12 14:46	1
Ethene	**0.58**	**J**	1.5	0.52	ug/L			03/04/12 14:46	1
Methane	**150**		1.0	0.22	ug/L			03/04/12 14:46	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**10.4**		0.50	0.28	mg/L			03/07/12 17:53	1
Sulfate	**21.7**		2.0	0.35	mg/L			03/07/12 17:53	1
Nitrate Nitrite as N	**0.47**		0.050	0.020	mg/L			03/07/12 17:25	1
Total Organic Carbon	**16.0**		1.0	0.43	mg/L			03/09/12 00:51	1
Acetic acid	**6.5**		1.0	0.15	mg/L			03/08/12 02:42	1
Butyric acid	ND		1.0	0.16	mg/L			03/08/12 02:42	1
Propionic acid	**14.6**		1.0	0.17	mg/L			03/08/12 02:42	1

Client Sample ID: FB-1 Lab Sample ID: 480-16799-6

Date Collected: 02/29/12 15:30 **Matrix: Water**
Date Received: 03/02/12 11:30

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			03/06/12 18:18	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			03/06/12 18:18	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			03/06/12 18:18	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			03/06/12 18:18	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			03/06/12 18:18	1
1,1-Dichloroethene	ND		1.0	0.29	ug/L			03/06/12 18:18	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			03/06/12 18:18	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			03/06/12 18:18	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			03/06/12 18:18	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			03/06/12 18:18	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			03/06/12 18:18	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			03/06/12 18:18	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			03/06/12 18:18	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			03/06/12 18:18	1

Client Sample ID: FB-1

Lab Sample ID: 480-16799-6

Date Collected: 02/29/12 15:30

Matrix: Water

Date Received: 03/02/12 11:30

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2-Hexanone	ND		5.0	1.2	ug/L			03/06/12 18:18	1
2-Butanone (MEK)	ND		10	1.3	ug/L			03/06/12 18:18	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			03/06/12 18:18	1
Acetone	**4.1**	**J**	10	3.0	ug/L			03/06/12 18:18	1
Benzene	ND		1.0	0.41	ug/L			03/06/12 18:18	1
Bromodichloromethane	ND		1.0	0.39	ug/L			03/06/12 18:18	1
Bromoform	ND		1.0	0.26	ug/L			03/06/12 18:18	1
Bromomethane	ND		1.0	0.69	ug/L			03/06/12 18:18	1
Carbon disulfide	ND		1.0	0.19	ug/L			03/06/12 18:18	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			03/06/12 18:18	1
Chlorobenzene	ND		1.0	0.75	ug/L			03/06/12 18:18	1
Dibromochloromethane	ND		1.0	0.32	ug/L			03/06/12 18:18	1
Chloroethane	ND		1.0	0.32	ug/L			03/06/12 18:18	1
Chloroform	ND		1.0	0.34	ug/L			03/06/12 18:18	1
Chloromethane	ND		1.0	0.35	ug/L			03/06/12 18:18	1
cis-1,2-Dichloroethene	ND		1.0	0.81	ug/L			03/06/12 18:18	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			03/06/12 18:18	1
Cyclohexane	ND		1.0	0.18	ug/L			03/06/12 18:18	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			03/06/12 18:18	1
Ethylbenzene	ND		1.0	0.74	ug/L			03/06/12 18:18	1
Isopropylbenzene	ND		1.0	0.79	ug/L			03/06/12 18:18	1
Methyl acetate	ND		1.0	0.50	ug/L			03/06/12 18:18	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			03/06/12 18:18	1
Methylcyclohexane	ND		1.0	0.16	ug/L			03/06/12 18:18	1
Methylene Chloride	ND		1.0	0.44	ug/L			03/06/12 18:18	1
Styrene	ND		1.0	0.73	ug/L			03/06/12 18:18	1
Tetrachloroethene	ND		1.0	0.36	ug/L			03/06/12 18:18	1
Toluene	ND		1.0	0.51	ug/L			03/06/12 18:18	1
trans-1,2-Dichloroethene	ND		1.0	0.90	ug/L			03/06/12 18:18	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			03/06/12 18:18	1
Trichloroethene	ND		1.0	0.46	ug/L			03/06/12 18:18	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			03/06/12 18:18	1
Vinyl chloride	ND		1.0	0.90	ug/L			03/06/12 18:18	1
Xylenes, Total	ND		2.0	0.66	ug/L			03/06/12 18:18	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*109*		*66 - 137*		*03/06/12 18:18*	*1*
Toluene-d8 (Surr)	*117*		*71 - 126*		*03/06/12 18:18*	*1*
4-Bromofluorobenzene (Surr)	*108*		*73 - 120*		*03/06/12 18:18*	*1*

Client Sample ID: TRIP BLANK

Lab Sample ID: 480-16799-7

Date Collected: 02/29/12 00:00

Matrix: Water

Date Received: 03/02/12 11:30

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			03/06/12 18:39	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			03/06/12 18:39	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			03/06/12 18:39	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			03/06/12 18:39	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			03/06/12 18:39	1

Client: CDM Smith, Inc. TestAmerica Job ID: 480-16799-1
Project/Site: New York state project

Client Sample ID: TRIP BLANK **Lab Sample ID: 480-16799-7**
Date Collected: 02/29/12 00:00 **Matrix: Water**
Date Received: 03/02/12 11:30

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1-Dichloroethene	ND		1.0	0.29	ug/L			03/06/12 18:39	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			03/06/12 18:39	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			03/06/12 18:39	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			03/06/12 18:39	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			03/06/12 18:39	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			03/06/12 18:39	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			03/06/12 18:39	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			03/06/12 18:39	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			03/06/12 18:39	1
2-Hexanone	ND		5.0	1.2	ug/L			03/06/12 18:39	1
2-Butanone (MEK)	ND		10	1.3	ug/L			03/06/12 18:39	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			03/06/12 18:39	1
Acetone	ND		10	3.0	ug/L			03/06/12 18:39	1
Benzene	ND		1.0	0.41	ug/L			03/06/12 18:39	1
Bromodichloromethane	ND		1.0	0.39	ug/L			03/06/12 18:39	1
Bromoform	ND		1.0	0.26	ug/L			03/06/12 18:39	1
Bromomethane	ND		1.0	0.69	ug/L			03/06/12 18:39	1
Carbon disulfide	ND		1.0	0.19	ug/L			03/06/12 18:39	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			03/06/12 18:39	1
Chlorobenzene	ND		1.0	0.75	ug/L			03/06/12 18:39	1
Dibromochloromethane	ND		1.0	0.32	ug/L			03/06/12 18:39	1
Chloroethane	ND		1.0	0.32	ug/L			03/06/12 18:39	1
Chloroform	ND		1.0	0.34	ug/L			03/06/12 18:39	1
Chloromethane	ND		1.0	0.35	ug/L			03/06/12 18:39	1
cis-1,2-Dichloroethene	ND		1.0	0.81	ug/L			03/06/12 18:39	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			03/06/12 18:39	1
Cyclohexane	ND		1.0	0.18	ug/L			03/06/12 18:39	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			03/06/12 18:39	1
Ethylbenzene	ND		1.0	0.74	ug/L			03/06/12 18:39	1
Isopropylbenzene	ND		1.0	0.79	ug/L			03/06/12 18:39	1
Methyl acetate	ND		1.0	0.50	ug/L			03/06/12 18:39	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			03/06/12 18:39	1
Methylcyclohexane	ND		1.0	0.16	ug/L			03/06/12 18:39	1
Methylene Chloride	ND		1.0	0.44	ug/L			03/06/12 18:39	1
Styrene	ND		1.0	0.73	ug/L			03/06/12 18:39	1
Tetrachloroethene	ND		1.0	0.36	ug/L			03/06/12 18:39	1
Toluene	ND		1.0	0.51	ug/L			03/06/12 18:39	1
trans-1,2-Dichloroethene	ND		1.0	0.90	ug/L			03/06/12 18:39	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			03/06/12 18:39	1
Trichloroethene	ND		1.0	0.46	ug/L			03/06/12 18:39	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			03/06/12 18:39	1
Vinyl chloride	ND		1.0	0.90	ug/L			03/06/12 18:39	1
Xylenes, Total	ND		2.0	0.66	ug/L			03/06/12 18:39	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*110*		*66 - 137*		*03/06/12 18:39*	*1*
Toluene-d8 (Surr)	*120*		*71 - 126*		*03/06/12 18:39*	*1*
4-Bromofluorobenzene (Surr)	*109*		*73 - 120*		*03/06/12 18:39*	*1*

Client: CDM Smith, Inc. TestAmerica Job ID: 480-16799-1
Project/Site: New York state project

Method: 8260B - Volatile Organic Compounds (GC/MS)

Matrix: Water **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)		
		12DCE	TOL	BFB
Lab Sample ID	Client Sample ID	(66-137)	(71-126)	(73-120)
480-16799-1	RU-19	110	120	110
480-16799-1 - DL	RU-19	111	120	108
480-16799-2	RU-10	112	118	110
480-16799-2 - DL	RU-10	109	117	105
480-16799-3	RU-20	111	119	108
480-16799-4	RU-21	108	116	105
480-16799-5	DUP-1	109	119	107
480-16799-6	FB-1	109	117	108
480-16799-7	TRIP BLANK	110	120	109
LCS 480-54020/3	Lab Control Sample	108	118	109
LCS 480-54121/3	Lab Control Sample	108	119	107
MB 480-54020/4	Method Blank	110	119	109
MB 480-54121/4	Method Blank	109	117	107

Surrogate Legend

12DCE = 1,2-Dichloroethane-d4 (Surr)
TOL = Toluene-d8 (Surr)
BFB = 4-Bromofluorobenzene (Surr)

QC Sample Results

Client: CDM Smith, Inc.
Project/Site: New York state project

TestAmerica Job ID: 480-16799-1

Method: 8260B - Volatile Organic Compounds (GC/MS)

Lab Sample ID: MB 480-54020/4
Matrix: Water
Analysis Batch: 54020

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			03/06/12 12:04	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			03/06/12 12:04	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			03/06/12 12:04	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			03/06/12 12:04	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			03/06/12 12:04	1
1,1-Dichloroethene	ND		1.0	0.29	ug/L			03/06/12 12:04	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			03/06/12 12:04	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			03/06/12 12:04	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			03/06/12 12:04	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			03/06/12 12:04	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			03/06/12 12:04	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			03/06/12 12:04	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			03/06/12 12:04	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			03/06/12 12:04	1
2-Hexanone	ND		5.0	1.2	ug/L			03/06/12 12:04	1
2-Butanone (MEK)	ND		10	1.3	ug/L			03/06/12 12:04	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			03/06/12 12:04	1
Acetone	ND		10	3.0	ug/L			03/06/12 12:04	1
Benzene	ND		1.0	0.41	ug/L			03/06/12 12:04	1
Bromodichloromethane	ND		1.0	0.39	ug/L			03/06/12 12:04	1
Bromoform	ND		1.0	0.26	ug/L			03/06/12 12:04	1
Bromomethane	ND		1.0	0.69	ug/L			03/06/12 12:04	1
Carbon disulfide	ND		1.0	0.19	ug/L			03/06/12 12:04	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			03/06/12 12:04	1
Chlorobenzene	ND		1.0	0.75	ug/L			03/06/12 12:04	1
Dibromochloromethane	ND		1.0	0.32	ug/L			03/06/12 12:04	1
Chloroethane	ND		1.0	0.32	ug/L			03/06/12 12:04	1
Chloroform	ND		1.0	0.34	ug/L			03/06/12 12:04	1
Chloromethane	ND		1.0	0.35	ug/L			03/06/12 12:04	1
cis-1,2-Dichloroethene	ND		1.0	0.81	ug/L			03/06/12 12:04	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			03/06/12 12:04	1
Cyclohexane	ND		1.0	0.18	ug/L			03/06/12 12:04	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			03/06/12 12:04	1
Ethylbenzene	ND		1.0	0.74	ug/L			03/06/12 12:04	1
Isopropylbenzene	ND		1.0	0.79	ug/L			03/06/12 12:04	1
Methyl acetate	ND		1.0	0.50	ug/L			03/06/12 12:04	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			03/06/12 12:04	1
Methylcyclohexane	ND		1.0	0.16	ug/L			03/06/12 12:04	1
Methylene Chloride	ND		1.0	0.44	ug/L			03/06/12 12:04	1
Styrene	ND		1.0	0.73	ug/L			03/06/12 12:04	1
Tetrachloroethene	ND		1.0	0.36	ug/L			03/06/12 12:04	1
Toluene	ND		1.0	0.51	ug/L			03/06/12 12:04	1
trans-1,2-Dichloroethene	ND		1.0	0.90	ug/L			03/06/12 12:04	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			03/06/12 12:04	1
Trichloroethene	ND		1.0	0.46	ug/L			03/06/12 12:04	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			03/06/12 12:04	1
Vinyl chloride	ND		1.0	0.90	ug/L			03/06/12 12:04	1
Xylenes, Total	ND		2.0	0.66	ug/L			03/06/12 12:04	1

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 480-54020/4
Matrix: Water
Analysis Batch: 54020

Client Sample ID: Method Blank
Prep Type: Total/NA

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	*110*		*66 - 137*		*03/06/12 12:04*	*1*
Toluene-d8 (Surr)	*119*		*71 - 126*		*03/06/12 12:04*	*1*
4-Bromofluorobenzene (Surr)	*109*		*73 - 120*		*03/06/12 12:04*	*1*

Lab Sample ID: LCS 480-54020/3
Matrix: Water
Analysis Batch: 54020

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1-Dichloroethane	25.0	24.1		ug/L		96	71 - 129
1,1-Dichloroethene	25.0	25.9		ug/L		104	65 - 138
1,2-Dichlorobenzene	25.0	25.4		ug/L		102	77 - 120
1,2-Dichloroethane	25.0	24.6		ug/L		98	75 - 127
Benzene	25.0	24.9		ug/L		100	71 - 124
Chlorobenzene	25.0	26.5		ug/L		106	72 - 120
cis-1,2-Dichloroethene	25.0	24.8		ug/L		99	74 - 124
Ethylbenzene	25.0	27.5		ug/L		110	77 - 123
Methyl tert-butyl ether	25.0	23.5		ug/L		94	64 - 127
Tetrachloroethene	25.0	27.8		ug/L		111	74 - 122
Toluene	25.0	26.2		ug/L		105	70 - 122
trans-1,2-Dichloroethene	25.0	26.3		ug/L		105	73 - 127
Trichloroethene	25.0	25.2		ug/L		101	74 - 123

Surrogate	LCS %Recovery	LCS Qualifier	Limits
1,2-Dichloroethane-d4 (Surr)	*108*		*66 - 137*
Toluene-d8 (Surr)	*118*		*71 - 126*
4-Bromofluorobenzene (Surr)	*109*		*73 - 120*

Lab Sample ID: MB 480-54121/4
Matrix: Water
Analysis Batch: 54121

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			03/06/12 21:49	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			03/06/12 21:49	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			03/06/12 21:49	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			03/06/12 21:49	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			03/06/12 21:49	1
1,1-Dichloroethene	ND		1.0	0.29	ug/L			03/06/12 21:49	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			03/06/12 21:49	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			03/06/12 21:49	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			03/06/12 21:49	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			03/06/12 21:49	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			03/06/12 21:49	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			03/06/12 21:49	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			03/06/12 21:49	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			03/06/12 21:49	1
2-Hexanone	ND		5.0	1.2	ug/L			03/06/12 21:49	1
2-Butanone (MEK)	ND		10	1.3	ug/L			03/06/12 21:49	1

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 480-54121/4
Matrix: Water
Analysis Batch: 54121

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			03/06/12 21:49	1
Acetone	ND		10	3.0	ug/L			03/06/12 21:49	1
Benzene	ND		1.0	0.41	ug/L			03/06/12 21:49	1
Bromodichloromethane	ND		1.0	0.39	ug/L			03/06/12 21:49	1
Bromoform	ND		1.0	0.26	ug/L			03/06/12 21:49	1
Bromomethane	ND		1.0	0.69	ug/L			03/06/12 21:49	1
Carbon disulfide	ND		1.0	0.19	ug/L			03/06/12 21:49	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			03/06/12 21:49	1
Chlorobenzene	ND		1.0	0.75	ug/L			03/06/12 21:49	1
Dibromochloromethane	ND		1.0	0.32	ug/L			03/06/12 21:49	1
Chloroethane	ND		1.0	0.32	ug/L			03/06/12 21:49	1
Chloroform	ND		1.0	0.34	ug/L			03/06/12 21:49	1
Chloromethane	ND		1.0	0.35	ug/L			03/06/12 21:49	1
cis-1,2-Dichloroethene	ND		1.0	0.81	ug/L			03/06/12 21:49	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			03/06/12 21:49	1
Cyclohexane	ND		1.0	0.18	ug/L			03/06/12 21:49	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			03/06/12 21:49	1
Ethylbenzene	ND		1.0	0.74	ug/L			03/06/12 21:49	1
Isopropylbenzene	ND		1.0	0.79	ug/L			03/06/12 21:49	1
Methyl acetate	ND		1.0	0.50	ug/L			03/06/12 21:49	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			03/06/12 21:49	1
Methylcyclohexane	ND		1.0	0.16	ug/L			03/06/12 21:49	1
Methylene Chloride	ND		1.0	0.44	ug/L			03/06/12 21:49	1
Styrene	ND		1.0	0.73	ug/L			03/06/12 21:49	1
Tetrachloroethene	ND		1.0	0.36	ug/L			03/06/12 21:49	1
Toluene	ND		1.0	0.51	ug/L			03/06/12 21:49	1
trans-1,2-Dichloroethene	ND		1.0	0.90	ug/L			03/06/12 21:49	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			03/06/12 21:49	1
Trichloroethene	ND		1.0	0.46	ug/L			03/06/12 21:49	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			03/06/12 21:49	1
Vinyl chloride	ND		1.0	0.90	ug/L			03/06/12 21:49	1
Xylenes, Total	ND		2.0	0.66	ug/L			03/06/12 21:49	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*109*		*66 - 137*		*03/06/12 21:49*	*1*
Toluene-d8 (Surr)	*117*		*71 - 126*		*03/06/12 21:49*	*1*
4-Bromofluorobenzene (Surr)	*107*		*73 - 120*		*03/06/12 21:49*	*1*

Lab Sample ID: LCS 480-54121/3
Matrix: Water
Analysis Batch: 54121

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1-Dichloroethane	25.0	22.7		ug/L		91	71 - 129
1,1-Dichloroethene	25.0	22.4		ug/L		90	65 - 138
1,2-Dichlorobenzene	25.0	24.3		ug/L		97	77 - 120
1,2-Dichloroethane	25.0	23.1		ug/L		92	75 - 127
Benzene	25.0	23.2		ug/L		93	71 - 124
Chlorobenzene	25.0	24.3		ug/L		97	72 - 120

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 480-54121/3
Matrix: Water
Analysis Batch: 54121

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
cis-1,2-Dichloroethene	25.0	22.7		ug/L		91	74 - 124
Ethylbenzene	25.0	25.3		ug/L		101	77 - 123
Methyl tert-butyl ether	25.0	22.0		ug/L		88	64 - 127
Tetrachloroethene	25.0	24.9		ug/L		100	74 - 122
Toluene	25.0	24.3		ug/L		97	70 - 122
trans-1,2-Dichloroethene	25.0	22.9		ug/L		92	73 - 127
Trichloroethene	25.0	22.5		ug/L		90	74 - 123

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
1,2-Dichloroethane-d4 (Surr)	*108*		*66 - 137*
Toluene-d8 (Surr)	*119*		*71 - 126*
4-Bromofluorobenzene (Surr)	*107*		*73 - 120*

Method: RSK-175 - Dissolved Gases (GC)

Lab Sample ID: MB 480-53795/2
Matrix: Water
Analysis Batch: 53795

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethane	ND		1.5	0.49	ug/L			03/04/12 10:18	1
Ethene	ND		1.5	0.52	ug/L			03/04/12 10:18	1
Methane	ND		1.0	0.22	ug/L			03/04/12 10:18	1

Lab Sample ID: LCS 480-53795/3
Matrix: Water
Analysis Batch: 53795

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Ethane	14.4	15.6		ug/L		108	71 - 147
Ethene	13.5	14.3		ug/L		106	71 - 147
Methane	7.77	8.27		ug/L		106	48 - 174

Method: 300.0 - Anions, Ion Chromatography

Lab Sample ID: MB 480-54087/28
Matrix: Water
Analysis Batch: 54087

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND		0.50	0.28	mg/L			03/07/12 15:52	1
Sulfate	ND		2.0	0.35	mg/L			03/07/12 15:52	1

Lab Sample ID: LCS 480-54087/27
Matrix: Water
Analysis Batch: 54087

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	20.0	20.10		mg/L		101	90 - 110
Sulfate	20.0	19.30		mg/L		97	90 - 110

Client: CDM Smith, Inc. TestAmerica Job ID: 480-16799-1
Project/Site: New York state project

Method: 300.0 - Anions, Ion Chromatography (Continued)

Lab Sample ID: 480-16799-3 MS **Client Sample ID: RU-20**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 54087

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	71.1		25.0	94.80		mg/L		95	80 - 120
Sulfate	9.9		25.0	33.40		mg/L		94	80 - 120

Lab Sample ID: MB 480-54605/28 **Client Sample ID: Method Blank**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 54605

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND		0.50	0.28	mg/L			03/09/12 23:33	1
Sulfate	ND		2.0	0.35	mg/L			03/09/12 23:33	1

Lab Sample ID: LCS 480-54605/27 **Client Sample ID: Lab Control Sample**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 54605

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	20.0	19.10		mg/L		96	90 - 110
Sulfate	20.0	18.20		mg/L		91	90 - 110

Lab Sample ID: MB 480-55196/4 **Client Sample ID: Method Blank**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 55196

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND		0.50	0.28	mg/L			03/14/12 12:47	1
Sulfate	ND		2.0	0.35	mg/L			03/14/12 12:47	1

Lab Sample ID: LCS 480-55196/3 **Client Sample ID: Lab Control Sample**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 55196

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	20.0	19.80		mg/L		99	90 - 110
Sulfate	20.0	19.80		mg/L		99	90 - 110

Method: 353.2 - Nitrogen, Nitrate-Nitrite

Lab Sample ID: MB 480-54291/4 **Client Sample ID: Method Blank**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 54291

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Nitrate Nitrite as N	ND		0.050	0.020	mg/L			03/07/12 17:17	1

Lab Sample ID: LCS 480-54291/5 **Client Sample ID: Lab Control Sample**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 54291

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate Nitrite as N	1.50	1.50		mg/L		100	90 - 110

Client: CDM Smith, Inc.
Project/Site: New York state project

TestAmerica Job ID: 480-16799-1

Method: SM 5310D - Organic Carbon, Total (TOC)

Lab Sample ID: MB 480-54596/32
Matrix: Water
Analysis Batch: 54596

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Organic Carbon	ND		1.0	0.43	mg/L			03/08/12 19:13	1

Lab Sample ID: LCS 480-54596/33
Matrix: Water
Analysis Batch: 54596

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Total Organic Carbon	60.0	59.84		mg/L		100	90 - 110

Lab Sample ID: MB 480-55266/3
Matrix: Water
Analysis Batch: 55266

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Organic Carbon	ND		1.0	0.43	mg/L			03/13/12 21:10	1

Lab Sample ID: LCS 480-55266/4
Matrix: Water
Analysis Batch: 55266

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Total Organic Carbon	60.0	60.09		mg/L		100	90 - 110

Method: VFA-IC - Volatile Fatty Acids, Ion Chromatography

Lab Sample ID: MB 480-53952/52
Matrix: Water
Analysis Batch: 53952

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetic acid	ND		1.0	0.15	mg/L			03/07/12 14:04	1
Butyric acid	ND		1.0	0.16	mg/L			03/07/12 14:04	1
Propionic acid	ND		1.0	0.17	mg/L			03/07/12 14:04	1

Lab Sample ID: LCS 480-53952/51
Matrix: Water
Analysis Batch: 53952

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acetic acid	10.0	9.65		mg/L		97	80 - 120
Butyric acid	10.0	9.72		mg/L		97	80 - 120
Propionic acid	10.0	9.83		mg/L		98	80 - 120

Lab Sample ID: 480-16799-3 MS
Matrix: Water
Analysis Batch: 53952

Client Sample ID: RU-20
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Butyric acid	ND		10.0	9.24		mg/L		92	80 - 120

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Method: VFA-IC - Volatile Fatty Acids, Ion Chromatography (Continued)

Lab Sample ID: MB 480-53953/76
Matrix: Water
Analysis Batch: 53953

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetic acid	ND		1.0	0.15	mg/L			03/08/12 01:44	1
Butyric acid	ND		1.0	0.16	mg/L			03/08/12 01:44	1
Propionic acid	ND		1.0	0.17	mg/L			03/08/12 01:44	1

Lab Sample ID: LCS 480-53953/75
Matrix: Water
Analysis Batch: 53953

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acetic acid	10.0	9.64		mg/L		96	80 - 120
Butyric acid	10.0	9.66		mg/L		97	80 - 120
Propionic acid	10.0	9.95		mg/L		100	80 - 120

Lab Sample ID: MB 480-54385/12
Matrix: Water
Analysis Batch: 54385

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetic acid	ND		1.0	0.15	mg/L			03/08/12 17:33	1
Butyric acid	ND		1.0	0.16	mg/L			03/08/12 17:33	1
Propionic acid	ND		1.0	0.17	mg/L			03/08/12 17:33	1

Lab Sample ID: LCS 480-54385/11
Matrix: Water
Analysis Batch: 54385

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acetic acid	10.0	9.66		mg/L		97	80 - 120
Butyric acid	10.0	9.77		mg/L		98	80 - 120
Propionic acid	10.0	10.10		mg/L		101	80 - 120

Lab Sample ID: 480-16799-4 MS
Matrix: Water
Analysis Batch: 54385

Client Sample ID: RU-21
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Acetic acid	740		500	1255		mg/L		103	80 - 120
Butyric acid	22.6		500	540.0		mg/L		103	80 - 120
Propionic acid	1370		500	1870		mg/L		100	80 - 120

Lab Sample ID: 480-16799-4 MSD
Matrix: Water
Analysis Batch: 54385

Client Sample ID: RU-21
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Acetic acid	740		500	1260		mg/L		104	80 - 120	0	20
Butyric acid	22.6		500	535.0		mg/L		102	80 - 120	1	20
Propionic acid	1370		500	1885		mg/L		103	80 - 120	1	20

GC/MS VOA

Analysis Batch: 54020

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-16799-1	RU-19	Total/NA	Water	8260B	
480-16799-2	RU-10	Total/NA	Water	8260B	
480-16799-6	FB-1	Total/NA	Water	8260B	
480-16799-7	TRIP BLANK	Total/NA	Water	8260B	
LCS 480-54020/3	Lab Control Sample	Total/NA	Water	8260B	
MB 480-54020/4	Method Blank	Total/NA	Water	8260B	

Analysis Batch: 54121

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-16799-1 - DL	RU-19	Total/NA	Water	8260B	
480-16799-2 - DL	RU-10	Total/NA	Water	8260B	
480-16799-3	RU-20	Total/NA	Water	8260B	
480-16799-4	RU-21	Total/NA	Water	8260B	
480-16799-5	DUP-1	Total/NA	Water	8260B	
LCS 480-54121/3	Lab Control Sample	Total/NA	Water	8260B	
MB 480-54121/4	Method Blank	Total/NA	Water	8260B	

GC VOA

Analysis Batch: 53795

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-16799-1	RU-19	Total/NA	Water	RSK-175	
480-16799-2	RU-10	Total/NA	Water	RSK-175	
480-16799-3	RU-20	Total/NA	Water	RSK-175	
480-16799-4	RU-21	Total/NA	Water	RSK-175	
480-16799-4 - DL	RU-21	Total/NA	Water	RSK-175	
480-16799-5	DUP-1	Total/NA	Water	RSK-175	
LCS 480-53795/3	Lab Control Sample	Total/NA	Water	RSK-175	
MB 480-53795/2	Method Blank	Total/NA	Water	RSK-175	

General Chemistry

Analysis Batch: 53952

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-16799-1	RU-19	Total/NA	Water	VFA-IC	
480-16799-2	RU-10	Total/NA	Water	VFA-IC	
480-16799-3	RU-20	Total/NA	Water	VFA-IC	
480-16799-3 MS	RU-20	Total/NA	Water	VFA-IC	
LCS 480-53952/51	Lab Control Sample	Total/NA	Water	VFA-IC	
MB 480-53952/52	Method Blank	Total/NA	Water	VFA-IC	

Analysis Batch: 53953

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-16799-4	RU-21	Total/NA	Water	VFA-IC	
480-16799-5	DUP-1	Total/NA	Water	VFA-IC	
LCS 480-53953/75	Lab Control Sample	Total/NA	Water	VFA-IC	
MB 480-53953/76	Method Blank	Total/NA	Water	VFA-IC	

Analysis Batch: 54087

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-16799-1	RU-19	Total/NA	Water	300.0	
480-16799-2	RU-10	Total/NA	Water	300.0	

Client: CDM Smith, Inc. TestAmerica Job ID: 480-16799-1
Project/Site: New York state project

General Chemistry (Continued)

Analysis Batch: 54087 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-16799-3	RU-20	Total/NA	Water	300.0	
480-16799-3 MS	RU-20	Total/NA	Water	300.0	
480-16799-4	RU-21	Total/NA	Water	300.0	
480-16799-5	DUP-1	Total/NA	Water	300.0	
LCS 480-54087/27	Lab Control Sample	Total/NA	Water	300.0	
MB 480-54087/28	Method Blank	Total/NA	Water	300.0	

Analysis Batch: 54291

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-16799-1	RU-19	Total/NA	Water	353.2	
480-16799-2	RU-10	Total/NA	Water	353.2	
480-16799-3	RU-20	Total/NA	Water	353.2	
480-16799-4	RU-21	Total/NA	Water	353.2	
480-16799-5	DUP-1	Total/NA	Water	353.2	
LCS 480-54291/5	Lab Control Sample	Total/NA	Water	353.2	
MB 480-54291/4	Method Blank	Total/NA	Water	353.2	

Analysis Batch: 54385

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-16799-3	RU-20	Total/NA	Water	VFA-IC	
480-16799-4	RU-21	Total/NA	Water	VFA-IC	
480-16799-4 MS	RU-21	Total/NA	Water	VFA-IC	
480-16799-4 MSD	RU-21	Total/NA	Water	VFA-IC	
LCS 480-54385/11	Lab Control Sample	Total/NA	Water	VFA-IC	
MB 480-54385/12	Method Blank	Total/NA	Water	VFA-IC	

Analysis Batch: 54596

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-16799-1	RU-19	Total/NA	Water	SM 5310D	
480-16799-2	RU-10	Total/NA	Water	SM 5310D	
480-16799-5	DUP-1	Total/NA	Water	SM 5310D	
LCS 480-54596/33	Lab Control Sample	Total/NA	Water	SM 5310D	
MB 480-54596/32	Method Blank	Total/NA	Water	SM 5310D	

Analysis Batch: 54605

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 480-54605/27	Lab Control Sample	Total/NA	Water	300.0	
MB 480-54605/28	Method Blank	Total/NA	Water	300.0	

Analysis Batch: 55196

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-16799-4	RU-21	Total/NA	Water	300.0	
LCS 480-55196/3	Lab Control Sample	Total/NA	Water	300.0	
MB 480-55196/4	Method Blank	Total/NA	Water	300.0	

Analysis Batch: 55266

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-16799-3	RU-20	Total/NA	Water	SM 5310D	
480-16799-4	RU-21	Total/NA	Water	SM 5310D	
LCS 480-55266/4	Lab Control Sample	Total/NA	Water	SM 5310D	
MB 480-55266/3	Method Blank	Total/NA	Water	SM 5310D	

Client Sample ID: RU-19 Lab Sample ID: 480-16799-1

Date Collected: 02/29/12 13:50 **Matrix: Water**

Date Received: 03/02/12 11:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		10	54020	03/06/12 16:29	RL	TAL BUF
Total/NA	Analysis	8260B	DL	20	54121	03/07/12 00:12	DC	TAL BUF
Total/NA	Analysis	RSK-175		1	53795	03/04/12 13:38	JM	TAL BUF
Total/NA	Analysis	VFA-IC		1	53952	03/07/12 22:19	KAC	TAL BUF
Total/NA	Analysis	300.0		1	54087	03/07/12 16:42	KAC	TAL BUF
Total/NA	Analysis	353.2		1	54291	03/07/12 17:20	KS	TAL BUF
Total/NA	Analysis	SM 5310D		1	54596	03/08/12 23:43	KAC	TAL BUF

Client Sample ID: RU-10 Lab Sample ID: 480-16799-2

Date Collected: 02/29/12 12:20 **Matrix: Water**

Date Received: 03/02/12 11:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	54020	03/06/12 16:50	RL	TAL BUF
Total/NA	Analysis	8260B	DL	5	54121	03/07/12 00:34	DC	TAL BUF
Total/NA	Analysis	RSK-175		1	53795	03/04/12 13:55	JM	TAL BUF
Total/NA	Analysis	VFA-IC		1	53952	03/07/12 22:49	KAC	TAL BUF
Total/NA	Analysis	300.0		1	54087	03/07/12 16:53	KAC	TAL BUF
Total/NA	Analysis	353.2		1	54291	03/07/12 17:22	KS	TAL BUF
Total/NA	Analysis	SM 5310D		1	54596	03/09/12 00:00	KAC	TAL BUF

Client Sample ID: RU-20 Lab Sample ID: 480-16799-3

Date Collected: 02/29/12 15:05 **Matrix: Water**

Date Received: 03/02/12 11:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		25	54121	03/07/12 00:56	DC	TAL BUF
Total/NA	Analysis	RSK-175		1	53795	03/04/12 14:12	JM	TAL BUF
Total/NA	Analysis	VFA-IC		1	53952	03/07/12 23:18	KAC	TAL BUF
Total/NA	Analysis	300.0		1	54087	03/07/12 17:03	KAC	TAL BUF
Total/NA	Analysis	353.2		1	54291	03/07/12 17:23	KS	TAL BUF
Total/NA	Analysis	VFA-IC		2	54385	03/08/12 23:52	KAC	TAL BUF
Total/NA	Analysis	SM 5310D		10	55266	03/13/12 21:44	KAC	TAL BUF

Client Sample ID: RU-21 Lab Sample ID: 480-16799-4

Date Collected: 02/29/12 16:40 **Matrix: Water**

Date Received: 03/02/12 11:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		2	54121	03/07/12 01:18	DC	TAL BUF
Total/NA	Analysis	RSK-175		1	53795	03/04/12 14:29	JM	TAL BUF
Total/NA	Analysis	RSK-175	DL	100	53795	03/04/12 15:30	JM	TAL BUF

Client Sample ID: RU-21

Lab Sample ID: 480-16799-4

Date Collected: 02/29/12 16:40
Date Received: 03/02/12 11:30

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	VFA-IC		1	53953	03/08/12 02:13	KAC	TAL BUF
Total/NA	Analysis	300.0		5	54087	03/07/12 17:43	KAC	TAL BUF
Total/NA	Analysis	353.2		1	54291	03/07/12 17:24	KS	TAL BUF
Total/NA	Analysis	VFA-IC		50	54385	03/09/12 00:21	KAC	TAL BUF
Total/NA	Analysis	300.0		1	55196	03/14/12 12:57	KAC	TAL BUF
Total/NA	Analysis	SM 5310D		40	55266	03/13/12 22:01	KAC	TAL BUF

Client Sample ID: DUP-1

Lab Sample ID: 480-16799-5

Date Collected: 02/29/12 00:00
Date Received: 03/02/12 11:30

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		4	54121	03/07/12 01:40	DC	TAL BUF
Total/NA	Analysis	RSK-175		1	53795	03/04/12 14:46	JM	TAL BUF
Total/NA	Analysis	VFA-IC		1	53953	03/08/12 02:42	KAC	TAL BUF
Total/NA	Analysis	300.0		1	54087	03/07/12 17:53	KAC	TAL BUF
Total/NA	Analysis	353.2		1	54291	03/07/12 17:25	KS	TAL BUF
Total/NA	Analysis	SM 5310D		1	54596	03/09/12 00:51	KAC	TAL BUF

Client Sample ID: FB-1

Lab Sample ID: 480-16799-6

Date Collected: 02/29/12 15:30
Date Received: 03/02/12 11:30

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	54020	03/06/12 18:18	RL	TAL BUF

Client Sample ID: TRIP BLANK

Lab Sample ID: 480-16799-7

Date Collected: 02/29/12 00:00
Date Received: 03/02/12 11:30

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	54020	03/06/12 18:39	RL	TAL BUF

Laboratory References:

TAL BUF = TestAmerica Buffalo, 10 Hazelwood Drive, Amherst, NY 14228-2298, TEL (716)691-2600

Certification Summary

Laboratory	Authority	Program	EPA Region	Certification ID
TestAmerica Buffalo	Arkansas DEQ	State Program	6	88-0686
TestAmerica Buffalo	California	NELAC	9	1169CA
TestAmerica Buffalo	Connecticut	State Program	1	PH-0568
TestAmerica Buffalo	Florida	NELAC	4	E87672
TestAmerica Buffalo	Georgia	State Program	4	956
TestAmerica Buffalo	Georgia	State Program	4	N/A
TestAmerica Buffalo	Illinois	NELAC	5	100325 / 200003
TestAmerica Buffalo	Iowa	State Program	7	374
TestAmerica Buffalo	Kansas	NELAC	7	E-10187
TestAmerica Buffalo	Kentucky	State Program	4	90029
TestAmerica Buffalo	Kentucky (UST)	State Program	4	30
TestAmerica Buffalo	Louisiana	NELAC	6	02031
TestAmerica Buffalo	Maine	State Program	1	NY0044
TestAmerica Buffalo	Maryland	State Program	3	294
TestAmerica Buffalo	Massachusetts	State Program	1	M-NY044
TestAmerica Buffalo	Michigan	State Program	5	9937
TestAmerica Buffalo	Minnesota	NELAC	5	036-999-337
TestAmerica Buffalo	New Hampshire	NELAC	1	2337
TestAmerica Buffalo	New Hampshire	NELAC	1	68-00281
TestAmerica Buffalo	New Jersey	NELAC	2	NY455
TestAmerica Buffalo	New York	NELAC	2	10026
TestAmerica Buffalo	North Dakota	State Program	8	R-176
TestAmerica Buffalo	Oklahoma	State Program	6	9421
TestAmerica Buffalo	Oregon	NELAC	10	NY200003
TestAmerica Buffalo	Pennsylvania	NELAC	3	68-00281
TestAmerica Buffalo	Tennessee	State Program	4	TN02970
TestAmerica Buffalo	Texas	NELAC	6	T104704412-08-TX
TestAmerica Buffalo	USDA	Federal		P330-08-00242
TestAmerica Buffalo	Virginia	NELAC Secondary AB	3	460185
TestAmerica Buffalo	Virginia	State Program	3	278
TestAmerica Buffalo	Washington	State Program	10	C1677
TestAmerica Buffalo	West Virginia DEP	State Program	3	252
TestAmerica Buffalo	Wisconsin	State Program	5	998310390

Accreditation may not be offered or required for all methods and analytes reported in this package. Please contact your project manager for the laboratory's current list of certified methods and analytes.

Method	Method Description	Protocol	Laboratory
8260B	Volatile Organic Compounds (GC/MS)	SW846	TAL BUF
RSK-175	Dissolved Gases (GC)	RSK	TAL BUF
300.0	Anions, Ion Chromatography	MCAWW	TAL BUF
353.2	Nitrogen, Nitrate-Nitrite	MCAWW	TAL BUF
SM 5310D	Organic Carbon, Total (TOC)	SM	TAL BUF
VFA-IC	Volatile Fatty Acids, Ion Chromatography	TestAmerica SOP	TAL BUF

Protocol References:

MCAWW = "Methods For Chemical Analysis Of Water And Wastes", EPA-600/4-79-020, March 1983 And Subsequent Revisions.

RSK = Sample Prep And Calculations For Dissolved Gas Analysis In Water Samples Using A GC Headspace Equilibration Technique, RSKSOP-175, Rev. 0, 8/11/94, USEPA Research Lab

SM = "Standard Methods For The Examination Of Water And Wastewater",

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

TestAmerica SOP = TestAmerica, Inc., Standard Operating Procedure

Laboratory References:

TAL BUF = TestAmerica Buffalo, 10 Hazelwood Drive, Amherst, NY 14228-2298, TEL (716)691-2600

Sample Summary

Client: CDM Smith, Inc.
Project/Site: New York state project

TestAmerica Job ID: 480-16799-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
480-16799-1	RU-19	Water	02/29/12 13:50	03/02/12 11:30
480-16799-2	RU-10	Water	02/29/12 12:20	03/02/12 11:30
480-16799-3	RU-20	Water	02/29/12 15:05	03/02/12 11:30
480-16799-4	RU-21	Water	02/29/12 16:40	03/02/12 11:30
480-16799-5	DUP-1	Water	02/29/12 00:00	03/02/12 11:30
480-16799-6	FB-1	Water	02/29/12 15:30	03/02/12 11:30
480-16799-7	TRIP BLANK	Water	02/29/12 00:00	03/02/12 11:30

TestAmerica Buffalo
10 Hazelwood Drive
Amherst, NY 14228-2298
Phone (716) 691-2600 Fax (716) 691-7991

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information

Client Contact: Neil Smith	Sampler: Eric Rosenzweig	Lab PM: Gray-Erdmann, Peggy	COC No: 480-21577-5467.1
Company: CDM Smith, Inc.	Phone: 578 380 4332	E-Mail: peggy.gray-erdmann@testamericainc.com	Page: Page 1 of 1
Address: 555 17th Street Suite 1100	Due Date Requested:	Carrier Tracking No(s):	Job #:
City: Denver	TAT Requested (days): Standard		
State, Zip: CO, 80202	PO #: Purchase Order not required		
Phone: 303-383-2447(Tel)	WO #:		
Email: smithnl@cdmsmith.com	Project #: 48005099		
Project Name: New York state project	SSOW#:		
Site:			

Analysis Requested

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8260B - TCL list OLM04.2	VFA_IC - (MOD) Standard VFA Compounds	300.0_28D - (MOD) Local Method	353.2_Pres - Nitrate Nitrite as N	SM5310D - Total Organic Carbon	RSK_175 - (MOD) Local Method	Total Number of containers	Special Instructions/Note:
				Preservation Code:			A	N	N	S	A	A		
RU-19	2/29/12	1350	G	Water	N	N	X	X	X	X	X	X		
RU-10		1220		Water			X							
RU-20		1505		Water			X							
RU-21		1640		Water			X							
Dup-1		—		Water			X							
EB-1		1530		Water			X							
TripBlank		—		Water			X							
				Water										
				Water										
				Water										
				Water										

Preservation Codes:
A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA
M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2SO3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - ph 4-5, Z - other (specify)
Other:

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*

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

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:		Date:		Time:		Method of Shipment:	
Relinquished by: [signature]	Date/Time: 3/1/12 1205	Company		Received by: [signature]		Date/Time: [illegible] 3-1-12	Company
Relinquished by: [signature]	Date/Time: 3-1-12 18:20	Company		Received by: [signature]		Date/Time: 3-2-12 11:30	Company: BLO
Relinquished by:	Date/Time:	Company		Received by:		Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No | Custody Seal No.: | Cooler Temperature(s) °C and Other Remarks: 2.6 #3

Login Sample Receipt Checklist

Client: CDM Smith, Inc. | Job Number: 480-16799-1

Login Number: 16799 | **List Source: TestAmerica Buffalo**
List Number: 1
Creator: May, Joel M

Question	Answer	Comment
Radioactivity either was not measured or, if measured, is at or below background	True	
The cooler's custody seal, if present, is intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	True	
If necessary, staff have been informed of any short hold time or quick TAT needs	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Sampling Company provided.	True	
Samples received within 48 hours of sampling.	True	
Samples requiring field filtration have been filtered in the field.	N/A	
Chlorine Residual checked.	N/A	

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Buffalo
10 Hazelwood Drive
Amherst, NY 14228-2298
Tel: (716)691-2600

TestAmerica Job ID: 480-19566-1
Client Project/Site: New York state project

For:
CDM Smith, Inc.
555 17th Street
Suite 1100
Denver, Colorado 80202

Attn: Neil Smith

EBerry

Authorized for release by:
5/17/2012 2:20:39 PM
Eve Berry
Project Administrator
eve.berry@testamericainc.com

Designee for

Peggy Gray-Erdmann
Project Manager II
peggy.gray-erdmann@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Client: CDM Smith, Inc. TestAmerica Job ID: 480-19566-1
Project/Site: New York state project

Qualifiers

GC/MS VOA

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

GC VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
B	Compound was found in the blank and sample.

Metals

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
B	Compound was found in the blank and sample.

General Chemistry

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
^	ICV,CCV,ICB,CCB, ISA, ISB, CRI, CRA, DLCK or MRL standard: Instrument related QC exceeds the control limits.
F	MS or MSD exceeds the control limits

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
☼	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DL, RA, RE, IN	Indicates a Dilution, Reanalysis, Re-extraction, or additional Initial metals/anion analysis of the sample
EDL	Estimated Detection Limit
EPA	United States Environmental Protection Agency
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RL	Reporting Limit
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 480-19566-1

Laboratory: TestAmerica Buffalo

Narrative

Job Narrative
480-19566-1

Receipt
The samples were received on 5/3/2012 9:00 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 2.0º C.

Except:

The following sample was collected in an improper containers: RU10-050112 (480-19566-1). This sample's metals volume was received in a Nitric Acid pre-preserved bottles. The client requested that the volume be lab filtered. Pre-preserved nitric acid volumes are not applicable to lab filtration to attain a dissolved metal aliquot so that volume was discarded.

Approximately 60 mls of volume was obtained from the other unpreserved volumes and poured off into a 125 ml plastic (UP). This volume was submitted to metals for lab filtration and preservation.

GC/MS VOA
Method(s) 8260B: The following samples were diluted due to the abundance of target analytes: (480-19566-2 MS), (480-19566-2 MSD), RU10-050112 (480-19566-1), RU19-050112 (480-19566-2), RU20-050112 (480-19566-4), RU21-050112 (480-19566-7). Elevated reporting limits (RLs) are provided.

No other analytical or quality issues were noted.

IC
Method(s) 300.0: The method blank for batch 63060 contained sulfate above the method detection limit. This target analyte concentration was less than the reporting limit (RL); therefore, re-extraction and/or re-analysis of samples was not performed.

Method(s) 300.0: The matrix spike (MS) recoveries for batch 63060 were outside control limits. The associated laboratory control sample (LCS) recovery met acceptance criteria.

Method(s) 300.0: In batch 63060, the following sample was diluted due to the abundance of target analytes: RU21-050112 (480-19566-7). Elevated reporting limits (RLs) are provided.

Method(s) 300.0: In batch 64072, the following sample was diluted due to the abundance of target analytes: RU20-050112 (480-19566-4). Elevated reporting limits (RLs) are provided.

Method(s) 300.0: In batch 64536, the following samples were diluted due to the abundance of target analytes: (480-19566-7 MS), (480-19566-7 MSD), RU21-050112 (480-19566-7). Elevated reporting limits (RLs) are provided.

Method(s) 300.0: Due to the high concentration of Fluoride, the matrix spike / matrix spike duplicate (MS/MSD) for batch 64536 could not be evaluated for accuracy and precision. The associated laboratory control sample (LCS) met acceptance criteria.

Method(s) VFA-IC: The matrix spike / matrix spike duplicate (MS/MSD) recoveries associated with batch 64494 were outside control limits: (480-19566-8 MS). Matrix interference is suspected.

Method(s) VFA-IC: In batch 64729, the following samples were diluted due to the abundance of target analytes: RU20-050112 (480-19566-4), RU21-050112 (480-19566-7). Elevated reporting limits (RLs) are provided.

No other analytical or quality issues were noted.

GC VOA
Method(s) RSK-175: The following samples were diluted due to the abundance of target analytes: RU10-050112 (480-19566-1), RU19-050112 (480-19566-2), RU19D-050112 (480-19566-3), RU20-050112 (480-19566-4), RU21-050112 (480-19566-7), RU8-050112 (480-19566-8). Elevated reporting limits (RLs) are provided.

Job ID: 480-19566-1 (Continued)

Laboratory: TestAmerica Buffalo (Continued)

No other analytical or quality issues were noted.

Metals
Method(s) 6010B: The Method Blank for batch 480-63221 contained dissolved potassium and sodium above the method detection limits. These target analyte concentrations were less than the reporting limits (RLs); therefore, re-extraction and/or re-analysis of sample RU10-050112 (480-19566-1) was not performed.

No other analytical or quality issues were noted.

General Chemistry
No analytical or quality issues were noted.

Detection Summary

Client: CDM Smith, Inc.
Project/Site: New York state project

TestAmerica Job ID: 480-19566-1

Client Sample ID: RU10-050112

Lab Sample ID: 480-19566-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,1-Dichloroethene	1.8		1.0	0.29	ug/L	1		8260B	Total/NA
Acetone	8.0	J	10	3.0	ug/L	1		8260B	Total/NA
Chloroethane	3.0		1.0	0.32	ug/L	1		8260B	Total/NA
Tetrachloroethene	1.0		1.0	0.36	ug/L	1		8260B	Total/NA
trans-1,2-Dichloroethene	3.8		1.0	0.90	ug/L	1		8260B	Total/NA
Vinyl chloride	32		1.0	0.90	ug/L	1		8260B	Total/NA
cis-1,2-Dichloroethene - DL	290		10	8.1	ug/L	10		8260B	Total/NA
Trichloroethene - DL	500		10	4.6	ug/L	10		8260B	Total/NA
Ethane	8.7		1.5	0.49	ug/L	1		RSK-175	Total/NA
Ethene	1.4	J	1.5	0.52	ug/L	1		RSK-175	Total/NA
Methane - DL	110	B	10	2.2	ug/L	10		RSK-175	Total/NA
Aluminum	0.075	J	0.20	0.060	mg/L	1		6010B	Dissolved
Arsenic	0.013		0.010	0.0056	mg/L	1		6010B	Dissolved
Barium	0.18		0.0020	0.00070	mg/L	1		6010B	Dissolved
Calcium	79.6		0.50	0.10	mg/L	1		6010B	Dissolved
Chromium	0.0026	J	0.0040	0.0010	mg/L	1		6010B	Dissolved
Cobalt	0.0052		0.0040	0.00063	mg/L	1		6010B	Dissolved
Iron	3.4		0.050	0.019	mg/L	1		6010B	Dissolved
Magnesium	10.9		0.20	0.043	mg/L	1		6010B	Dissolved
Manganese	3.2		0.0030	0.00040	mg/L	1		6010B	Dissolved
Nickel	0.0044	J	0.010	0.0013	mg/L	1		6010B	Dissolved
Potassium	1.2	B	0.50	0.10	mg/L	1		6010B	Dissolved
Selenium	0.019		0.015	0.0087	mg/L	1		6010B	Dissolved
Sodium	18.6	B	1.0	0.32	mg/L	1		6010B	Dissolved
Zinc	0.028		0.010	0.0015	mg/L	1		6010B	Dissolved
Chloride	17.1		0.50	0.28	mg/L	1		300.0	Total/NA
Sulfate	27.3		2.0	0.35	mg/L	1		300.0	Total/NA
Nitrate Nitrite as N	0.034	J	0.050	0.020	mg/L	1		353.2	Total/NA
Total Organic Carbon	8.6		1.0	0.43	mg/L	1		SM 5310D	Total/NA
Total Organic Carbon - Duplicates	8.6		1.0	0.43	mg/L	1		SM 5310D	Total/NA
TOC Result 1	9.2		1.0	0.43	mg/L	1		SM 5310D	Total/NA
TOC Result 2	8.1		1.0	0.43	mg/L	1		SM 5310D	Total/NA
Acetic acid	10.9		1.0	0.15	mg/L	1		VFA-IC	Total/NA

Client Sample ID: RU19-050112

Lab Sample ID: 480-19566-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	400		10	8.1	ug/L	10		8260B	Total/NA
Vinyl chloride	49		10	9.0	ug/L	10		8260B	Total/NA
Trichloroethene - DL	1100		20	9.2	ug/L	20		8260B	Total/NA
Ethane	9.9		1.5	0.49	ug/L	1		RSK-175	Total/NA
Ethene	1.5		1.5	0.52	ug/L	1		RSK-175	Total/NA
Methane - DL	170	B	10	2.2	ug/L	10		RSK-175	Total/NA
Barium	0.065		0.0020	0.00070	mg/L	1		6010B	Dissolved
Calcium	95.1		0.50	0.10	mg/L	1		6010B	Dissolved
Cobalt	0.0011	J	0.0040	0.00063	mg/L	1		6010B	Dissolved
Iron	0.11		0.050	0.019	mg/L	1		6010B	Dissolved
Magnesium	15.2		0.20	0.043	mg/L	1		6010B	Dissolved
Manganese	2.6		0.0030	0.00040	mg/L	1		6010B	Dissolved
Nickel	0.0023	J	0.010	0.0013	mg/L	1		6010B	Dissolved
Potassium	1.5		0.50	0.10	mg/L	1		6010B	Dissolved
Sodium	18.2		1.0	0.32	mg/L	1		6010B	Dissolved
Zinc	0.0033	J	0.010	0.0015	mg/L	1		6010B	Dissolved

Client Sample ID: RU19-050112 (Continued) Lab Sample ID: 480-19566-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chloride	24.4		0.50	0.28	mg/L	1		300.0	Total/NA
Sulfate	47.2		2.0	0.35	mg/L	1		300.0	Total/NA
Nitrate Nitrite as N	0.037	J	0.050	0.020	mg/L	1		353.2	Total/NA
Total Organic Carbon	2.5		1.0	0.43	mg/L	1		SM 5310D	Total/NA
Total Organic Carbon - Duplicates	2.5		1.0	0.43	mg/L	1		SM 5310D	Total/NA
TOC Result 1	2.8		1.0	0.43	mg/L	1		SM 5310D	Total/NA
TOC Result 2	2.1		1.0	0.43	mg/L	1		SM 5310D	Total/NA

Client Sample ID: RU19D-050112 Lab Sample ID: 480-19566-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	360		10	8.1	ug/L	10		8260B	Total/NA
Trichloroethene	940		10	4.6	ug/L	10		8260B	Total/NA
Vinyl chloride	46		10	9.0	ug/L	10		8260B	Total/NA
Ethane	9.5		1.5	0.49	ug/L	1		RSK-175	Total/NA
Ethene	1.6		1.5	0.52	ug/L	1		RSK-175	Total/NA
Methane - DL	95	B	10	2.2	ug/L	10		RSK-175	Total/NA
Barium	0.064		0.0020	0.00070	mg/L	1		6010B	Dissolved
Calcium	96.2		0.50	0.10	mg/L	1		6010B	Dissolved
Cobalt	0.0012	J	0.0040	0.00063	mg/L	1		6010B	Dissolved
Iron	0.11		0.050	0.019	mg/L	1		6010B	Dissolved
Magnesium	15.2		0.20	0.043	mg/L	1		6010B	Dissolved
Manganese	2.6		0.0030	0.00040	mg/L	1		6010B	Dissolved
Nickel	0.0021	J	0.010	0.0013	mg/L	1		6010B	Dissolved
Potassium	1.5		0.50	0.10	mg/L	1		6010B	Dissolved
Sodium	18.1		1.0	0.32	mg/L	1		6010B	Dissolved
Zinc	0.0027	J	0.010	0.0015	mg/L	1		6010B	Dissolved
Chloride	24.6		0.50	0.28	mg/L	1		300.0	Total/NA
Sulfate	48.8		2.0	0.35	mg/L	1		300.0	Total/NA
Nitrate Nitrite as N	0.046	J	0.050	0.020	mg/L	1		353.2	Total/NA
Total Organic Carbon	2.3		1.0	0.43	mg/L	1		SM 5310D	Total/NA
Total Organic Carbon - Duplicates	2.3		1.0	0.43	mg/L	1		SM 5310D	Total/NA
TOC Result 1	2.6		1.0	0.43	mg/L	1		SM 5310D	Total/NA
TOC Result 2	2.1		1.0	0.43	mg/L	1		SM 5310D	Total/NA

Client Sample ID: RU20-050112 Lab Sample ID: 480-19566-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	77		50	41	ug/L	50		8260B	Total/NA
Trichloroethene	2100		50	23	ug/L	50		8260B	Total/NA
Ethane	7.8	J	15	4.9	ug/L	10		RSK-175	Total/NA
Ethene	7.6	J	15	5.2	ug/L	10		RSK-175	Total/NA
Methane	60	B	10	2.2	ug/L	10		RSK-175	Total/NA
Arsenic	0.0069	J	0.010	0.0056	mg/L	1		6010B	Dissolved
Barium	0.12		0.0020	0.00070	mg/L	1		6010B	Dissolved
Calcium	98.0		0.50	0.10	mg/L	1		6010B	Dissolved
Chromium	0.0012	J	0.0040	0.0010	mg/L	1		6010B	Dissolved
Iron	0.42		0.050	0.019	mg/L	1		6010B	Dissolved
Magnesium	15.2		0.20	0.043	mg/L	1		6010B	Dissolved
Manganese	0.85		0.0030	0.00040	mg/L	1		6010B	Dissolved
Nickel	0.0016	J	0.010	0.0013	mg/L	1		6010B	Dissolved
Potassium	4.7		0.50	0.10	mg/L	1		6010B	Dissolved
Sodium	64.2		1.0	0.32	mg/L	1		6010B	Dissolved

Detection Summary

Client: CDM Smith, Inc.
Project/Site: New York state project

TestAmerica Job ID: 480-19566-1

Client Sample ID: RU20-050112 (Continued)

Lab Sample ID: 480-19566-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chloride	71.6		0.50	0.28	mg/L	1		300.0	Total/NA
Sulfate	22.8		2.0	0.35	mg/L	1		300.0	Total/NA
Nitrate Nitrite as N	0.56		0.050	0.020	mg/L	1		353.2	Total/NA
Total Organic Carbon	75.5		1.0	0.43	mg/L	1		SM 5310D	Total/NA
Total Organic Carbon - Duplicates	75.5		1.0	0.43	mg/L	1		SM 5310D	Total/NA
TOC Result 1	73.1		1.0	0.43	mg/L	1		SM 5310D	Total/NA
TOC Result 2	77.8		1.0	0.43	mg/L	1		SM 5310D	Total/NA
Acetic acid	63.6		2.0	0.30	mg/L	2		VFA-IC	Total/NA
Propionic acid	33.0		1.0	0.17	mg/L	1		VFA-IC	Total/NA

Client Sample ID: FB-050112

Lab Sample ID: 480-19566-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	8.5	J	10	3.0	ug/L	1		8260B	Total/NA
Xylenes, Total	1.1	J	2.0	0.66	ug/L	1		8260B	Total/NA

Client Sample ID: TRIP BLANK

Lab Sample ID: 480-19566-6

No Detections

Client Sample ID: RU21-050112

Lab Sample ID: 480-19566-7

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
2-Butanone (MEK)	46		20	2.6	ug/L	2		8260B	Total/NA
Acetone	47		20	6.0	ug/L	2		8260B	Total/NA
Carbon disulfide	1.0	J	2.0	0.38	ug/L	2		8260B	Total/NA
Chloroethane	9.7		2.0	0.64	ug/L	2		8260B	Total/NA
Chloromethane	0.72	J	2.0	0.70	ug/L	2		8260B	Total/NA
cis-1,2-Dichloroethene	71		2.0	1.6	ug/L	2		8260B	Total/NA
Ethylbenzene	1.5	J	2.0	1.5	ug/L	2		8260B	Total/NA
Methyl acetate	1.5	J	2.0	1.0	ug/L	2		8260B	Total/NA
Trichloroethene	69		2.0	0.92	ug/L	2		8260B	Total/NA
Vinyl chloride	170		2.0	1.8	ug/L	2		8260B	Total/NA
Ethane	16		15	4.9	ug/L	10		RSK-175	Total/NA
Ethene	18		15	5.2	ug/L	10		RSK-175	Total/NA
Methane - DL	1700	B	100	22	ug/L	100		RSK-175	Total/NA
Aluminum	0.10	J	0.20	0.060	mg/L	1		6010B	Dissolved
Arsenic	0.023		0.010	0.0056	mg/L	1		6010B	Dissolved
Barium	0.46		0.0020	0.00070	mg/L	1		6010B	Dissolved
Cadmium	0.00052	J	0.0010	0.00050	mg/L	1		6010B	Dissolved
Calcium	83.1		0.50	0.10	mg/L	1		6010B	Dissolved
Chromium	0.0028	J	0.0040	0.0010	mg/L	1		6010B	Dissolved
Cobalt	0.010		0.0040	0.00063	mg/L	1		6010B	Dissolved
Iron	18.7		0.050	0.019	mg/L	1		6010B	Dissolved
Magnesium	16.3		0.20	0.043	mg/L	1		6010B	Dissolved
Manganese	17.1		0.0030	0.00040	mg/L	1		6010B	Dissolved
Nickel	0.0086	J	0.010	0.0013	mg/L	1		6010B	Dissolved
Potassium	1.5		0.50	0.10	mg/L	1		6010B	Dissolved
Selenium	0.0098	J	0.015	0.0087	mg/L	1		6010B	Dissolved
Sodium	524		1.0	0.32	mg/L	1		6010B	Dissolved
Thallium	0.020		0.020	0.010	mg/L	1		6010B	Dissolved
Zinc	0.0029	J	0.010	0.0015	mg/L	1		6010B	Dissolved
Chloride	36.6		2.5	1.4	mg/L	5		300.0	Total/NA
Sulfate	2.4		2.0	0.35	mg/L	1		300.0	Total/NA

Client Sample ID: RU21-050112 (Continued)

Lab Sample ID: 480-19566-7

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Total Organic Carbon	751		40.0	17.4	mg/L	40		SM 5310D	Total/NA
Total Organic Carbon - Duplicates	751		40.0	17.4	mg/L	40		SM 5310D	Total/NA
TOC Result 1	712	^	40.0	17.4	mg/L	40		SM 5310D	Total/NA
TOC Result 2	791		40.0	17.4	mg/L	40		SM 5310D	Total/NA
Acetic acid	650		20.0	3.0	mg/L	20		VFA-IC	Total/NA
n-Butyric Acid	57.0		20.0	3.2	mg/L	20		VFA-IC	Total/NA
Propionic acid	770		20.0	3.4	mg/L	20		VFA-IC	Total/NA

Client Sample ID: RU8-050112

Lab Sample ID: 480-19566-8

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
cis-1,2-Dichloroethene	3.0		1.0	0.81	ug/L	1		8260B	Total/NA
Trichloroethene	77		1.0	0.46	ug/L	1		8260B	Total/NA
Ethane	1.4	J	1.5	0.49	ug/L	1		RSK-175	Total/NA
Methane	9.7	B	1.0	0.22	ug/L	1		RSK-175	Total/NA
Barium	0.13		0.0020	0.00070	mg/L	1		6010B	Dissolved
Calcium	117		0.50	0.10	mg/L	1		6010B	Dissolved
Copper	0.0017	J	0.010	0.0016	mg/L	1		6010B	Dissolved
Magnesium	22.5		0.20	0.043	mg/L	1		6010B	Dissolved
Manganese	0.48		0.0030	0.00040	mg/L	1		6010B	Dissolved
Potassium	1.8		0.50	0.10	mg/L	1		6010B	Dissolved
Sodium	12.7		1.0	0.32	mg/L	1		6010B	Dissolved
Zinc	0.0086	J	0.010	0.0015	mg/L	1		6010B	Dissolved
Chloride	12.2		0.50	0.28	mg/L	1		300.0	Total/NA
Sulfate	38.1		2.0	0.35	mg/L	1		300.0	Total/NA
Nitrate Nitrite as N	0.18		0.050	0.020	mg/L	1		353.2	Total/NA
Total Organic Carbon	0.67	J	1.0	0.43	mg/L	1		SM 5310D	Total/NA
Total Organic Carbon - Duplicates	0.67	J	1.0	0.43	mg/L	1		SM 5310D	Total/NA
TOC Result 1	0.95	J	1.0	0.43	mg/L	1		SM 5310D	Total/NA

Client Sample Results

Client: CDM Smith, Inc.
Project/Site: New York state project

TestAmerica Job ID: 480-19566-1

Client Sample ID: RU10-050112

Lab Sample ID: 480-19566-1

Date Collected: 05/01/12 11:15
Matrix: Water
Date Received: 05/03/12 09:00

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			05/10/12 17:04	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			05/10/12 17:04	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			05/10/12 17:04	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			05/10/12 17:04	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			05/10/12 17:04	1
1,1-Dichloroethene	**1.8**		1.0	0.29	ug/L			05/10/12 17:04	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			05/10/12 17:04	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			05/10/12 17:04	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			05/10/12 17:04	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			05/10/12 17:04	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			05/10/12 17:04	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			05/10/12 17:04	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			05/10/12 17:04	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			05/10/12 17:04	1
2-Hexanone	ND		5.0	1.2	ug/L			05/10/12 17:04	1
2-Butanone (MEK)	ND		10	1.3	ug/L			05/10/12 17:04	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			05/10/12 17:04	1
Acetone	**8.0**	**J**	10	3.0	ug/L			05/10/12 17:04	1
Benzene	ND		1.0	0.41	ug/L			05/10/12 17:04	1
Bromodichloromethane	ND		1.0	0.39	ug/L			05/10/12 17:04	1
Bromoform	ND		1.0	0.26	ug/L			05/10/12 17:04	1
Bromomethane	ND		1.0	0.69	ug/L			05/10/12 17:04	1
Carbon disulfide	ND		1.0	0.19	ug/L			05/10/12 17:04	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			05/10/12 17:04	1
Chlorobenzene	ND		1.0	0.75	ug/L			05/10/12 17:04	1
Dibromochloromethane	ND		1.0	0.32	ug/L			05/10/12 17:04	1
Chloroethane	**3.0**		1.0	0.32	ug/L			05/10/12 17:04	1
Chloroform	ND		1.0	0.34	ug/L			05/10/12 17:04	1
Chloromethane	ND		1.0	0.35	ug/L			05/10/12 17:04	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			05/10/12 17:04	1
Cyclohexane	ND		1.0	0.18	ug/L			05/10/12 17:04	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			05/10/12 17:04	1
Ethylbenzene	ND		1.0	0.74	ug/L			05/10/12 17:04	1
Isopropylbenzene	ND		1.0	0.79	ug/L			05/10/12 17:04	1
Methyl acetate	ND		1.0	0.50	ug/L			05/10/12 17:04	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			05/10/12 17:04	1
Methylcyclohexane	ND		1.0	0.16	ug/L			05/10/12 17:04	1
Methylene Chloride	ND		1.0	0.44	ug/L			05/10/12 17:04	1
Styrene	ND		1.0	0.73	ug/L			05/10/12 17:04	1
Tetrachloroethene	**1.0**		1.0	0.36	ug/L			05/10/12 17:04	1
Toluene	ND		1.0	0.51	ug/L			05/10/12 17:04	1
trans-1,2-Dichloroethene	**3.8**		1.0	0.90	ug/L			05/10/12 17:04	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			05/10/12 17:04	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			05/10/12 17:04	1
Vinyl chloride	**32**		1.0	0.90	ug/L			05/10/12 17:04	1
Xylenes, Total	ND		2.0	0.66	ug/L			05/10/12 17:04	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*111*		*66 - 137*		*05/10/12 17:04*	*1*
Toluene-d8 (Surr)	*115*		*71 - 126*		*05/10/12 17:04*	*1*
4-Bromofluorobenzene (Surr)	*97*		*73 - 120*		*05/10/12 17:04*	*1*

Client: CDM Smith, Inc. TestAmerica Job ID: 480-19566-1
Project/Site: New York state project

Client Sample ID: RU10-050112 **Lab Sample ID: 480-19566-1**
Date Collected: 05/01/12 11:15 **Matrix: Water**
Date Received: 05/03/12 09:00

Method: 8260B - Volatile Organic Compounds (GC/MS) - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	290		10	8.1	ug/L			05/11/12 15:20	10
Trichloroethene	500		10	4.6	ug/L			05/11/12 15:20	10

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*107*		*66 - 137*		*05/11/12 15:20*	*10*
Toluene-d8 (Surr)	*114*		*71 - 126*		*05/11/12 15:20*	*10*
4-Bromofluorobenzene (Surr)	*94*		*73 - 120*		*05/11/12 15:20*	*10*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetylene	ND		1.5	0.47	ug/L			05/08/12 13:12	1
Ethane	8.7		1.5	0.49	ug/L			05/08/12 13:12	1
Ethene	1.4	J	1.5	0.52	ug/L			05/08/12 13:12	1
Propane	ND		3.0	1.5	ug/L			05/08/12 13:12	1
Butane	ND		3.0	1.5	ug/L			05/08/12 13:12	1

Method: RSK-175 - Dissolved Gases (GC) - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methane	110	B	10	2.2	ug/L			05/08/12 15:14	10

Method: 6010B - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	0.075	J	0.20	0.060	mg/L		05/07/12 07:20	05/07/12 18:17	1
Antimony	ND		0.020	0.0068	mg/L		05/07/12 07:20	05/07/12 18:17	1
Arsenic	0.013		0.010	0.0056	mg/L		05/07/12 07:20	05/07/12 18:17	1
Barium	0.18		0.0020	0.00070	mg/L		05/07/12 07:20	05/07/12 18:17	1
Beryllium	ND		0.0020	0.00030	mg/L		05/07/12 07:20	05/07/12 18:17	1
Cadmium	ND		0.0010	0.00050	mg/L		05/07/12 07:20	05/07/12 18:17	1
Calcium	79.6		0.50	0.10	mg/L		05/07/12 07:20	05/07/12 18:17	1
Chromium	0.0026	J	0.0040	0.0010	mg/L		05/07/12 07:20	05/07/12 18:17	1
Cobalt	0.0052		0.0040	0.00063	mg/L		05/07/12 07:20	05/07/12 18:17	1
Copper	ND		0.010	0.0016	mg/L		05/07/12 07:20	05/07/12 18:17	1
Iron	3.4		0.050	0.019	mg/L		05/07/12 07:20	05/07/12 18:17	1
Lead	ND		0.0050	0.0030	mg/L		05/07/12 07:20	05/07/12 18:17	1
Magnesium	10.9		0.20	0.043	mg/L		05/07/12 07:20	05/07/12 18:17	1
Manganese	3.2		0.0030	0.00040	mg/L		05/07/12 07:20	05/07/12 18:17	1
Nickel	0.0044	J	0.010	0.0013	mg/L		05/07/12 07:20	05/07/12 18:17	1
Potassium	1.2	B	0.50	0.10	mg/L		05/07/12 07:20	05/07/12 18:17	1
Selenium	0.019		0.015	0.0087	mg/L		05/07/12 07:20	05/07/12 18:17	1
Silver	ND		0.0030	0.0017	mg/L		05/07/12 07:20	05/07/12 18:17	1
Sodium	18.6	B	1.0	0.32	mg/L		05/07/12 07:20	05/07/12 18:17	1
Thallium	ND		0.020	0.010	mg/L		05/07/12 07:20	05/07/12 18:17	1
Vanadium	ND		0.0050	0.0015	mg/L		05/07/12 07:20	05/07/12 18:17	1
Zinc	0.028		0.010	0.0015	mg/L		05/07/12 07:20	05/07/12 18:17	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020	0.00012	mg/L		05/16/12 10:00	05/16/12 13:35	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	17.1		0.50	0.28	mg/L			05/04/12 20:56	1

Client Sample Results

Client: CDM Smith, Inc.
Project/Site: New York state project

TestAmerica Job ID: 480-19566-1

Client Sample ID: RU10-050112

Lab Sample ID: 480-19566-1
Date Collected: 05/01/12 11:15
Matrix: Water
Date Received: 05/03/12 09:00

General Chemistry (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Sulfate	**27.3**		2.0	0.35	mg/L			05/08/12 14:12	1
Nitrate Nitrite as N	**0.034**	**J**	0.050	0.020	mg/L			05/03/12 18:10	1
Total Organic Carbon	**8.6**		1.0	0.43	mg/L			05/05/12 20:38	1
Total Organic Carbon - Duplicates	**8.6**		1.0	0.43	mg/L			05/05/12 20:38	1
TOC Result 1	**9.2**		1.0	0.43	mg/L			05/05/12 20:38	1
TOC Result 2	**8.1**		1.0	0.43	mg/L			05/05/12 20:38	1
Acetic acid	**10.9**		1.0	0.15	mg/L			05/16/12 06:56	1
Butyric acid	ND		1.0	0.16	mg/L			05/16/12 06:56	1
Propionic acid	ND		1.0	0.17	mg/L			05/16/12 06:56	1

Client Sample ID: RU19-050112

Lab Sample ID: 480-19566-2
Date Collected: 05/01/12 14:15
Matrix: Water
Date Received: 05/03/12 09:00

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		10	8.2	ug/L			05/10/12 17:27	10
1,1,2,2-Tetrachloroethane	ND		10	2.1	ug/L			05/10/12 17:27	10
1,1,2-Trichloroethane	ND		10	2.3	ug/L			05/10/12 17:27	10
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		10	3.1	ug/L			05/10/12 17:27	10
1,1-Dichloroethane	ND		10	3.8	ug/L			05/10/12 17:27	10
1,1-Dichloroethene	ND		10	2.9	ug/L			05/10/12 17:27	10
1,2,4-Trichlorobenzene	ND		10	4.1	ug/L			05/10/12 17:27	10
1,2-Dibromo-3-Chloropropane	ND		10	3.9	ug/L			05/10/12 17:27	10
1,2-Dibromoethane	ND		10	7.3	ug/L			05/10/12 17:27	10
1,2-Dichlorobenzene	ND		10	7.9	ug/L			05/10/12 17:27	10
1,2-Dichloroethane	ND		10	2.1	ug/L			05/10/12 17:27	10
1,2-Dichloropropane	ND		10	7.2	ug/L			05/10/12 17:27	10
1,3-Dichlorobenzene	ND		10	7.8	ug/L			05/10/12 17:27	10
1,4-Dichlorobenzene	ND		10	8.4	ug/L			05/10/12 17:27	10
2-Hexanone	ND		50	12	ug/L			05/10/12 17:27	10
2-Butanone (MEK)	ND		100	13	ug/L			05/10/12 17:27	10
4-Methyl-2-pentanone (MIBK)	ND		50	21	ug/L			05/10/12 17:27	10
Acetone	ND		100	30	ug/L			05/10/12 17:27	10
Benzene	ND		10	4.1	ug/L			05/10/12 17:27	10
Bromodichloromethane	ND		10	3.9	ug/L			05/10/12 17:27	10
Bromoform	ND		10	2.6	ug/L			05/10/12 17:27	10
Bromomethane	ND		10	6.9	ug/L			05/10/12 17:27	10
Carbon disulfide	ND		10	1.9	ug/L			05/10/12 17:27	10
Carbon tetrachloride	ND		10	2.7	ug/L			05/10/12 17:27	10
Chlorobenzene	ND		10	7.5	ug/L			05/10/12 17:27	10
Dibromochloromethane	ND		10	3.2	ug/L			05/10/12 17:27	10
Chloroethane	ND		10	3.2	ug/L			05/10/12 17:27	10
Chloroform	ND		10	3.4	ug/L			05/10/12 17:27	10
Chloromethane	ND		10	3.5	ug/L			05/10/12 17:27	10
cis-1,2-Dichloroethene	**400**		10	8.1	ug/L			05/10/12 17:27	10
cis-1,3-Dichloropropene	ND		10	3.6	ug/L			05/10/12 17:27	10
Cyclohexane	ND		10	1.8	ug/L			05/10/12 17:27	10
Dichlorodifluoromethane	ND		10	6.8	ug/L			05/10/12 17:27	10
Ethylbenzene	ND		10	7.4	ug/L			05/10/12 17:27	10
Isopropylbenzene	ND		10	7.9	ug/L			05/10/12 17:27	10

Client Sample ID: RU19-050112 **Lab Sample ID: 480-19566-2**
Date Collected: 05/01/12 14:15 **Matrix: Water**
Date Received: 05/03/12 09:00

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acetate	ND		10	5.0	ug/L			05/10/12 17:27	10
Methyl tert-butyl ether	ND		10	1.6	ug/L			05/10/12 17:27	10
Methylcyclohexane	ND		10	1.6	ug/L			05/10/12 17:27	10
Methylene Chloride	ND		10	4.4	ug/L			05/10/12 17:27	10
Styrene	ND		10	7.3	ug/L			05/10/12 17:27	10
Tetrachloroethene	ND		10	3.6	ug/L			05/10/12 17:27	10
Toluene	ND		10	5.1	ug/L			05/10/12 17:27	10
trans-1,2-Dichloroethene	ND		10	9.0	ug/L			05/10/12 17:27	10
trans-1,3-Dichloropropene	ND		10	3.7	ug/L			05/10/12 17:27	10
Trichlorofluoromethane	ND		10	8.8	ug/L			05/10/12 17:27	10
Vinyl chloride	**49**		10	9.0	ug/L			05/10/12 17:27	10
Xylenes, Total	ND		20	6.6	ug/L			05/10/12 17:27	10

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*107*		*66 - 137*		*05/10/12 17:27*	*10*
Toluene-d8 (Surr)	*111*		*71 - 126*		*05/10/12 17:27*	*10*
4-Bromofluorobenzene (Surr)	*92*		*73 - 120*		*05/10/12 17:27*	*10*

Method: 8260B - Volatile Organic Compounds (GC/MS) - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Trichloroethene	**1100**		20	9.2	ug/L			05/11/12 15:43	20

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*104*		*66 - 137*		*05/11/12 15:43*	*20*
Toluene-d8 (Surr)	*110*		*71 - 126*		*05/11/12 15:43*	*20*
4-Bromofluorobenzene (Surr)	*90*		*73 - 120*		*05/11/12 15:43*	*20*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetylene	ND		1.5	0.47	ug/L			05/08/12 13:29	1
Ethane	**9.9**		1.5	0.49	ug/L			05/08/12 13:29	1
Ethene	**1.5**		1.5	0.52	ug/L			05/08/12 13:29	1
Propane	ND		3.0	1.5	ug/L			05/08/12 13:29	1
Butane	ND		3.0	1.5	ug/L			05/08/12 13:29	1

Method: RSK-175 - Dissolved Gases (GC) - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methane	**170**	**B**	10	2.2	ug/L			05/08/12 15:31	10

Method: 6010B - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.20	0.060	mg/L		05/04/12 10:10	05/04/12 15:42	1
Antimony	ND		0.020	0.0068	mg/L		05/04/12 10:10	05/04/12 15:42	1
Arsenic	ND		0.010	0.0056	mg/L		05/04/12 10:10	05/04/12 15:42	1
Barium	**0.065**		0.0020	0.00070	mg/L		05/04/12 10:10	05/04/12 15:42	1
Beryllium	ND		0.0020	0.00030	mg/L		05/04/12 10:10	05/04/12 15:42	1
Cadmium	ND		0.0010	0.00050	mg/L		05/04/12 10:10	05/04/12 15:42	1
Calcium	**95.1**		0.50	0.10	mg/L		05/04/12 10:10	05/04/12 15:42	1
Chromium	ND		0.0040	0.0010	mg/L		05/04/12 10:10	05/04/12 15:42	1
Cobalt	**0.0011**	**J**	0.0040	0.00063	mg/L		05/04/12 10:10	05/04/12 15:42	1
Copper	ND		0.010	0.0016	mg/L		05/04/12 10:10	05/04/12 15:42	1
Iron	**0.11**		0.050	0.019	mg/L		05/04/12 10:10	05/04/12 15:42	1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Client Sample ID: RU19-050112

Lab Sample ID: 480-19566-2

Date Collected: 05/01/12 14:15

Matrix: Water

Date Received: 05/03/12 09:00

Method: 6010B - Metals (ICP) - Dissolved (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.0050	0.0030	mg/L		05/04/12 10:10	05/04/12 15:42	1
Magnesium	**15.2**		0.20	0.043	mg/L		05/04/12 10:10	05/04/12 15:42	1
Manganese	**2.6**		0.0030	0.00040	mg/L		05/04/12 10:10	05/04/12 15:42	1
Nickel	**0.0023**	**J**	0.010	0.0013	mg/L		05/04/12 10:10	05/04/12 15:42	1
Potassium	**1.5**		0.50	0.10	mg/L		05/04/12 10:10	05/04/12 15:42	1
Selenium	ND		0.015	0.0087	mg/L		05/04/12 10:10	05/04/12 15:42	1
Silver	ND		0.0030	0.0017	mg/L		05/04/12 10:10	05/04/12 15:42	1
Sodium	**18.2**		1.0	0.32	mg/L		05/04/12 10:10	05/04/12 15:42	1
Thallium	ND		0.020	0.010	mg/L		05/04/12 10:10	05/04/12 15:42	1
Vanadium	ND		0.0050	0.0015	mg/L		05/04/12 10:10	05/04/12 15:42	1
Zinc	**0.0033**	**J**	0.010	0.0015	mg/L		05/04/12 10:10	05/04/12 15:42	1

Method: 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020	0.00012	mg/L		05/04/12 09:15	05/04/12 15:35	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**24.4**		0.50	0.28	mg/L			05/04/12 21:36	1
Sulfate	**47.2**		2.0	0.35	mg/L			05/08/12 14:22	1
Nitrate Nitrite as N	**0.037**	**J**	0.050	0.020	mg/L			05/03/12 18:11	1
Total Organic Carbon	**2.5**		1.0	0.43	mg/L			05/05/12 20:54	1
Total Organic Carbon - Duplicates	**2.5**		1.0	0.43	mg/L			05/05/12 20:54	1
TOC Result 1	**2.8**		1.0	0.43	mg/L			05/05/12 20:54	1
TOC Result 2	**2.1**		1.0	0.43	mg/L			05/05/12 20:54	1
Acetic acid	ND		1.0	0.15	mg/L			05/16/12 07:25	1
n-Butyric Acid	ND		1.0	0.16	mg/L			05/16/12 07:25	1
Propionic acid	ND		1.0	0.17	mg/L			05/16/12 07:25	1

Client Sample ID: RU19D-050112

Lab Sample ID: 480-19566-3

Date Collected: 05/01/12 14:20

Matrix: Water

Date Received: 05/03/12 09:00

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		10	8.2	ug/L			05/10/12 17:50	10
1,1,2,2-Tetrachloroethane	ND		10	2.1	ug/L			05/10/12 17:50	10
1,1,2-Trichloroethane	ND		10	2.3	ug/L			05/10/12 17:50	10
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		10	3.1	ug/L			05/10/12 17:50	10
1,1-Dichloroethane	ND		10	3.8	ug/L			05/10/12 17:50	10
1,1-Dichloroethene	ND		10	2.9	ug/L			05/10/12 17:50	10
1,2,4-Trichlorobenzene	ND		10	4.1	ug/L			05/10/12 17:50	10
1,2-Dibromo-3-Chloropropane	ND		10	3.9	ug/L			05/10/12 17:50	10
1,2-Dibromoethane	ND		10	7.3	ug/L			05/10/12 17:50	10
1,2-Dichlorobenzene	ND		10	7.9	ug/L			05/10/12 17:50	10
1,2-Dichloroethane	ND		10	2.1	ug/L			05/10/12 17:50	10
1,2-Dichloropropane	ND		10	7.2	ug/L			05/10/12 17:50	10
1,3-Dichlorobenzene	ND		10	7.8	ug/L			05/10/12 17:50	10
1,4-Dichlorobenzene	ND		10	8.4	ug/L			05/10/12 17:50	10
2-Hexanone	ND		50	12	ug/L			05/10/12 17:50	10
2-Butanone (MEK)	ND		100	13	ug/L			05/10/12 17:50	10
4-Methyl-2-pentanone (MIBK)	ND		50	21	ug/L			05/10/12 17:50	10

Client Sample Results

Client: CDM Smith, Inc.
Project/Site: New York state project

TestAmerica Job ID: 480-19566-1

Client Sample ID: RU19D-050112
Date Collected: 05/01/12 14:20
Date Received: 05/03/12 09:00

Lab Sample ID: 480-19566-3
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetone	ND		100	30	ug/L			05/10/12 17:50	10
Benzene	ND		10	4.1	ug/L			05/10/12 17:50	10
Bromodichloromethane	ND		10	3.9	ug/L			05/10/12 17:50	10
Bromoform	ND		10	2.6	ug/L			05/10/12 17:50	10
Bromomethane	ND		10	6.9	ug/L			05/10/12 17:50	10
Carbon disulfide	ND		10	1.9	ug/L			05/10/12 17:50	10
Carbon tetrachloride	ND		10	2.7	ug/L			05/10/12 17:50	10
Chlorobenzene	ND		10	7.5	ug/L			05/10/12 17:50	10
Dibromochloromethane	ND		10	3.2	ug/L			05/10/12 17:50	10
Chloroethane	ND		10	3.2	ug/L			05/10/12 17:50	10
Chloroform	ND		10	3.4	ug/L			05/10/12 17:50	10
Chloromethane	ND		10	3.5	ug/L			05/10/12 17:50	10
cis-1,2-Dichloroethene	**360**		10	8.1	ug/L			05/10/12 17:50	10
cis-1,3-Dichloropropene	ND		10	3.6	ug/L			05/10/12 17:50	10
Cyclohexane	ND		10	1.8	ug/L			05/10/12 17:50	10
Dichlorodifluoromethane	ND		10	6.8	ug/L			05/10/12 17:50	10
Ethylbenzene	ND		10	7.4	ug/L			05/10/12 17:50	10
Isopropylbenzene	ND		10	7.9	ug/L			05/10/12 17:50	10
Methyl acetate	ND		10	5.0	ug/L			05/10/12 17:50	10
Methyl tert-butyl ether	ND		10	1.6	ug/L			05/10/12 17:50	10
Methylcyclohexane	ND		10	1.6	ug/L			05/10/12 17:50	10
Methylene Chloride	ND		10	4.4	ug/L			05/10/12 17:50	10
Styrene	ND		10	7.3	ug/L			05/10/12 17:50	10
Tetrachloroethene	ND		10	3.6	ug/L			05/10/12 17:50	10
Toluene	ND		10	5.1	ug/L			05/10/12 17:50	10
trans-1,2-Dichloroethene	ND		10	9.0	ug/L			05/10/12 17:50	10
trans-1,3-Dichloropropene	ND		10	3.7	ug/L			05/10/12 17:50	10
Trichloroethene	**940**		10	4.6	ug/L			05/10/12 17:50	10
Trichlorofluoromethane	ND		10	8.8	ug/L			05/10/12 17:50	10
Vinyl chloride	**46**		10	9.0	ug/L			05/10/12 17:50	10
Xylenes, Total	ND		20	6.6	ug/L			05/10/12 17:50	10

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*110*		*66 - 137*		*05/10/12 17:50*	*10*
Toluene-d8 (Surr)	*117*		*71 - 126*		*05/10/12 17:50*	*10*
4-Bromofluorobenzene (Surr)	*96*		*73 - 120*		*05/10/12 17:50*	*10*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetylene	ND		1.5	0.47	ug/L			05/08/12 13:46	1
Ethane	**9.5**		1.5	0.49	ug/L			05/08/12 13:46	1
Ethene	**1.6**		1.5	0.52	ug/L			05/08/12 13:46	1
Propane	ND		3.0	1.5	ug/L			05/08/12 13:46	1
Butane	ND		3.0	1.5	ug/L			05/08/12 13:46	1

Method: RSK-175 - Dissolved Gases (GC) - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methane	**95**	**B**	10	2.2	ug/L			05/08/12 15:48	10

Method: 6010B - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.20	0.060	mg/L		05/04/12 10:10	05/04/12 15:44	1

Client: CDM Smith, Inc.
Project/Site: New York state project

TestAmerica Job ID: 480-19566-1

Client Sample ID: RU19D-050112

Lab Sample ID: 480-19566-3
Date Collected: 05/01/12 14:20
Matrix: Water
Date Received: 05/03/12 09:00

Method: 6010B - Metals (ICP) - Dissolved (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	ND		0.020	0.0068	mg/L		05/04/12 10:10	05/04/12 15:44	1
Arsenic	ND		0.010	0.0056	mg/L		05/04/12 10:10	05/04/12 15:44	1
Barium	**0.064**		0.0020	0.00070	mg/L		05/04/12 10:10	05/04/12 15:44	1
Beryllium	ND		0.0020	0.00030	mg/L		05/04/12 10:10	05/04/12 15:44	1
Cadmium	ND		0.0010	0.00050	mg/L		05/04/12 10:10	05/04/12 15:44	1
Calcium	**96.2**		0.50	0.10	mg/L		05/04/12 10:10	05/04/12 15:44	1
Chromium	ND		0.0040	0.0010	mg/L		05/04/12 10:10	05/04/12 15:44	1
Cobalt	**0.0012**	**J**	0.0040	0.00063	mg/L		05/04/12 10:10	05/04/12 15:44	1
Copper	ND		0.010	0.0016	mg/L		05/04/12 10:10	05/04/12 15:44	1
Iron	**0.11**		0.050	0.019	mg/L		05/04/12 10:10	05/04/12 15:44	1
Lead	ND		0.0050	0.0030	mg/L		05/04/12 10:10	05/04/12 15:44	1
Magnesium	**15.2**		0.20	0.043	mg/L		05/04/12 10:10	05/04/12 15:44	1
Manganese	**2.6**		0.0030	0.00040	mg/L		05/04/12 10:10	05/04/12 15:44	1
Nickel	**0.0021**	**J**	0.010	0.0013	mg/L		05/04/12 10:10	05/04/12 15:44	1
Potassium	**1.5**		0.50	0.10	mg/L		05/04/12 10:10	05/04/12 15:44	1
Selenium	ND		0.015	0.0087	mg/L		05/04/12 10:10	05/04/12 15:44	1
Silver	ND		0.0030	0.0017	mg/L		05/04/12 10:10	05/04/12 15:44	1
Sodium	**18.1**		1.0	0.32	mg/L		05/04/12 10:10	05/04/12 15:44	1
Thallium	ND		0.020	0.010	mg/L		05/04/12 10:10	05/04/12 15:44	1
Vanadium	ND		0.0050	0.0015	mg/L		05/04/12 10:10	05/04/12 15:44	1
Zinc	**0.0027**	**J**	0.010	0.0015	mg/L		05/04/12 10:10	05/04/12 15:44	1

Method: 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020	0.00012	mg/L		05/04/12 09:15	05/04/12 15:37	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**24.6**		0.50	0.28	mg/L			05/04/12 21:46	1
Sulfate	**48.8**		2.0	0.35	mg/L			05/08/12 14:32	1
Nitrate Nitrite as N	**0.046**	**J**	0.050	0.020	mg/L			05/03/12 18:12	1
Total Organic Carbon	**2.3**		1.0	0.43	mg/L			05/05/12 21:10	1
Total Organic Carbon - Duplicates	**2.3**		1.0	0.43	mg/L			05/05/12 21:10	1
TOC Result 1	**2.6**		1.0	0.43	mg/L			05/05/12 21:10	1
TOC Result 2	**2.1**		1.0	0.43	mg/L			05/05/12 21:10	1
Acetic acid	ND		1.0	0.15	mg/L			05/16/12 07:54	1
n-Butyric Acid	ND		1.0	0.16	mg/L			05/16/12 07:54	1
Propionic acid	ND		1.0	0.17	mg/L			05/16/12 07:54	1

Client Sample ID: RU20-050112

Lab Sample ID: 480-19566-4
Date Collected: 05/01/12 17:20
Matrix: Water
Date Received: 05/03/12 09:00

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		50	41	ug/L			05/10/12 18:13	50
1,1,2,2-Tetrachloroethane	ND		50	11	ug/L			05/10/12 18:13	50
1,1,2-Trichloroethane	ND		50	12	ug/L			05/10/12 18:13	50
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		50	16	ug/L			05/10/12 18:13	50
1,1-Dichloroethane	ND		50	19	ug/L			05/10/12 18:13	50
1,1-Dichloroethene	ND		50	15	ug/L			05/10/12 18:13	50
1,2,4-Trichlorobenzene	ND		50	21	ug/L			05/10/12 18:13	50

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

Client Sample ID: RU20-050112
Lab Sample ID: 480-19566-4
Date Collected: 05/01/12 17:20
Matrix: Water
Date Received: 05/03/12 09:00

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromo-3-Chloropropane	ND		50	20	ug/L			05/10/12 18:13	50
1,2-Dibromoethane	ND		50	37	ug/L			05/10/12 18:13	50
1,2-Dichlorobenzene	ND		50	40	ug/L			05/10/12 18:13	50
1,2-Dichloroethane	ND		50	11	ug/L			05/10/12 18:13	50
1,2-Dichloropropane	ND		50	36	ug/L			05/10/12 18:13	50
1,3-Dichlorobenzene	ND		50	39	ug/L			05/10/12 18:13	50
1,4-Dichlorobenzene	ND		50	42	ug/L			05/10/12 18:13	50
2-Hexanone	ND		250	62	ug/L			05/10/12 18:13	50
2-Butanone (MEK)	ND		500	66	ug/L			05/10/12 18:13	50
4-Methyl-2-pentanone (MIBK)	ND		250	110	ug/L			05/10/12 18:13	50
Acetone	ND		500	150	ug/L			05/10/12 18:13	50
Benzene	ND		50	21	ug/L			05/10/12 18:13	50
Bromodichloromethane	ND		50	20	ug/L			05/10/12 18:13	50
Bromoform	ND		50	13	ug/L			05/10/12 18:13	50
Bromomethane	ND		50	35	ug/L			05/10/12 18:13	50
Carbon disulfide	ND		50	9.5	ug/L			05/10/12 18:13	50
Carbon tetrachloride	ND		50	14	ug/L			05/10/12 18:13	50
Chlorobenzene	ND		50	38	ug/L			05/10/12 18:13	50
Dibromochloromethane	ND		50	16	ug/L			05/10/12 18:13	50
Chloroethane	ND		50	16	ug/L			05/10/12 18:13	50
Chloroform	ND		50	17	ug/L			05/10/12 18:13	50
Chloromethane	ND		50	18	ug/L			05/10/12 18:13	50
cis-1,2-Dichloroethene	**77**		50	41	ug/L			05/10/12 18:13	50
cis-1,3-Dichloropropene	ND		50	18	ug/L			05/10/12 18:13	50
Cyclohexane	ND		50	9.0	ug/L			05/10/12 18:13	50
Dichlorodifluoromethane	ND		50	34	ug/L			05/10/12 18:13	50
Ethylbenzene	ND		50	37	ug/L			05/10/12 18:13	50
Isopropylbenzene	ND		50	40	ug/L			05/10/12 18:13	50
Methyl acetate	ND		50	25	ug/L			05/10/12 18:13	50
Methyl tert-butyl ether	ND		50	8.0	ug/L			05/10/12 18:13	50
Methylcyclohexane	ND		50	8.0	ug/L			05/10/12 18:13	50
Methylene Chloride	ND		50	22	ug/L			05/10/12 18:13	50
Styrene	ND		50	37	ug/L			05/10/12 18:13	50
Tetrachloroethene	ND		50	18	ug/L			05/10/12 18:13	50
Toluene	ND		50	26	ug/L			05/10/12 18:13	50
trans-1,2-Dichloroethene	ND		50	45	ug/L			05/10/12 18:13	50
trans-1,3-Dichloropropene	ND		50	19	ug/L			05/10/12 18:13	50
Trichloroethene	**2100**		50	23	ug/L			05/10/12 18:13	50
Trichlorofluoromethane	ND		50	44	ug/L			05/10/12 18:13	50
Vinyl chloride	ND		50	45	ug/L			05/10/12 18:13	50
Xylenes, Total	ND		100	33	ug/L			05/10/12 18:13	50

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*112*		*66 - 137*		*05/10/12 18:13*	*50*
Toluene-d8 (Surr)	*116*		*71 - 126*		*05/10/12 18:13*	*50*
4-Bromofluorobenzene (Surr)	*96*		*73 - 120*		*05/10/12 18:13*	*50*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetylene	ND		15	4.7	ug/L			05/08/12 14:14	10
Ethane	**7.8**	**J**	15	4.9	ug/L			05/08/12 14:14	10

Client Sample ID: RU20-050112
Lab Sample ID: 480-19566-4
Date Collected: 05/01/12 17:20
Matrix: Water
Date Received: 05/03/12 09:00

Method: RSK-175 - Dissolved Gases (GC) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethene	**7.6**	**J**	15	5.2	ug/L			05/08/12 14:14	10
Methane	**60**	**B**	10	2.2	ug/L			05/08/12 14:14	10
Propane	ND		30	15	ug/L			05/08/12 14:14	10
Butane	ND		30	15	ug/L			05/08/12 14:14	10

Method: 6010B - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.20	0.060	mg/L		05/04/12 10:10	05/04/12 15:50	1
Antimony	ND		0.020	0.0068	mg/L		05/04/12 10:10	05/04/12 15:50	1
Arsenic	**0.0069**	**J**	0.010	0.0056	mg/L		05/04/12 10:10	05/04/12 15:50	1
Barium	**0.12**		0.0020	0.00070	mg/L		05/04/12 10:10	05/04/12 15:50	1
Beryllium	ND		0.0020	0.00030	mg/L		05/04/12 10:10	05/04/12 15:50	1
Cadmium	ND		0.0010	0.00050	mg/L		05/04/12 10:10	05/04/12 15:50	1
Calcium	**98.0**		0.50	0.10	mg/L		05/04/12 10:10	05/04/12 15:50	1
Chromium	**0.0012**	**J**	0.0040	0.0010	mg/L		05/04/12 10:10	05/04/12 15:50	1
Cobalt	ND		0.0040	0.00063	mg/L		05/04/12 10:10	05/04/12 15:50	1
Copper	ND		0.010	0.0016	mg/L		05/04/12 10:10	05/04/12 15:50	1
Iron	**0.42**		0.050	0.019	mg/L		05/04/12 10:10	05/04/12 15:50	1
Lead	ND		0.0050	0.0030	mg/L		05/04/12 10:10	05/04/12 15:50	1
Magnesium	**15.2**		0.20	0.043	mg/L		05/04/12 10:10	05/04/12 15:50	1
Manganese	**0.85**		0.0030	0.00040	mg/L		05/04/12 10:10	05/04/12 15:50	1
Nickel	**0.0016**	**J**	0.010	0.0013	mg/L		05/04/12 10:10	05/04/12 15:50	1
Potassium	**4.7**		0.50	0.10	mg/L		05/04/12 10:10	05/04/12 15:50	1
Selenium	ND		0.015	0.0087	mg/L		05/04/12 10:10	05/04/12 15:50	1
Silver	ND		0.0030	0.0017	mg/L		05/04/12 10:10	05/04/12 15:50	1
Sodium	**64.2**		1.0	0.32	mg/L		05/04/12 10:10	05/04/12 15:50	1
Thallium	ND		0.020	0.010	mg/L		05/04/12 10:10	05/04/12 15:50	1
Vanadium	ND		0.0050	0.0015	mg/L		05/04/12 10:10	05/04/12 15:50	1
Zinc	ND		0.010	0.0015	mg/L		05/04/12 10:10	05/04/12 15:50	1

Method: 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020	0.00012	mg/L		05/04/12 09:15	05/04/12 15:40	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**71.6**		0.50	0.28	mg/L			05/04/12 21:56	1
Sulfate	**22.8**		2.0	0.35	mg/L			05/09/12 18:05	1
Nitrate Nitrite as N	**0.56**		0.050	0.020	mg/L			05/03/12 18:15	1
Total Organic Carbon	**75.5**		1.0	0.43	mg/L			05/05/12 21:27	1
Total Organic Carbon - Duplicates	**75.5**		1.0	0.43	mg/L			05/05/12 21:27	1
TOC Result 1	**73.1**		1.0	0.43	mg/L			05/05/12 21:27	1
TOC Result 2	**77.8**		1.0	0.43	mg/L			05/05/12 21:27	1
Acetic acid	**63.6**		2.0	0.30	mg/L			05/16/12 18:52	2
n-Butyric Acid	ND		1.0	0.16	mg/L			05/16/12 08:23	1
Propionic acid	**33.0**		1.0	0.17	mg/L			05/16/12 08:23	1

Client Sample ID: FB-050112

Lab Sample ID: 480-19566-5

Date Collected: 05/01/12 00:00

Matrix: Water

Date Received: 05/03/12 09:00

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			05/10/12 18:36	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			05/10/12 18:36	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			05/10/12 18:36	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			05/10/12 18:36	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			05/10/12 18:36	1
1,1-Dichloroethene	ND		1.0	0.29	ug/L			05/10/12 18:36	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			05/10/12 18:36	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			05/10/12 18:36	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			05/10/12 18:36	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			05/10/12 18:36	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			05/10/12 18:36	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			05/10/12 18:36	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			05/10/12 18:36	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			05/10/12 18:36	1
2-Hexanone	ND		5.0	1.2	ug/L			05/10/12 18:36	1
2-Butanone (MEK)	ND		10	1.3	ug/L			05/10/12 18:36	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			05/10/12 18:36	1
Acetone	**8.5**	**J**	10	3.0	ug/L			05/10/12 18:36	1
Benzene	ND		1.0	0.41	ug/L			05/10/12 18:36	1
Bromodichloromethane	ND		1.0	0.39	ug/L			05/10/12 18:36	1
Bromoform	ND		1.0	0.26	ug/L			05/10/12 18:36	1
Bromomethane	ND		1.0	0.69	ug/L			05/10/12 18:36	1
Carbon disulfide	ND		1.0	0.19	ug/L			05/10/12 18:36	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			05/10/12 18:36	1
Chlorobenzene	ND		1.0	0.75	ug/L			05/10/12 18:36	1
Dibromochloromethane	ND		1.0	0.32	ug/L			05/10/12 18:36	1
Chloroethane	ND		1.0	0.32	ug/L			05/10/12 18:36	1
Chloroform	ND		1.0	0.34	ug/L			05/10/12 18:36	1
Chloromethane	ND		1.0	0.35	ug/L			05/10/12 18:36	1
cis-1,2-Dichloroethene	ND		1.0	0.81	ug/L			05/10/12 18:36	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			05/10/12 18:36	1
Cyclohexane	ND		1.0	0.18	ug/L			05/10/12 18:36	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			05/10/12 18:36	1
Ethylbenzene	ND		1.0	0.74	ug/L			05/10/12 18:36	1
Isopropylbenzene	ND		1.0	0.79	ug/L			05/10/12 18:36	1
Methyl acetate	ND		1.0	0.50	ug/L			05/10/12 18:36	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			05/10/12 18:36	1
Methylcyclohexane	ND		1.0	0.16	ug/L			05/10/12 18:36	1
Methylene Chloride	ND		1.0	0.44	ug/L			05/10/12 18:36	1
Styrene	ND		1.0	0.73	ug/L			05/10/12 18:36	1
Tetrachloroethene	ND		1.0	0.36	ug/L			05/10/12 18:36	1
Toluene	ND		1.0	0.51	ug/L			05/10/12 18:36	1
trans-1,2-Dichloroethene	ND		1.0	0.90	ug/L			05/10/12 18:36	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			05/10/12 18:36	1
Trichloroethene	ND		1.0	0.46	ug/L			05/10/12 18:36	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			05/10/12 18:36	1
Vinyl chloride	ND		1.0	0.90	ug/L			05/10/12 18:36	1
Xylenes, Total	**1.1**	**J**	2.0	0.66	ug/L			05/10/12 18:36	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*108*		*66 - 137*		*05/10/12 18:36*	*1*

Client: CDM Smith, Inc. TestAmerica Job ID: 480-19566-1
Project/Site: New York state project

Client Sample ID: FB-050112 Lab Sample ID: 480-19566-5
Date Collected: 05/01/12 00:00 **Matrix: Water**
Date Received: 05/03/12 09:00

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Toluene-d8 (Surr)	111		71 - 126		05/10/12 18:36	1
4-Bromofluorobenzene (Surr)	93		73 - 120		05/10/12 18:36	1

Client Sample ID: TRIP BLANK Lab Sample ID: 480-19566-6
Date Collected: 05/01/12 00:00 **Matrix: Water**
Date Received: 05/03/12 09:00

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			05/10/12 18:59	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			05/10/12 18:59	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			05/10/12 18:59	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			05/10/12 18:59	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			05/10/12 18:59	1
1,1-Dichloroethene	ND		1.0	0.29	ug/L			05/10/12 18:59	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			05/10/12 18:59	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			05/10/12 18:59	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			05/10/12 18:59	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			05/10/12 18:59	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			05/10/12 18:59	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			05/10/12 18:59	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			05/10/12 18:59	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			05/10/12 18:59	1
2-Hexanone	ND		5.0	1.2	ug/L			05/10/12 18:59	1
2-Butanone (MEK)	ND		10	1.3	ug/L			05/10/12 18:59	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			05/10/12 18:59	1
Acetone	ND		10	3.0	ug/L			05/10/12 18:59	1
Benzene	ND		1.0	0.41	ug/L			05/10/12 18:59	1
Bromodichloromethane	ND		1.0	0.39	ug/L			05/10/12 18:59	1
Bromoform	ND		1.0	0.26	ug/L			05/10/12 18:59	1
Bromomethane	ND		1.0	0.69	ug/L			05/10/12 18:59	1
Carbon disulfide	ND		1.0	0.19	ug/L			05/10/12 18:59	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			05/10/12 18:59	1
Chlorobenzene	ND		1.0	0.75	ug/L			05/10/12 18:59	1
Dibromochloromethane	ND		1.0	0.32	ug/L			05/10/12 18:59	1
Chloroethane	ND		1.0	0.32	ug/L			05/10/12 18:59	1
Chloroform	ND		1.0	0.34	ug/L			05/10/12 18:59	1
Chloromethane	ND		1.0	0.35	ug/L			05/10/12 18:59	1
cis-1,2-Dichloroethene	ND		1.0	0.81	ug/L			05/10/12 18:59	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			05/10/12 18:59	1
Cyclohexane	ND		1.0	0.18	ug/L			05/10/12 18:59	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			05/10/12 18:59	1
Ethylbenzene	ND		1.0	0.74	ug/L			05/10/12 18:59	1
Isopropylbenzene	ND		1.0	0.79	ug/L			05/10/12 18:59	1
Methyl acetate	ND		1.0	0.50	ug/L			05/10/12 18:59	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			05/10/12 18:59	1
Methylcyclohexane	ND		1.0	0.16	ug/L			05/10/12 18:59	1
Methylene Chloride	ND		1.0	0.44	ug/L			05/10/12 18:59	1
Styrene	ND		1.0	0.73	ug/L			05/10/12 18:59	1
Tetrachloroethene	ND		1.0	0.36	ug/L			05/10/12 18:59	1
Toluene	ND		1.0	0.51	ug/L			05/10/12 18:59	1

Client Sample ID: TRIP BLANK

Lab Sample ID: 480-19566-6

Date Collected: 05/01/12 00:00

Matrix: Water

Date Received: 05/03/12 09:00

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
trans-1,2-Dichloroethene	ND		1.0	0.90	ug/L			05/10/12 18:59	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			05/10/12 18:59	1
Trichloroethene	ND		1.0	0.46	ug/L			05/10/12 18:59	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			05/10/12 18:59	1
Vinyl chloride	ND		1.0	0.90	ug/L			05/10/12 18:59	1
Xylenes, Total	ND		2.0	0.66	ug/L			05/10/12 18:59	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*101*		*66 - 137*		*05/10/12 18:59*	*1*
Toluene-d8 (Surr)	*104*		*71 - 126*		*05/10/12 18:59*	*1*
4-Bromofluorobenzene (Surr)	*87*		*73 - 120*		*05/10/12 18:59*	*1*

Client Sample ID: RU21-050112

Lab Sample ID: 480-19566-7

Date Collected: 05/01/12 20:10

Matrix: Water

Date Received: 05/03/12 09:00

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		2.0	1.6	ug/L			05/11/12 16:06	2
1,1,2,2-Tetrachloroethane	ND		2.0	0.42	ug/L			05/11/12 16:06	2
1,1,2-Trichloroethane	ND		2.0	0.46	ug/L			05/11/12 16:06	2
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		2.0	0.62	ug/L			05/11/12 16:06	2
1,1-Dichloroethane	ND		2.0	0.76	ug/L			05/11/12 16:06	2
1,1-Dichloroethene	ND		2.0	0.58	ug/L			05/11/12 16:06	2
1,2,4-Trichlorobenzene	ND		2.0	0.82	ug/L			05/11/12 16:06	2
1,2-Dibromo-3-Chloropropane	ND		2.0	0.78	ug/L			05/11/12 16:06	2
1,2-Dibromoethane	ND		2.0	1.5	ug/L			05/11/12 16:06	2
1,2-Dichlorobenzene	ND		2.0	1.6	ug/L			05/11/12 16:06	2
1,2-Dichloroethane	ND		2.0	0.42	ug/L			05/11/12 16:06	2
1,2-Dichloropropane	ND		2.0	1.4	ug/L			05/11/12 16:06	2
1,3-Dichlorobenzene	ND		2.0	1.6	ug/L			05/11/12 16:06	2
1,4-Dichlorobenzene	ND		2.0	1.7	ug/L			05/11/12 16:06	2
2-Hexanone	ND		10	2.5	ug/L			05/11/12 16:06	2
2-Butanone (MEK)	**46**		20	2.6	ug/L			05/11/12 16:06	2
4-Methyl-2-pentanone (MIBK)	ND		10	4.2	ug/L			05/11/12 16:06	2
Acetone	**47**		20	6.0	ug/L			05/11/12 16:06	2
Benzene	ND		2.0	0.82	ug/L			05/11/12 16:06	2
Bromodichloromethane	ND		2.0	0.78	ug/L			05/11/12 16:06	2
Bromoform	ND		2.0	0.52	ug/L			05/11/12 16:06	2
Bromomethane	ND		2.0	1.4	ug/L			05/11/12 16:06	2
Carbon disulfide	**1.0**	**J**	2.0	0.38	ug/L			05/11/12 16:06	2
Carbon tetrachloride	ND		2.0	0.54	ug/L			05/11/12 16:06	2
Chlorobenzene	ND		2.0	1.5	ug/L			05/11/12 16:06	2
Dibromochloromethane	ND		2.0	0.64	ug/L			05/11/12 16:06	2
Chloroethane	**9.7**		2.0	0.64	ug/L			05/11/12 16:06	2
Chloroform	ND		2.0	0.68	ug/L			05/11/12 16:06	2
Chloromethane	**0.72**	**J**	2.0	0.70	ug/L			05/11/12 16:06	2
cis-1,2-Dichloroethene	**71**		2.0	1.6	ug/L			05/11/12 16:06	2
cis-1,3-Dichloropropene	ND		2.0	0.72	ug/L			05/11/12 16:06	2
Cyclohexane	ND		2.0	0.36	ug/L			05/11/12 16:06	2
Dichlorodifluoromethane	ND		2.0	1.4	ug/L			05/11/12 16:06	2

Client Sample Results

Client: CDM Smith, Inc.
Project/Site: New York state project

TestAmerica Job ID: 480-19566-1

Client Sample ID: RU21-050112

Date Collected: 05/01/12 20:10
Date Received: 05/03/12 09:00

Lab Sample ID: 480-19566-7
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethylbenzene	**1.5**	**J**	2.0	1.5	ug/L			05/11/12 16:06	2
Isopropylbenzene	ND		2.0	1.6	ug/L			05/11/12 16:06	2
Methyl acetate	**1.5**	**J**	2.0	1.0	ug/L			05/11/12 16:06	2
Methyl tert-butyl ether	ND		2.0	0.32	ug/L			05/11/12 16:06	2
Methylcyclohexane	ND		2.0	0.32	ug/L			05/11/12 16:06	2
Methylene Chloride	ND		2.0	0.88	ug/L			05/11/12 16:06	2
Styrene	ND		2.0	1.5	ug/L			05/11/12 16:06	2
Tetrachloroethene	ND		2.0	0.72	ug/L			05/11/12 16:06	2
Toluene	ND		2.0	1.0	ug/L			05/11/12 16:06	2
trans-1,2-Dichloroethene	ND		2.0	1.8	ug/L			05/11/12 16:06	2
trans-1,3-Dichloropropene	ND		2.0	0.74	ug/L			05/11/12 16:06	2
Trichloroethene	**69**		2.0	0.92	ug/L			05/11/12 16:06	2
Trichlorofluoromethane	ND		2.0	1.8	ug/L			05/11/12 16:06	2
Vinyl chloride	**170**		2.0	1.8	ug/L			05/11/12 16:06	2
Xylenes, Total	ND		4.0	1.3	ug/L			05/11/12 16:06	2

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*108*		*66 - 137*		*05/11/12 16:06*	*2*
Toluene-d8 (Surr)	*112*		*71 - 126*		*05/11/12 16:06*	*2*
4-Bromofluorobenzene (Surr)	*95*		*73 - 120*		*05/11/12 16:06*	*2*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetylene	ND		15	4.7	ug/L			05/08/12 14:31	10
Ethane	**16**		15	4.9	ug/L			05/08/12 14:31	10
Ethene	**18**		15	5.2	ug/L			05/08/12 14:31	10
Propane	ND		30	15	ug/L			05/08/12 14:31	10
Butane	ND		30	15	ug/L			05/08/12 14:31	10

Method: RSK-175 - Dissolved Gases (GC) - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methane	**1700**	**B**	100	22	ug/L			05/08/12 16:05	100

Method: 6010B - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**0.10**	**J**	0.20	0.060	mg/L		05/04/12 10:10	05/04/12 15:53	1
Antimony	ND		0.020	0.0068	mg/L		05/04/12 10:10	05/04/12 15:53	1
Arsenic	**0.023**		0.010	0.0056	mg/L		05/04/12 10:10	05/04/12 15:53	1
Barium	**0.46**		0.0020	0.00070	mg/L		05/04/12 10:10	05/04/12 15:53	1
Beryllium	ND		0.0020	0.00030	mg/L		05/04/12 10:10	05/04/12 15:53	1
Cadmium	**0.00052**	**J**	0.0010	0.00050	mg/L		05/04/12 10:10	05/04/12 15:53	1
Calcium	**83.1**		0.50	0.10	mg/L		05/04/12 10:10	05/04/12 15:53	1
Chromium	**0.0028**	**J**	0.0040	0.0010	mg/L		05/04/12 10:10	05/04/12 15:53	1
Cobalt	**0.010**		0.0040	0.00063	mg/L		05/04/12 10:10	05/04/12 15:53	1
Copper	ND		0.010	0.0016	mg/L		05/04/12 10:10	05/04/12 15:53	1
Iron	**18.7**		0.050	0.019	mg/L		05/04/12 10:10	05/04/12 15:53	1
Lead	ND		0.0050	0.0030	mg/L		05/04/12 10:10	05/04/12 15:53	1
Magnesium	**16.3**		0.20	0.043	mg/L		05/04/12 10:10	05/04/12 15:53	1
Manganese	**17.1**		0.0030	0.00040	mg/L		05/04/12 10:10	05/04/12 15:53	1
Nickel	**0.0086**	**J**	0.010	0.0013	mg/L		05/04/12 10:10	05/04/12 15:53	1
Potassium	**1.5**		0.50	0.10	mg/L		05/04/12 10:10	05/04/12 15:53	1
Selenium	**0.0098**	**J**	0.015	0.0087	mg/L		05/04/12 10:10	05/04/12 15:53	1

Client Sample Results

Client: CDM Smith, Inc.
Project/Site: New York state project

TestAmerica Job ID: 480-19566-1

Client Sample ID: RU21-050112

Lab Sample ID: 480-19566-7
Date Collected: 05/01/12 20:10
Matrix: Water
Date Received: 05/03/12 09:00

Method: 6010B - Metals (ICP) - Dissolved (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Silver	ND		0.0030	0.0017	mg/L		05/04/12 10:10	05/04/12 15:53	1
Sodium	**524**		1.0	0.32	mg/L		05/04/12 10:10	05/04/12 15:53	1
Thallium	**0.020**		0.020	0.010	mg/L		05/04/12 10:10	05/04/12 15:53	1
Vanadium	ND		0.0050	0.0015	mg/L		05/04/12 10:10	05/04/12 15:53	1
Zinc	**0.0029**	**J**	0.010	0.0015	mg/L		05/04/12 10:10	05/04/12 15:53	1

Method: 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020	0.00012	mg/L		05/04/12 09:15	05/04/12 15:41	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**36.6**		2.5	1.4	mg/L			05/04/12 22:06	5
Sulfate	**2.4**		2.0	0.35	mg/L			05/09/12 18:15	1
Nitrate Nitrite as N	ND		0.050	0.020	mg/L			05/03/12 18:16	1
Total Organic Carbon	**751**		40.0	17.4	mg/L			05/08/12 08:59	40
Total Organic Carbon - Duplicates	**751**		40.0	17.4	mg/L			05/08/12 08:59	40
TOC Result 1	**712**	**^**	40.0	17.4	mg/L			05/08/12 08:59	40
TOC Result 2	**791**		40.0	17.4	mg/L			05/08/12 08:59	40
Acetic acid	**650**		20.0	3.0	mg/L			05/16/12 19:21	20
n-Butyric Acid	**57.0**		20.0	3.2	mg/L			05/16/12 19:21	20
Propionic acid	**770**		20.0	3.4	mg/L			05/16/12 19:21	20

Client Sample ID: RU8-050112

Lab Sample ID: 480-19566-8
Date Collected: 05/02/12 10:15
Matrix: Water
Date Received: 05/03/12 09:00

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			05/11/12 16:29	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			05/11/12 16:29	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			05/11/12 16:29	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			05/11/12 16:29	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			05/11/12 16:29	1
1,1-Dichloroethene	ND		1.0	0.29	ug/L			05/11/12 16:29	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			05/11/12 16:29	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			05/11/12 16:29	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			05/11/12 16:29	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			05/11/12 16:29	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			05/11/12 16:29	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			05/11/12 16:29	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			05/11/12 16:29	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			05/11/12 16:29	1
2-Hexanone	ND		5.0	1.2	ug/L			05/11/12 16:29	1
2-Butanone (MEK)	ND		10	1.3	ug/L			05/11/12 16:29	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			05/11/12 16:29	1
Acetone	ND		10	3.0	ug/L			05/11/12 16:29	1
Benzene	ND		1.0	0.41	ug/L			05/11/12 16:29	1
Bromodichloromethane	ND		1.0	0.39	ug/L			05/11/12 16:29	1
Bromoform	ND		1.0	0.26	ug/L			05/11/12 16:29	1
Bromomethane	ND		1.0	0.69	ug/L			05/11/12 16:29	1
Carbon disulfide	ND		1.0	0.19	ug/L			05/11/12 16:29	1

Client Sample ID: RU8-050112
Lab Sample ID: 480-19566-8

Date Collected: 05/02/12 10:15
Matrix: Water
Date Received: 05/03/12 09:00

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Carbon tetrachloride	ND		1.0	0.27	ug/L			05/11/12 16:29	1
Chlorobenzene	ND		1.0	0.75	ug/L			05/11/12 16:29	1
Dibromochloromethane	ND		1.0	0.32	ug/L			05/11/12 16:29	1
Chloroethane	ND		1.0	0.32	ug/L			05/11/12 16:29	1
Chloroform	ND		1.0	0.34	ug/L			05/11/12 16:29	1
Chloromethane	ND		1.0	0.35	ug/L			05/11/12 16:29	1
cis-1,2-Dichloroethene	**3.0**		1.0	0.81	ug/L			05/11/12 16:29	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			05/11/12 16:29	1
Cyclohexane	ND		1.0	0.18	ug/L			05/11/12 16:29	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			05/11/12 16:29	1
Ethylbenzene	ND		1.0	0.74	ug/L			05/11/12 16:29	1
Isopropylbenzene	ND		1.0	0.79	ug/L			05/11/12 16:29	1
Methyl acetate	ND		1.0	0.50	ug/L			05/11/12 16:29	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			05/11/12 16:29	1
Methylcyclohexane	ND		1.0	0.16	ug/L			05/11/12 16:29	1
Methylene Chloride	ND		1.0	0.44	ug/L			05/11/12 16:29	1
Styrene	ND		1.0	0.73	ug/L			05/11/12 16:29	1
Tetrachloroethene	ND		1.0	0.36	ug/L			05/11/12 16:29	1
Toluene	ND		1.0	0.51	ug/L			05/11/12 16:29	1
trans-1,2-Dichloroethene	ND		1.0	0.90	ug/L			05/11/12 16:29	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			05/11/12 16:29	1
Trichloroethene	**77**		1.0	0.46	ug/L			05/11/12 16:29	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			05/11/12 16:29	1
Vinyl chloride	ND		1.0	0.90	ug/L			05/11/12 16:29	1
Xylenes, Total	ND		2.0	0.66	ug/L			05/11/12 16:29	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*110*		*66 - 137*		*05/11/12 16:29*	*1*
Toluene-d8 (Surr)	*114*		*71 - 126*		*05/11/12 16:29*	*1*
4-Bromofluorobenzene (Surr)	*95*		*73 - 120*		*05/11/12 16:29*	*1*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetylene	ND		1.5	0.47	ug/L			05/08/12 16:39	1
Ethane	**1.4**	**J**	1.5	0.49	ug/L			05/08/12 16:39	1
Ethene	ND		1.5	0.52	ug/L			05/08/12 16:39	1
Methane	**9.7**	**B**	1.0	0.22	ug/L			05/08/12 16:39	1
Propane	ND		3.0	1.5	ug/L			05/08/12 16:39	1
Butane	ND		3.0	1.5	ug/L			05/08/12 16:39	1

Method: 6010B - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.20	0.060	mg/L		05/04/12 10:10	05/04/12 15:55	1
Antimony	ND		0.020	0.0068	mg/L		05/04/12 10:10	05/04/12 15:55	1
Arsenic	ND		0.010	0.0056	mg/L		05/04/12 10:10	05/04/12 15:55	1
Barium	**0.13**		0.0020	0.00070	mg/L		05/04/12 10:10	05/04/12 15:55	1
Beryllium	ND		0.0020	0.00030	mg/L		05/04/12 10:10	05/04/12 15:55	1
Cadmium	ND		0.0010	0.00050	mg/L		05/04/12 10:10	05/04/12 15:55	1
Calcium	**117**		0.50	0.10	mg/L		05/04/12 10:10	05/04/12 15:55	1
Chromium	ND		0.0040	0.0010	mg/L		05/04/12 10:10	05/04/12 15:55	1
Cobalt	ND		0.0040	0.00063	mg/L		05/04/12 10:10	05/04/12 15:55	1
Copper	**0.0017**	**J**	0.010	0.0016	mg/L		05/04/12 10:10	05/04/12 15:55	1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Client Sample ID: RU8-050112

Lab Sample ID: 480-19566-8

Date Collected: 05/02/12 10:15
Matrix: Water
Date Received: 05/03/12 09:00

Method: 6010B - Metals (ICP) - Dissolved (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Iron	ND		0.050	0.019	mg/L		05/04/12 10:10	05/04/12 15:55	1
Lead	ND		0.0050	0.0030	mg/L		05/04/12 10:10	05/04/12 15:55	1
Magnesium	**22.5**		0.20	0.043	mg/L		05/04/12 10:10	05/04/12 15:55	1
Manganese	**0.48**		0.0030	0.00040	mg/L		05/04/12 10:10	05/04/12 15:55	1
Nickel	ND		0.010	0.0013	mg/L		05/04/12 10:10	05/04/12 15:55	1
Potassium	**1.8**		0.50	0.10	mg/L		05/04/12 10:10	05/04/12 15:55	1
Selenium	ND		0.015	0.0087	mg/L		05/04/12 10:10	05/04/12 15:55	1
Silver	ND		0.0030	0.0017	mg/L		05/04/12 10:10	05/04/12 15:55	1
Sodium	**12.7**		1.0	0.32	mg/L		05/04/12 10:10	05/04/12 15:55	1
Thallium	ND		0.020	0.010	mg/L		05/04/12 10:10	05/04/12 15:55	1
Vanadium	ND		0.0050	0.0015	mg/L		05/04/12 10:10	05/04/12 15:55	1
Zinc	**0.0086**	**J**	0.010	0.0015	mg/L		05/04/12 10:10	05/04/12 15:55	1

Method: 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020	0.00012	mg/L		05/04/12 09:15	05/04/12 15:43	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**12.2**		0.50	0.28	mg/L			05/04/12 22:17	1
Sulfate	**38.1**		2.0	0.35	mg/L			05/08/12 16:03	1
Nitrate Nitrite as N	**0.18**		0.050	0.020	mg/L			05/03/12 18:17	1
Total Organic Carbon	**0.67**	**J**	1.0	0.43	mg/L			05/05/12 23:41	1
Total Organic Carbon - Duplicates	**0.67**	**J**	1.0	0.43	mg/L			05/05/12 23:41	1
TOC Result 1	**0.95**	**J**	1.0	0.43	mg/L			05/05/12 23:41	1
TOC Result 2	ND		1.0	0.43	mg/L			05/05/12 23:41	1
Acetic acid	ND		1.0	0.15	mg/L			05/16/12 09:22	1
n-Butyric Acid	ND		1.0	0.16	mg/L			05/16/12 09:22	1
Propionic acid	ND		1.0	0.17	mg/L			05/16/12 09:22	1

Surrogate Summary

Client: CDM Smith, Inc.
Project/Site: New York state project

TestAmerica Job ID: 480-19566-1

Method: 8260B - Volatile Organic Compounds (GC/MS)

Matrix: Water **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)		
		12DCE	TOL	BFB
Lab Sample ID	Client Sample ID	(66-137)	(71-126)	(73-120)
480-19566-1	RU10-050112	111	115	97
480-19566-1 - DL	RU10-050112	107	114	94
480-19566-2	RU19-050112	107	111	92
480-19566-2 - DL	RU19-050112	104	110	90
480-19566-2 MS	RU19-050112	112	119	100
480-19566-2 MSD	RU19-050112	111	117	99
480-19566-3	RU19D-050112	110	117	96
480-19566-4	RU20-050112	112	116	96
480-19566-5	FB-050112	108	111	93
480-19566-6	TRIP BLANK	101	104	87
480-19566-7	RU21-050112	108	112	95
480-19566-8	RU8-050112	110	114	95
LCS 480-63819/4	Lab Control Sample	109	118	97
LCS 480-64011/4	Lab Control Sample	104	114	95
MB 480-63819/5	Method Blank	115	121	99
MB 480-64011/5	Method Blank	106	115	96

Surrogate Legend

12DCE = 1,2-Dichloroethane-d4 (Surr)
TOL = Toluene-d8 (Surr)
BFB = 4-Bromofluorobenzene (Surr)

Client: CDM Smith, Inc. TestAmerica Job ID: 480-19566-1
Project/Site: New York state project

Method: 8260B - Volatile Organic Compounds (GC/MS)

Lab Sample ID: MB 480-63819/5 **Client Sample ID: Method Blank**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 63819

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			05/10/12 11:24	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			05/10/12 11:24	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			05/10/12 11:24	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			05/10/12 11:24	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			05/10/12 11:24	1
1,1-Dichloroethene	ND		1.0	0.29	ug/L			05/10/12 11:24	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			05/10/12 11:24	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			05/10/12 11:24	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			05/10/12 11:24	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			05/10/12 11:24	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			05/10/12 11:24	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			05/10/12 11:24	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			05/10/12 11:24	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			05/10/12 11:24	1
2-Hexanone	ND		5.0	1.2	ug/L			05/10/12 11:24	1
2-Butanone (MEK)	ND		10	1.3	ug/L			05/10/12 11:24	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			05/10/12 11:24	1
Acetone	ND		10	3.0	ug/L			05/10/12 11:24	1
Benzene	ND		1.0	0.41	ug/L			05/10/12 11:24	1
Bromodichloromethane	ND		1.0	0.39	ug/L			05/10/12 11:24	1
Bromoform	ND		1.0	0.26	ug/L			05/10/12 11:24	1
Bromomethane	ND		1.0	0.69	ug/L			05/10/12 11:24	1
Carbon disulfide	ND		1.0	0.19	ug/L			05/10/12 11:24	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			05/10/12 11:24	1
Chlorobenzene	ND		1.0	0.75	ug/L			05/10/12 11:24	1
Dibromochloromethane	ND		1.0	0.32	ug/L			05/10/12 11:24	1
Chloroethane	ND		1.0	0.32	ug/L			05/10/12 11:24	1
Chloroform	ND		1.0	0.34	ug/L			05/10/12 11:24	1
Chloromethane	ND		1.0	0.35	ug/L			05/10/12 11:24	1
cis-1,2-Dichloroethene	ND		1.0	0.81	ug/L			05/10/12 11:24	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			05/10/12 11:24	1
Cyclohexane	ND		1.0	0.18	ug/L			05/10/12 11:24	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			05/10/12 11:24	1
Ethylbenzene	ND		1.0	0.74	ug/L			05/10/12 11:24	1
Isopropylbenzene	ND		1.0	0.79	ug/L			05/10/12 11:24	1
Methyl acetate	ND		1.0	0.50	ug/L			05/10/12 11:24	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			05/10/12 11:24	1
Methylcyclohexane	ND		1.0	0.16	ug/L			05/10/12 11:24	1
Methylene Chloride	ND		1.0	0.44	ug/L			05/10/12 11:24	1
Styrene	ND		1.0	0.73	ug/L			05/10/12 11:24	1
Tetrachloroethene	ND		1.0	0.36	ug/L			05/10/12 11:24	1
Toluene	ND		1.0	0.51	ug/L			05/10/12 11:24	1
trans-1,2-Dichloroethene	ND		1.0	0.90	ug/L			05/10/12 11:24	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			05/10/12 11:24	1
Trichloroethene	ND		1.0	0.46	ug/L			05/10/12 11:24	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			05/10/12 11:24	1
Vinyl chloride	ND		1.0	0.90	ug/L			05/10/12 11:24	1
Xylenes, Total	ND		2.0	0.66	ug/L			05/10/12 11:24	1

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 480-63819/5
Matrix: Water
Analysis Batch: 63819

Client Sample ID: Method Blank
Prep Type: Total/NA

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	*115*		*66 - 137*		*05/10/12 11:24*	*1*
Toluene-d8 (Surr)	*121*		*71 - 126*		*05/10/12 11:24*	*1*
4-Bromofluorobenzene (Surr)	*99*		*73 - 120*		*05/10/12 11:24*	*1*

Lab Sample ID: LCS 480-63819/4
Matrix: Water
Analysis Batch: 63819

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1-Dichloroethane	25.0	25.7		ug/L		103	71 - 129
1,1-Dichloroethene	25.0	20.9		ug/L		84	65 - 138
1,2-Dichlorobenzene	25.0	25.3		ug/L		101	77 - 120
1,2-Dichloroethane	25.0	25.2		ug/L		101	75 - 127
Benzene	25.0	26.1		ug/L		104	71 - 124
Chlorobenzene	25.0	26.4		ug/L		106	72 - 120
cis-1,2-Dichloroethene	25.0	25.3		ug/L		101	74 - 124
Ethylbenzene	25.0	26.9		ug/L		108	77 - 123
Methyl tert-butyl ether	25.0	24.0		ug/L		96	64 - 127
Tetrachloroethene	25.0	27.2		ug/L		109	74 - 122
Toluene	25.0	26.4		ug/L		106	70 - 122
trans-1,2-Dichloroethene	25.0	26.7		ug/L		107	73 - 127
Trichloroethene	25.0	25.4		ug/L		102	74 - 123

Surrogate	LCS %Recovery	LCS Qualifier	Limits
1,2-Dichloroethane-d4 (Surr)	*109*		*66 - 137*
Toluene-d8 (Surr)	*118*		*71 - 126*
4-Bromofluorobenzene (Surr)	*97*		*73 - 120*

Lab Sample ID: 480-19566-2 MS
Matrix: Water
Analysis Batch: 63819

Client Sample ID: RU19-050112
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1-Dichloroethane	ND		250	261		ug/L		104	71 - 129
1,1-Dichloroethene	ND		250	213		ug/L		85	65 - 138
1,2-Dichlorobenzene	ND		250	259		ug/L		104	77 - 120
1,2-Dichloroethane	ND		250	255		ug/L		102	75 - 127
Benzene	ND		250	256		ug/L		102	71 - 124
Chlorobenzene	ND		250	264		ug/L		106	72 - 120
cis-1,2-Dichloroethene	400		250	610		ug/L		86	74 - 124
Ethylbenzene	ND		250	261		ug/L		104	77 - 123
Methyl tert-butyl ether	ND		250	236		ug/L		94	64 - 127
Tetrachloroethene	ND		250	267		ug/L		107	74 - 122
Toluene	ND		250	259		ug/L		104	70 - 122
trans-1,2-Dichloroethene	ND		250	271		ug/L		108	73 - 127

Surrogate	MS %Recovery	MS Qualifier	Limits
1,2-Dichloroethane-d4 (Surr)	*112*		*66 - 137*
Toluene-d8 (Surr)	*119*		*71 - 126*

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: 480-19566-2 MS
Matrix: Water
Analysis Batch: 63819

Client Sample ID: RU19-050112
Prep Type: Total/NA

Surrogate	MS %Recovery	MS Qualifier	Limits
4-Bromofluorobenzene (Surr)	*100*		*73 - 120*

Lab Sample ID: 480-19566-2 MSD
Matrix: Water
Analysis Batch: 63819

Client Sample ID: RU19-050112
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
1,1-Dichloroethane	ND		250	269		ug/L		108	71 - 129	3	20
1,1-Dichloroethene	ND		250	221		ug/L		88	65 - 138	4	16
1,2-Dichlorobenzene	ND		250	260		ug/L		104	77 - 120	0	20
1,2-Dichloroethane	ND		250	256		ug/L		102	75 - 127	0	20
Benzene	ND		250	263		ug/L		105	71 - 124	3	13
Chlorobenzene	ND		250	266		ug/L		106	72 - 120	1	25
cis-1,2-Dichloroethene	400		250	619		ug/L		90	74 - 124	1	15
Ethylbenzene	ND		250	269		ug/L		108	77 - 123	3	15
Methyl tert-butyl ether	ND		250	240		ug/L		96	64 - 127	2	37
Tetrachloroethene	ND		250	276		ug/L		110	74 - 122	3	20
Toluene	ND		250	264		ug/L		106	70 - 122	2	15
trans-1,2-Dichloroethene	ND		250	270		ug/L		108	73 - 127	0	20

Surrogate	MSD %Recovery	MSD Qualifier	Limits
1,2-Dichloroethane-d4 (Surr)	*111*		*66 - 137*
Toluene-d8 (Surr)	*117*		*71 - 126*
4-Bromofluorobenzene (Surr)	*99*		*73 - 120*

Lab Sample ID: MB 480-64011/5
Matrix: Water
Analysis Batch: 64011

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.0	0.82	ug/L			05/11/12 10:36	1
1,1,2,2-Tetrachloroethane	ND		1.0	0.21	ug/L			05/11/12 10:36	1
1,1,2-Trichloroethane	ND		1.0	0.23	ug/L			05/11/12 10:36	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.0	0.31	ug/L			05/11/12 10:36	1
1,1-Dichloroethane	ND		1.0	0.38	ug/L			05/11/12 10:36	1
1,1-Dichloroethene	ND		1.0	0.29	ug/L			05/11/12 10:36	1
1,2,4-Trichlorobenzene	ND		1.0	0.41	ug/L			05/11/12 10:36	1
1,2-Dibromo-3-Chloropropane	ND		1.0	0.39	ug/L			05/11/12 10:36	1
1,2-Dibromoethane	ND		1.0	0.73	ug/L			05/11/12 10:36	1
1,2-Dichlorobenzene	ND		1.0	0.79	ug/L			05/11/12 10:36	1
1,2-Dichloroethane	ND		1.0	0.21	ug/L			05/11/12 10:36	1
1,2-Dichloropropane	ND		1.0	0.72	ug/L			05/11/12 10:36	1
1,3-Dichlorobenzene	ND		1.0	0.78	ug/L			05/11/12 10:36	1
1,4-Dichlorobenzene	ND		1.0	0.84	ug/L			05/11/12 10:36	1
2-Hexanone	ND		5.0	1.2	ug/L			05/11/12 10:36	1
2-Butanone (MEK)	ND		10	1.3	ug/L			05/11/12 10:36	1
4-Methyl-2-pentanone (MIBK)	ND		5.0	2.1	ug/L			05/11/12 10:36	1
Acetone	ND		10	3.0	ug/L			05/11/12 10:36	1
Benzene	ND		1.0	0.41	ug/L			05/11/12 10:36	1

QC Sample Results

Client: CDM Smith, Inc. TestAmerica Job ID: 480-19566-1
Project/Site: New York state project

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 480-64011/5 **Client Sample ID: Method Blank**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 64011

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromodichloromethane	ND		1.0	0.39	ug/L			05/11/12 10:36	1
Bromoform	ND		1.0	0.26	ug/L			05/11/12 10:36	1
Bromomethane	ND		1.0	0.69	ug/L			05/11/12 10:36	1
Carbon disulfide	ND		1.0	0.19	ug/L			05/11/12 10:36	1
Carbon tetrachloride	ND		1.0	0.27	ug/L			05/11/12 10:36	1
Chlorobenzene	ND		1.0	0.75	ug/L			05/11/12 10:36	1
Dibromochloromethane	ND		1.0	0.32	ug/L			05/11/12 10:36	1
Chloroethane	ND		1.0	0.32	ug/L			05/11/12 10:36	1
Chloroform	ND		1.0	0.34	ug/L			05/11/12 10:36	1
Chloromethane	ND		1.0	0.35	ug/L			05/11/12 10:36	1
cis-1,2-Dichloroethene	ND		1.0	0.81	ug/L			05/11/12 10:36	1
cis-1,3-Dichloropropene	ND		1.0	0.36	ug/L			05/11/12 10:36	1
Cyclohexane	ND		1.0	0.18	ug/L			05/11/12 10:36	1
Dichlorodifluoromethane	ND		1.0	0.68	ug/L			05/11/12 10:36	1
Ethylbenzene	ND		1.0	0.74	ug/L			05/11/12 10:36	1
Isopropylbenzene	ND		1.0	0.79	ug/L			05/11/12 10:36	1
Methyl acetate	ND		1.0	0.50	ug/L			05/11/12 10:36	1
Methyl tert-butyl ether	ND		1.0	0.16	ug/L			05/11/12 10:36	1
Methylcyclohexane	ND		1.0	0.16	ug/L			05/11/12 10:36	1
Methylene Chloride	ND		1.0	0.44	ug/L			05/11/12 10:36	1
Styrene	ND		1.0	0.73	ug/L			05/11/12 10:36	1
Tetrachloroethene	ND		1.0	0.36	ug/L			05/11/12 10:36	1
Toluene	ND		1.0	0.51	ug/L			05/11/12 10:36	1
trans-1,2-Dichloroethene	ND		1.0	0.90	ug/L			05/11/12 10:36	1
trans-1,3-Dichloropropene	ND		1.0	0.37	ug/L			05/11/12 10:36	1
Trichloroethene	ND		1.0	0.46	ug/L			05/11/12 10:36	1
Trichlorofluoromethane	ND		1.0	0.88	ug/L			05/11/12 10:36	1
Vinyl chloride	ND		1.0	0.90	ug/L			05/11/12 10:36	1
Xylenes, Total	ND		2.0	0.66	ug/L			05/11/12 10:36	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*106*		*66 - 137*		*05/11/12 10:36*	*1*
Toluene-d8 (Surr)	*115*		*71 - 126*		*05/11/12 10:36*	*1*
4-Bromofluorobenzene (Surr)	*96*		*73 - 120*		*05/11/12 10:36*	*1*

Lab Sample ID: LCS 480-64011/4 **Client Sample ID: Lab Control Sample**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 64011

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1-Dichloroethane	25.0	23.9		ug/L		96	71 - 129
1,1-Dichloroethene	25.0	20.8		ug/L		83	65 - 138
1,2-Dichlorobenzene	25.0	24.6		ug/L		98	77 - 120
1,2-Dichloroethane	25.0	23.9		ug/L		96	75 - 127
Benzene	25.0	25.2		ug/L		101	71 - 124
Chlorobenzene	25.0	25.8		ug/L		103	72 - 120
cis-1,2-Dichloroethene	25.0	25.0		ug/L		100	74 - 124
Ethylbenzene	25.0	26.3		ug/L		105	77 - 123
Methyl tert-butyl ether	25.0	23.4		ug/L		94	64 - 127

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 480-64011/4 **Client Sample ID: Lab Control Sample**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 64011

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Tetrachloroethene	25.0	27.1		ug/L		108	74 - 122
Toluene	25.0	25.9		ug/L		104	70 - 122
trans-1,2-Dichloroethene	25.0	26.1		ug/L		104	73 - 127
Trichloroethene	25.0	24.7		ug/L		99	74 - 123

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
1,2-Dichloroethane-d4 (Surr)	*104*		*66 - 137*
Toluene-d8 (Surr)	*114*		*71 - 126*
4-Bromofluorobenzene (Surr)	*95*		*73 - 120*

Method: RSK-175 - Dissolved Gases (GC)

Lab Sample ID: MB 480-63448/2 **Client Sample ID: Method Blank**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 63448

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetylene	ND		1.5	0.47	ug/L			05/08/12 08:39	1
Ethane	ND		1.5	0.49	ug/L			05/08/12 08:39	1
Ethene	ND		1.5	0.52	ug/L			05/08/12 08:39	1
Methane	0.477	J	1.0	0.22	ug/L			05/08/12 08:39	1
Propane	ND		3.0	1.5	ug/L			05/08/12 08:39	1
Butane	ND		3.0	1.5	ug/L			05/08/12 08:39	1

Lab Sample ID: LCS 480-63448/3 **Client Sample ID: Lab Control Sample**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 63448

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Ethane	7.19	8.08		ug/L		112	71 - 147
Ethene	6.73	7.48		ug/L		111	71 - 147
Methane	3.88	4.39		ug/L		113	48 - 174

Lab Sample ID: LCSD 480-63448/4 **Client Sample ID: Lab Control Sample Dup**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 63448

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Ethane	7.19	8.13		ug/L		113	71 - 147	1	50
Ethene	6.73	7.64		ug/L		114	71 - 147	2	50
Methane	3.88	4.75		ug/L		122	48 - 174	8	50

Method: 6010B - Metals (ICP)

Lab Sample ID: MB 480-62826/13-B **Client Sample ID: Method Blank**
Matrix: Water **Prep Type: Dissolved**
Analysis Batch: 63282 **Prep Batch: 63048**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.20	0.060	mg/L		05/04/12 10:10	05/04/12 15:02	1

Method: 6010B - Metals (ICP) (Continued)

Lab Sample ID: MB 480-62826/13-B
Matrix: Water
Analysis Batch: 63282

Client Sample ID: Method Blank
Prep Type: Dissolved
Prep Batch: 63048

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	ND		0.020	0.0068	mg/L		05/04/12 10:10	05/04/12 15:02	1
Arsenic	ND		0.010	0.0056	mg/L		05/04/12 10:10	05/04/12 15:02	1
Barium	ND		0.0020	0.00070	mg/L		05/04/12 10:10	05/04/12 15:02	1
Beryllium	ND		0.0020	0.00030	mg/L		05/04/12 10:10	05/04/12 15:02	1
Cadmium	ND		0.0010	0.00050	mg/L		05/04/12 10:10	05/04/12 15:02	1
Calcium	ND		0.50	0.10	mg/L		05/04/12 10:10	05/04/12 15:02	1
Chromium	ND		0.0040	0.0010	mg/L		05/04/12 10:10	05/04/12 15:02	1
Cobalt	ND		0.0040	0.00063	mg/L		05/04/12 10:10	05/04/12 15:02	1
Copper	ND		0.010	0.0016	mg/L		05/04/12 10:10	05/04/12 15:02	1
Iron	ND		0.050	0.019	mg/L		05/04/12 10:10	05/04/12 15:02	1
Lead	ND		0.0050	0.0030	mg/L		05/04/12 10:10	05/04/12 15:02	1
Magnesium	ND		0.20	0.043	mg/L		05/04/12 10:10	05/04/12 15:02	1
Manganese	ND		0.0030	0.00040	mg/L		05/04/12 10:10	05/04/12 15:02	1
Nickel	ND		0.010	0.0013	mg/L		05/04/12 10:10	05/04/12 15:02	1
Potassium	ND		0.50	0.10	mg/L		05/04/12 10:10	05/04/12 15:02	1
Selenium	ND		0.015	0.0087	mg/L		05/04/12 10:10	05/04/12 15:02	1
Silver	ND		0.0030	0.0017	mg/L		05/04/12 10:10	05/04/12 15:02	1
Sodium	ND		1.0	0.32	mg/L		05/04/12 10:10	05/04/12 15:02	1
Thallium	ND		0.020	0.010	mg/L		05/04/12 10:10	05/04/12 15:02	1
Vanadium	ND		0.0050	0.0015	mg/L		05/04/12 10:10	05/04/12 15:02	1
Zinc	ND		0.010	0.0015	mg/L		05/04/12 10:10	05/04/12 15:02	1

Lab Sample ID: LCS 480-62826/14-B
Matrix: Water
Analysis Batch: 63282

Client Sample ID: Lab Control Sample
Prep Type: Dissolved
Prep Batch: 63048

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	10.0	10.50		mg/L		105	80 - 120
Antimony	0.200	0.201		mg/L		100	80 - 120
Arsenic	0.200	0.200		mg/L		100	80 - 120
Barium	0.200	0.207		mg/L		104	80 - 120
Beryllium	0.200	0.205		mg/L		103	80 - 120
Cadmium	0.200	0.200		mg/L		100	80 - 120
Calcium	10.0	9.97		mg/L		100	80 - 120
Chromium	0.200	0.200		mg/L		100	80 - 120
Cobalt	0.200	0.197		mg/L		98	80 - 120
Copper	0.200	0.202		mg/L		101	80 - 120
Iron	10.0	10.02		mg/L		100	80 - 120
Lead	0.200	0.198		mg/L		99	80 - 120
Magnesium	10.0	9.91		mg/L		99	80 - 120
Manganese	0.200	0.201		mg/L		101	80 - 120
Nickel	0.200	0.193		mg/L		97	80 - 120
Potassium	10.0	10.26		mg/L		103	80 - 120
Selenium	0.200	0.196		mg/L		98	80 - 120
Silver	0.0500	0.0507		mg/L		101	80 - 120
Sodium	10.0	10.30		mg/L		103	80 - 120
Thallium	0.200	0.197		mg/L		99	80 - 120
Vanadium	0.200	0.199		mg/L		99	80 - 120
Zinc	0.200	0.208		mg/L		104	80 - 120

Method: 6010B - Metals (ICP) (Continued)

Lab Sample ID: MB 480-63123/1-B
Matrix: Water
Analysis Batch: 63458

Client Sample ID: Method Blank
Prep Type: Dissolved
Prep Batch: 63221

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.20	0.060	mg/L		05/07/12 07:20	05/07/12 17:39	1
Antimony	ND		0.020	0.0068	mg/L		05/07/12 07:20	05/07/12 17:39	1
Arsenic	ND		0.010	0.0056	mg/L		05/07/12 07:20	05/07/12 17:39	1
Barium	ND		0.0020	0.00070	mg/L		05/07/12 07:20	05/07/12 17:39	1
Beryllium	ND		0.0020	0.00030	mg/L		05/07/12 07:20	05/07/12 17:39	1
Cadmium	ND		0.0010	0.00050	mg/L		05/07/12 07:20	05/07/12 17:39	1
Calcium	ND		0.50	0.10	mg/L		05/07/12 07:20	05/07/12 17:39	1
Chromium	ND		0.0040	0.0010	mg/L		05/07/12 07:20	05/07/12 17:39	1
Cobalt	ND		0.0040	0.00063	mg/L		05/07/12 07:20	05/07/12 17:39	1
Copper	ND		0.010	0.0016	mg/L		05/07/12 07:20	05/07/12 17:39	1
Iron	ND		0.050	0.019	mg/L		05/07/12 07:20	05/07/12 17:39	1
Lead	ND		0.0050	0.0030	mg/L		05/07/12 07:20	05/07/12 17:39	1
Magnesium	ND		0.20	0.043	mg/L		05/07/12 07:20	05/07/12 17:39	1
Manganese	ND		0.0030	0.00040	mg/L		05/07/12 07:20	05/07/12 17:39	1
Nickel	ND		0.010	0.0013	mg/L		05/07/12 07:20	05/07/12 17:39	1
Potassium	0.236	J	0.50	0.10	mg/L		05/07/12 07:20	05/07/12 17:39	1
Selenium	ND		0.015	0.0087	mg/L		05/07/12 07:20	05/07/12 17:39	1
Silver	ND		0.0030	0.0017	mg/L		05/07/12 07:20	05/07/12 17:39	1
Sodium	0.772	J	1.0	0.32	mg/L		05/07/12 07:20	05/07/12 17:39	1
Thallium	ND		0.020	0.010	mg/L		05/07/12 07:20	05/07/12 17:39	1
Vanadium	ND		0.0050	0.0015	mg/L		05/07/12 07:20	05/07/12 17:39	1
Zinc	ND		0.010	0.0015	mg/L		05/07/12 07:20	05/07/12 17:39	1

Lab Sample ID: LCS 480-63123/2-B
Matrix: Water
Analysis Batch: 63458

Client Sample ID: Lab Control Sample
Prep Type: Dissolved
Prep Batch: 63221

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	10.0	10.42		mg/L		104	80 - 120
Antimony	0.200	0.192		mg/L		96	80 - 120
Arsenic	0.200	0.196		mg/L		98	80 - 120
Barium	0.200	0.198		mg/L		99	80 - 120
Beryllium	0.200	0.221		mg/L		110	80 - 120
Cadmium	0.200	0.191		mg/L		95	80 - 120
Calcium	10.0	10.65		mg/L		106	80 - 120
Chromium	0.200	0.200		mg/L		100	80 - 120
Cobalt	0.200	0.195		mg/L		98	80 - 120
Copper	0.200	0.194		mg/L		97	80 - 120
Iron	10.0	10.51		mg/L		105	80 - 120
Lead	0.200	0.200		mg/L		100	80 - 120
Magnesium	10.0	10.45		mg/L		105	80 - 120
Manganese	0.200	0.206		mg/L		103	80 - 120
Nickel	0.200	0.196		mg/L		98	80 - 120
Potassium	10.0	10.35		mg/L		103	80 - 120
Selenium	0.200	0.202		mg/L		101	80 - 120
Silver	0.0500	0.0503		mg/L		101	80 - 120
Sodium	10.0	10.51		mg/L		105	80 - 120
Thallium	0.200	0.199		mg/L		100	80 - 120
Vanadium	0.200	0.206		mg/L		103	80 - 120
Zinc	0.200	0.221		mg/L		110	80 - 120

Client: CDM Smith, Inc. TestAmerica Job ID: 480-19566-1
Project/Site: New York state project

Method: 7470A - Mercury (CVAA)

Lab Sample ID: MB 480-64638/1-A **Client Sample ID: Method Blank**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 64720 **Prep Batch: 64638**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020	0.00012	mg/L		05/16/12 10:00	05/16/12 12:50	1

Lab Sample ID: LCS 480-64638/2-A **Client Sample ID: Lab Control Sample**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 64720 **Prep Batch: 64638**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.00667	0.00665		mg/L		100	80 - 120

Lab Sample ID: MB 480-62826/9-B **Client Sample ID: Method Blank**
Matrix: Water **Prep Type: Dissolved**
Analysis Batch: 63147 **Prep Batch: 63037**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020	0.00012	mg/L		05/04/12 09:15	05/04/12 15:12	1

Lab Sample ID: LCS 480-62826/10-B **Client Sample ID: Lab Control Sample**
Matrix: Water **Prep Type: Dissolved**
Analysis Batch: 63147 **Prep Batch: 63037**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.00667	0.00660		mg/L		99	80 - 120

Method: 300.0 - Anions, Ion Chromatography

Lab Sample ID: MB 480-63060/28 **Client Sample ID: Method Blank**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 63060

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND		0.50	0.28	mg/L			05/04/12 19:45	1
Sulfate	ND		2.0	0.35	mg/L			05/04/12 19:45	1

Lab Sample ID: LCS 480-63060/27 **Client Sample ID: Lab Control Sample**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 63060

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	20.0	19.20		mg/L		96	90 - 110
Sulfate	20.0	18.20		mg/L		91	90 - 110

Lab Sample ID: 480-19566-1 MS **Client Sample ID: RU10-050112**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 63060

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	17.1		25.0	40.10		mg/L		92	80 - 120

Method: 300.0 - Anions, Ion Chromatography (Continued)

Lab Sample ID: MB 480-63359/124
Matrix: Water
Analysis Batch: 63359

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND		0.50	0.28	mg/L			05/08/12 11:50	1
Sulfate	ND		2.0	0.35	mg/L			05/08/12 11:50	1

Lab Sample ID: LCS 480-63359/123
Matrix: Water
Analysis Batch: 63359

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	20.0	19.60		mg/L		98	90 - 110
Sulfate	20.0	20.20		mg/L		101	90 - 110

Lab Sample ID: MB 480-63360/148
Matrix: Water
Analysis Batch: 63360

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND		0.50	0.28	mg/L			05/08/12 15:53	1
Sulfate	ND		2.0	0.35	mg/L			05/08/12 15:53	1

Lab Sample ID: LCS 480-63360/147
Matrix: Water
Analysis Batch: 63360

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	20.0	20.20		mg/L		101	90 - 110
Sulfate	20.0	20.70		mg/L		104	90 - 110

Lab Sample ID: MB 480-63671/4
Matrix: Water
Analysis Batch: 63671

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND		0.50	0.28	mg/L			05/09/12 15:13	1
Sulfate	ND		2.0	0.35	mg/L			05/09/12 15:13	1

Lab Sample ID: LCS 480-63671/3
Matrix: Water
Analysis Batch: 63671

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	20.0	19.30		mg/L		97	90 - 110
Sulfate	20.0	19.80		mg/L		99	90 - 110

Lab Sample ID: 480-19566-7 MS
Matrix: Water
Analysis Batch: 63671

Client Sample ID: RU21-050112
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Sulfate	2.4		25.0	26.00		mg/L		94	80 - 120

Method: 300.0 - Anions, Ion Chromatography (Continued)

Lab Sample ID: 480-19566-7 MSD
Matrix: Water
Analysis Batch: 63671
Client Sample ID: RU21-050112
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Sulfate	2.4		25.0	26.90		mg/L		98	80 - 120	3	20

Lab Sample ID: MB 480-64072/11
Matrix: Water
Analysis Batch: 64072
Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND		0.50	0.28	mg/L			05/11/12 15:56	1
Sulfate	ND		2.0	0.35	mg/L			05/11/12 15:56	1

Lab Sample ID: LCS 480-64072/10
Matrix: Water
Analysis Batch: 64072
Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	20.0	20.20		mg/L		101	90 - 110
Sulfate	20.0	21.30		mg/L		107	90 - 110

Lab Sample ID: MB 480-64536/4
Matrix: Water
Analysis Batch: 64536
Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND		0.50	0.28	mg/L			05/15/12 16:52	1
Sulfate	ND		2.0	0.35	mg/L			05/15/12 16:52	1

Lab Sample ID: LCS 480-64536/3
Matrix: Water
Analysis Batch: 64536
Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	20.0	20.20		mg/L		101	90 - 110
Sulfate	20.0	21.20		mg/L		106	90 - 110

Method: 353.2 - Nitrogen, Nitrate-Nitrite

Lab Sample ID: MB 480-62975/28
Matrix: Water
Analysis Batch: 62975
Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Nitrate Nitrite as N	ND		0.050	0.020	mg/L			05/03/12 18:03	1

Lab Sample ID: LCS 480-62975/29
Matrix: Water
Analysis Batch: 62975
Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate Nitrite as N	1.50	1.46		mg/L		97	90 - 110

Method: SM 5310D - Organic Carbon, Total (TOC)

Lab Sample ID: MB 480-63279/27
Matrix: Water
Analysis Batch: 63279

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Organic Carbon	ND		1.0	0.43	mg/L			05/05/12 23:08	1
Total Organic Carbon - Duplicates	ND		1.0	0.43	mg/L			05/05/12 23:08	1
TOC Result 1	ND		1.0	0.43	mg/L			05/05/12 23:08	1
TOC Result 2	ND		1.0	0.43	mg/L			05/05/12 23:08	1

Lab Sample ID: MB 480-63279/3
Matrix: Water
Analysis Batch: 63279

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Organic Carbon	ND		1.0	0.43	mg/L			05/05/12 16:27	1
Total Organic Carbon - Duplicates	ND		1.0	0.43	mg/L			05/05/12 16:27	1
TOC Result 1	ND		1.0	0.43	mg/L			05/05/12 16:27	1
TOC Result 2	ND		1.0	0.43	mg/L			05/05/12 16:27	1

Lab Sample ID: LCS 480-63279/28
Matrix: Water
Analysis Batch: 63279

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Total Organic Carbon	60.0	59.66		mg/L		99	90 - 110
Total Organic Carbon - Duplicates	60.0	59.66		mg/L		99	90 - 110
TOC Result 1	60.0	57.13		mg/L		95	90 - 110
TOC Result 2	60.0	62.19		mg/L		104	90 - 110

Lab Sample ID: LCS 480-63279/4
Matrix: Water
Analysis Batch: 63279

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Total Organic Carbon	60.0	58.78		mg/L		98	90 - 110
Total Organic Carbon - Duplicates	60.0	58.78		mg/L		98	90 - 110
TOC Result 1	60.0	56.11		mg/L		94	90 - 110
TOC Result 2	60.0	61.45		mg/L		102	90 - 110

Lab Sample ID: MB 480-63639/15
Matrix: Water
Analysis Batch: 63639

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Organic Carbon	ND		1.0	0.43	mg/L			05/08/12 07:10	1
Total Organic Carbon - Duplicates	ND		1.0	0.43	mg/L			05/08/12 07:10	1
TOC Result 1	ND	^	1.0	0.43	mg/L			05/08/12 07:10	1
TOC Result 2	ND		1.0	0.43	mg/L			05/08/12 07:10	1

Method: SM 5310D - Organic Carbon, Total (TOC) (Continued)

Lab Sample ID: LCS 480-63639/16
Matrix: Water
Analysis Batch: 63639

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Total Organic Carbon	60.0	57.03		mg/L		95	90 - 110
Total Organic Carbon - Duplicates	60.0	57.03		mg/L		95	90 - 110
TOC Result 1	60.0	54.35	^	mg/L		91	90 - 110
TOC Result 2	60.0	59.71		mg/L		100	90 - 110

Method: VFA-IC - Volatile Fatty Acids, Ion Chromatography

Lab Sample ID: MB 480-64494/28
Matrix: Water
Analysis Batch: 64494

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetic acid	ND		1.0	0.15	mg/L			05/16/12 05:58	1
Butyric acid	ND		1.0	0.16	mg/L			05/16/12 05:58	1
n-Butyric Acid	ND		1.0	0.16	mg/L			05/16/12 05:58	1
Propionic acid	ND		1.0	0.17	mg/L			05/16/12 05:58	1

Lab Sample ID: LCS 480-64494/27
Matrix: Water
Analysis Batch: 64494

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acetic acid	10.0	10.20		mg/L		102	80 - 120
Butyric acid	10.0	9.60		mg/L		96	80 - 120
n-Butyric Acid	10.0	9.60		mg/L		96	80 - 120
Propionic acid	10.0	10.20		mg/L		102	80 - 120

Lab Sample ID: 480-19566-8 MS
Matrix: Water
Analysis Batch: 64494

Client Sample ID: RU8-050112
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Acetic acid	ND		10.0	10.40		mg/L		104	80 - 120
Butyric acid	ND		10.0	9.42		mg/L		94	80 - 120
n-Butyric Acid	ND		10.0	9.42		mg/L		94	80 - 120
Propionic acid	ND		10.0	ND	F	mg/L		0	80 - 120

Lab Sample ID: MB 480-64729/4
Matrix: Water
Analysis Batch: 64729

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acetic acid	ND		1.0	0.15	mg/L			05/16/12 18:23	1
n-Butyric Acid	ND		1.0	0.16	mg/L			05/16/12 18:23	1
Propionic acid	ND		1.0	0.17	mg/L			05/16/12 18:23	1

Client: CDM Smith, Inc.
Project/Site: New York state project

TestAmerica Job ID: 480-19566-1

Method: VFA-IC - Volatile Fatty Acids, Ion Chromatography (Continued)

Lab Sample ID: LCS 480-64729/3
Matrix: Water
Analysis Batch: 64729

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acetic acid	10.0	10.40		mg/L		104	80 - 120
n-Butyric Acid	10.0	9.74		mg/L		97	80 - 120
Propionic acid	10.0	10.50		mg/L		105	80 - 120

QC Association Summary

Client: CDM Smith, Inc.   TestAmerica Job ID: 480-19566-1
Project/Site: New York state project

GC/MS VOA

Analysis Batch: 63819

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-19566-1	RU10-050112	Total/NA	Water	8260B	
480-19566-2	RU19-050112	Total/NA	Water	8260B	
480-19566-2 MS	RU19-050112	Total/NA	Water	8260B	
480-19566-2 MSD	RU19-050112	Total/NA	Water	8260B	
480-19566-3	RU19D-050112	Total/NA	Water	8260B	
480-19566-4	RU20-050112	Total/NA	Water	8260B	
480-19566-5	FB-050112	Total/NA	Water	8260B	
480-19566-6	TRIP BLANK	Total/NA	Water	8260B	
LCS 480-63819/4	Lab Control Sample	Total/NA	Water	8260B	
MB 480-63819/5	Method Blank	Total/NA	Water	8260B	

Analysis Batch: 64011

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-19566-1 - DL	RU10-050112	Total/NA	Water	8260B	
480-19566-2 - DL	RU19-050112	Total/NA	Water	8260B	
480-19566-7	RU21-050112	Total/NA	Water	8260B	
480-19566-8	RU8-050112	Total/NA	Water	8260B	
LCS 480-64011/4	Lab Control Sample	Total/NA	Water	8260B	
MB 480-64011/5	Method Blank	Total/NA	Water	8260B	

GC VOA

Analysis Batch: 63448

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-19566-1	RU10-050112	Total/NA	Water	RSK-175	
480-19566-1 - DL	RU10-050112	Total/NA	Water	RSK-175	
480-19566-2	RU19-050112	Total/NA	Water	RSK-175	
480-19566-2 - DL	RU19-050112	Total/NA	Water	RSK-175	
480-19566-3	RU19D-050112	Total/NA	Water	RSK-175	
480-19566-3 - DL	RU19D-050112	Total/NA	Water	RSK-175	
480-19566-4	RU20-050112	Total/NA	Water	RSK-175	
480-19566-7	RU21-050112	Total/NA	Water	RSK-175	
480-19566-7 - DL	RU21-050112	Total/NA	Water	RSK-175	
480-19566-8	RU8-050112	Total/NA	Water	RSK-175	
LCS 480-63448/3	Lab Control Sample	Total/NA	Water	RSK-175	
LCSD 480-63448/4	Lab Control Sample Dup	Total/NA	Water	RSK-175	
MB 480-63448/2	Method Blank	Total/NA	Water	RSK-175	

Metals

Prep Batch: 63037

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-19566-2	RU19-050112	Dissolved	Water	7470A	
480-19566-3	RU19D-050112	Dissolved	Water	7470A	
480-19566-4	RU20-050112	Dissolved	Water	7470A	
480-19566-7	RU21-050112	Dissolved	Water	7470A	
480-19566-8	RU8-050112	Dissolved	Water	7470A	
LCS 480-62826/10-B	Lab Control Sample	Dissolved	Water	7470A	
MB 480-62826/9-B	Method Blank	Dissolved	Water	7470A	

Metals (Continued)

Prep Batch: 63048

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-19566-2	RU19-050112	Dissolved	Water	3005A	
480-19566-3	RU19D-050112	Dissolved	Water	3005A	
480-19566-4	RU20-050112	Dissolved	Water	3005A	
480-19566-7	RU21-050112	Dissolved	Water	3005A	
480-19566-8	RU8-050112	Dissolved	Water	3005A	
LCS 480-62826/14-B	Lab Control Sample	Dissolved	Water	3005A	
MB 480-62826/13-B	Method Blank	Dissolved	Water	3005A	

Analysis Batch: 63147

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-19566-2	RU19-050112	Dissolved	Water	7470A	63037
480-19566-3	RU19D-050112	Dissolved	Water	7470A	63037
480-19566-4	RU20-050112	Dissolved	Water	7470A	63037
480-19566-7	RU21-050112	Dissolved	Water	7470A	63037
480-19566-8	RU8-050112	Dissolved	Water	7470A	63037
LCS 480-62826/10-B	Lab Control Sample	Dissolved	Water	7470A	63037
MB 480-62826/9-B	Method Blank	Dissolved	Water	7470A	63037

Prep Batch: 63221

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-19566-1	RU10-050112	Dissolved	Water	3005A	
LCS 480-63123/2-B	Lab Control Sample	Dissolved	Water	3005A	
MB 480-63123/1-B	Method Blank	Dissolved	Water	3005A	

Analysis Batch: 63282

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-19566-2	RU19-050112	Dissolved	Water	6010B	63048
480-19566-3	RU19D-050112	Dissolved	Water	6010B	63048
480-19566-4	RU20-050112	Dissolved	Water	6010B	63048
480-19566-7	RU21-050112	Dissolved	Water	6010B	63048
480-19566-8	RU8-050112	Dissolved	Water	6010B	63048
LCS 480-62826/14-B	Lab Control Sample	Dissolved	Water	6010B	63048
MB 480-62826/13-B	Method Blank	Dissolved	Water	6010B	63048

Analysis Batch: 63458

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-19566-1	RU10-050112	Dissolved	Water	6010B	63221
LCS 480-63123/2-B	Lab Control Sample	Dissolved	Water	6010B	63221
MB 480-63123/1-B	Method Blank	Dissolved	Water	6010B	63221

Prep Batch: 64638

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-19566-1	RU10-050112	Total/NA	Water	7470A	
LCS 480-64638/2-A	Lab Control Sample	Total/NA	Water	7470A	
MB 480-64638/1-A	Method Blank	Total/NA	Water	7470A	

Analysis Batch: 64720

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-19566-1	RU10-050112	Total/NA	Water	7470A	64638
LCS 480-64638/2-A	Lab Control Sample	Total/NA	Water	7470A	64638
MB 480-64638/1-A	Method Blank	Total/NA	Water	7470A	64638

General Chemistry

Analysis Batch: 62975

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-19566-1	RU10-050112	Total/NA	Water	353.2	
480-19566-2	RU19-050112	Total/NA	Water	353.2	
480-19566-3	RU19D-050112	Total/NA	Water	353.2	
480-19566-4	RU20-050112	Total/NA	Water	353.2	
480-19566-7	RU21-050112	Total/NA	Water	353.2	
480-19566-8	RU8-050112	Total/NA	Water	353.2	
LCS 480-62975/29	Lab Control Sample	Total/NA	Water	353.2	
MB 480-62975/28	Method Blank	Total/NA	Water	353.2	

Analysis Batch: 63060

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-19566-1	RU10-050112	Total/NA	Water	300.0	
480-19566-1 MS	RU10-050112	Total/NA	Water	300.0	
480-19566-2	RU19-050112	Total/NA	Water	300.0	
480-19566-3	RU19D-050112	Total/NA	Water	300.0	
480-19566-4	RU20-050112	Total/NA	Water	300.0	
480-19566-7	RU21-050112	Total/NA	Water	300.0	
480-19566-8	RU8-050112	Total/NA	Water	300.0	
LCS 480-63060/27	Lab Control Sample	Total/NA	Water	300.0	
MB 480-63060/28	Method Blank	Total/NA	Water	300.0	

Analysis Batch: 63279

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-19566-1	RU10-050112	Total/NA	Water	SM 5310D	
480-19566-2	RU19-050112	Total/NA	Water	SM 5310D	
480-19566-3	RU19D-050112	Total/NA	Water	SM 5310D	
480-19566-4	RU20-050112	Total/NA	Water	SM 5310D	
480-19566-8	RU8-050112	Total/NA	Water	SM 5310D	
LCS 480-63279/28	Lab Control Sample	Total/NA	Water	SM 5310D	
LCS 480-63279/4	Lab Control Sample	Total/NA	Water	SM 5310D	
MB 480-63279/27	Method Blank	Total/NA	Water	SM 5310D	
MB 480-63279/3	Method Blank	Total/NA	Water	SM 5310D	

Analysis Batch: 63359

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-19566-1	RU10-050112	Total/NA	Water	300.0	
480-19566-2	RU19-050112	Total/NA	Water	300.0	
480-19566-3	RU19D-050112	Total/NA	Water	300.0	
LCS 480-63359/123	Lab Control Sample	Total/NA	Water	300.0	
MB 480-63359/124	Method Blank	Total/NA	Water	300.0	

Analysis Batch: 63360

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-19566-8	RU8-050112	Total/NA	Water	300.0	
LCS 480-63360/147	Lab Control Sample	Total/NA	Water	300.0	
MB 480-63360/148	Method Blank	Total/NA	Water	300.0	

Analysis Batch: 63639

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-19566-7	RU21-050112	Total/NA	Water	SM 5310D	
LCS 480-63639/16	Lab Control Sample	Total/NA	Water	SM 5310D	
MB 480-63639/15	Method Blank	Total/NA	Water	SM 5310D	

General Chemistry (Continued)

Analysis Batch: 63671

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-19566-4	RU20-050112	Total/NA	Water	300.0	
480-19566-7	RU21-050112	Total/NA	Water	300.0	
480-19566-7 MS	RU21-050112	Total/NA	Water	300.0	
480-19566-7 MSD	RU21-050112	Total/NA	Water	300.0	
LCS 480-63671/3	Lab Control Sample	Total/NA	Water	300.0	
MB 480-63671/4	Method Blank	Total/NA	Water	300.0	

Analysis Batch: 64072

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 480-64072/10	Lab Control Sample	Total/NA	Water	300.0	
MB 480-64072/11	Method Blank	Total/NA	Water	300.0	

Analysis Batch: 64494

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-19566-1	RU10-050112	Total/NA	Water	VFA-IC	
480-19566-2	RU19-050112	Total/NA	Water	VFA-IC	
480-19566-3	RU19D-050112	Total/NA	Water	VFA-IC	
480-19566-4	RU20-050112	Total/NA	Water	VFA-IC	
480-19566-8	RU8-050112	Total/NA	Water	VFA-IC	
480-19566-8 MS	RU8-050112	Total/NA	Water	VFA-IC	
LCS 480-64494/27	Lab Control Sample	Total/NA	Water	VFA-IC	
MB 480-64494/28	Method Blank	Total/NA	Water	VFA-IC	

Analysis Batch: 64536

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 480-64536/3	Lab Control Sample	Total/NA	Water	300.0	
MB 480-64536/4	Method Blank	Total/NA	Water	300.0	

Analysis Batch: 64729

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
480-19566-4	RU20-050112	Total/NA	Water	VFA-IC	
480-19566-7	RU21-050112	Total/NA	Water	VFA-IC	
LCS 480-64729/3	Lab Control Sample	Total/NA	Water	VFA-IC	
MB 480-64729/4	Method Blank	Total/NA	Water	VFA-IC	

Client Sample ID: RU10-050112 Lab Sample ID: 480-19566-1

Date Collected: 05/01/12 11:15 Matrix: Water

Date Received: 05/03/12 09:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	63819	05/10/12 17:04	DC	TAL BUF
Total/NA	Analysis	8260B	DL	10	64011	05/11/12 15:20	DC	TAL BUF
Total/NA	Analysis	RSK-175		1	63448	05/08/12 13:12	CD	TAL BUF
Total/NA	Analysis	RSK-175	DL	10	63448	05/08/12 15:14	CD	TAL BUF
Dissolved	Prep	3005A			63221	05/07/12 07:20	SS	TAL BUF
Dissolved	Analysis	6010B		1	63458	05/07/12 18:17	LH	TAL BUF
Total/NA	Prep	7470A			64638	05/16/12 10:00	JRK	TAL BUF
Total/NA	Analysis	7470A		1	64720	05/16/12 13:35	MM	TAL BUF
Total/NA	Analysis	353.2		1	62975	05/03/12 18:10	KS	TAL BUF
Total/NA	Analysis	300.0		1	63060	05/04/12 20:56	KAC	TAL BUF
Total/NA	Analysis	SM 5310D		1	63279	05/05/12 20:38	KAC	TAL BUF
Total/NA	Analysis	300.0		1	63359	05/08/12 14:12	KAC	TAL BUF
Total/NA	Analysis	VFA-IC		1	64494	05/16/12 06:56	KAC	TAL BUF

Client Sample ID: RU19-050112 Lab Sample ID: 480-19566-2

Date Collected: 05/01/12 14:15 Matrix: Water

Date Received: 05/03/12 09:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		10	63819	05/10/12 17:27	DC	TAL BUF
Total/NA	Analysis	8260B	DL	20	64011	05/11/12 15:43	DC	TAL BUF
Total/NA	Analysis	RSK-175		1	63448	05/08/12 13:29	CD	TAL BUF
Total/NA	Analysis	RSK-175	DL	10	63448	05/08/12 15:31	CD	TAL BUF
Dissolved	Prep	7470A			63037	05/04/12 09:15	JRK	TAL BUF
Dissolved	Analysis	7470A		1	63147	05/04/12 15:35	JRK	TAL BUF
Dissolved	Prep	3005A			63048	05/04/12 10:10	SS	TAL BUF
Dissolved	Analysis	6010B		1	63282	05/04/12 15:42	LH	TAL BUF
Total/NA	Analysis	353.2		1	62975	05/03/12 18:11	KS	TAL BUF
Total/NA	Analysis	300.0		1	63060	05/04/12 21:36	KAC	TAL BUF
Total/NA	Analysis	SM 5310D		1	63279	05/05/12 20:54	KAC	TAL BUF
Total/NA	Analysis	300.0		1	63359	05/08/12 14:22	KAC	TAL BUF
Total/NA	Analysis	VFA-IC		1	64494	05/16/12 07:25	KAC	TAL BUF

Client Sample ID: RU19D-050112 Lab Sample ID: 480-19566-3

Date Collected: 05/01/12 14:20 Matrix: Water

Date Received: 05/03/12 09:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		10	63819	05/10/12 17:50	DC	TAL BUF
Total/NA	Analysis	RSK-175		1	63448	05/08/12 13:46	CD	TAL BUF
Total/NA	Analysis	RSK-175	DL	10	63448	05/08/12 15:48	CD	TAL BUF
Dissolved	Prep	7470A			63037	05/04/12 09:15	JRK	TAL BUF

Client Sample ID: RU19D-050112 Lab Sample ID: 480-19566-3

Date Collected: 05/01/12 14:20 **Matrix: Water**
Date Received: 05/03/12 09:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	7470A		1	63147	05/04/12 15:37	JRK	TAL BUF
Dissolved	Prep	3005A			63048	05/04/12 10:10	SS	TAL BUF
Dissolved	Analysis	6010B		1	63282	05/04/12 15:44	LH	TAL BUF
Total/NA	Analysis	353.2		1	62975	05/03/12 18:12	KS	TAL BUF
Total/NA	Analysis	300.0		1	63060	05/04/12 21:46	KAC	TAL BUF
Total/NA	Analysis	SM 5310D		1	63279	05/05/12 21:10	KAC	TAL BUF
Total/NA	Analysis	300.0		1	63359	05/08/12 14:32	KAC	TAL BUF
Total/NA	Analysis	VFA-IC		1	64494	05/16/12 07:54	KAC	TAL BUF

Client Sample ID: RU20-050112 Lab Sample ID: 480-19566-4

Date Collected: 05/01/12 17:20 **Matrix: Water**
Date Received: 05/03/12 09:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		50	63819	05/10/12 18:13	DC	TAL BUF
Total/NA	Analysis	RSK-175		10	63448	05/08/12 14:14	CD	TAL BUF
Dissolved	Prep	7470A			63037	05/04/12 09:15	JRK	TAL BUF
Dissolved	Analysis	7470A		1	63147	05/04/12 15:40	JRK	TAL BUF
Dissolved	Prep	3005A			63048	05/04/12 10:10	SS	TAL BUF
Dissolved	Analysis	6010B		1	63282	05/04/12 15:50	LH	TAL BUF
Total/NA	Analysis	353.2		1	62975	05/03/12 18:15	KS	TAL BUF
Total/NA	Analysis	300.0		1	63060	05/04/12 21:56	KAC	TAL BUF
Total/NA	Analysis	SM 5310D		1	63279	05/05/12 21:27	KAC	TAL BUF
Total/NA	Analysis	300.0		1	63671	05/09/12 18:05	KAC	TAL BUF
Total/NA	Analysis	VFA-IC		1	64494	05/16/12 08:23	KAC	TAL BUF
Total/NA	Analysis	VFA-IC		2	64729	05/16/12 18:52	KAC	TAL BUF

Client Sample ID: FB-050112 Lab Sample ID: 480-19566-5

Date Collected: 05/01/12 00:00 **Matrix: Water**
Date Received: 05/03/12 09:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	63819	05/10/12 18:36	DC	TAL BUF

Client Sample ID: TRIP BLANK Lab Sample ID: 480-19566-6

Date Collected: 05/01/12 00:00 **Matrix: Water**
Date Received: 05/03/12 09:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	63819	05/10/12 18:59	DC	TAL BUF

Client Sample ID: RU21-050112 Lab Sample ID: 480-19566-7

Date Collected: 05/01/12 20:10 **Matrix: Water**
Date Received: 05/03/12 09:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		2	64011	05/11/12 16:06	DC	TAL BUF
Total/NA	Analysis	RSK-175		10	63448	05/08/12 14:31	CD	TAL BUF
Total/NA	Analysis	RSK-175	DL	100	63448	05/08/12 16:05	CD	TAL BUF
Dissolved	Prep	7470A			63037	05/04/12 09:15	JRK	TAL BUF
Dissolved	Analysis	7470A		1	63147	05/04/12 15:41	JRK	TAL BUF
Dissolved	Prep	3005A			63048	05/04/12 10:10	SS	TAL BUF
Dissolved	Analysis	6010B		1	63282	05/04/12 15:53	LH	TAL BUF
Total/NA	Analysis	353.2		1	62975	05/03/12 18:16	KS	TAL BUF
Total/NA	Analysis	300.0		5	63060	05/04/12 22:06	KAC	TAL BUF
Total/NA	Analysis	SM 5310D		40	63639	05/08/12 08:59	KAC	TAL BUF
Total/NA	Analysis	300.0		1	63671	05/09/12 18:15	KAC	TAL BUF
Total/NA	Analysis	VFA-IC		20	64729	05/16/12 19:21	KAC	TAL BUF

Client Sample ID: RU8-050112 Lab Sample ID: 480-19566-8

Date Collected: 05/02/12 10:15 **Matrix: Water**
Date Received: 05/03/12 09:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	64011	05/11/12 16:29	DC	TAL BUF
Total/NA	Analysis	RSK-175		1	63448	05/08/12 16:39	CD	TAL BUF
Dissolved	Prep	7470A			63037	05/04/12 09:15	JRK	TAL BUF
Dissolved	Analysis	7470A		1	63147	05/04/12 15:43	JRK	TAL BUF
Dissolved	Prep	3005A			63048	05/04/12 10:10	SS	TAL BUF
Dissolved	Analysis	6010B		1	63282	05/04/12 15:55	LH	TAL BUF
Total/NA	Analysis	353.2		1	62975	05/03/12 18:17	KS	TAL BUF
Total/NA	Analysis	300.0		1	63060	05/04/12 22:17	KAC	TAL BUF
Total/NA	Analysis	SM 5310D		1	63279	05/05/12 23:41	KAC	TAL BUF
Total/NA	Analysis	300.0		1	63360	05/08/12 16:03	KAC	TAL BUF
Total/NA	Analysis	VFA-IC		1	64494	05/16/12 09:22	KAC	TAL BUF

Laboratory References:

TAL BUF = TestAmerica Buffalo, 10 Hazelwood Drive, Amherst, NY 14228-2298, TEL (716)691-2600

Certification Summary

Client: CDM Smith, Inc.
Project/Site: New York state project

TestAmerica Job ID: 480-19566-1

Laboratory	Authority	Program	EPA Region	Certification ID
TestAmerica Buffalo	Arkansas DEQ	State Program	6	88-0686
TestAmerica Buffalo	California	NELAC	9	1169CA
TestAmerica Buffalo	Connecticut	State Program	1	PH-0568
TestAmerica Buffalo	Florida	NELAC	4	E87672
TestAmerica Buffalo	Georgia	State Program	4	956
TestAmerica Buffalo	Georgia	State Program	4	N/A
TestAmerica Buffalo	Illinois	NELAC	5	100325 / 200003
TestAmerica Buffalo	Iowa	State Program	7	374
TestAmerica Buffalo	Kansas	NELAC	7	E-10187
TestAmerica Buffalo	Kentucky	State Program	4	90029
TestAmerica Buffalo	Kentucky (UST)	State Program	4	30
TestAmerica Buffalo	Louisiana	NELAC	6	02031
TestAmerica Buffalo	Maine	State Program	1	NY0044
TestAmerica Buffalo	Maryland	State Program	3	294
TestAmerica Buffalo	Massachusetts	State Program	1	M-NY044
TestAmerica Buffalo	Michigan	State Program	5	9937
TestAmerica Buffalo	Minnesota	NELAC	5	036-999-337
TestAmerica Buffalo	New Hampshire	NELAC	1	2337
TestAmerica Buffalo	New Hampshire	NELAC	1	68-00281
TestAmerica Buffalo	New Jersey	NELAC	2	NY455
TestAmerica Buffalo	New York	NELAC	2	10026
TestAmerica Buffalo	North Dakota	State Program	8	R-176
TestAmerica Buffalo	Oklahoma	State Program	6	9421
TestAmerica Buffalo	Oregon	NELAC	10	NY200003
TestAmerica Buffalo	Pennsylvania	NELAC	3	68-00281
TestAmerica Buffalo	Tennessee	State Program	4	TN02970
TestAmerica Buffalo	Texas	NELAC	6	T104704412-08-TX
TestAmerica Buffalo	USDA	Federal		P330-08-00242
TestAmerica Buffalo	Virginia	NELAC	3	460185
TestAmerica Buffalo	Virginia	State Program	3	278
TestAmerica Buffalo	Washington	State Program	10	C1677
TestAmerica Buffalo	West Virginia DEP	State Program	3	252
TestAmerica Buffalo	Wisconsin	State Program	5	998310390

Accreditation may not be offered or required for all methods and analytes reported in this package. Please contact your project manager for the laboratory's current list of certified methods and analytes.

Method	Method Description	Protocol	Laboratory
8260B	Volatile Organic Compounds (GC/MS)	SW846	TAL BUF
RSK-175	Dissolved Gases (GC)	RSK	TAL BUF
6010B	Metals (ICP)	SW846	TAL BUF
7470A	Mercury (CVAA)	SW846	TAL BUF
300.0	Anions, Ion Chromatography	MCAWW	TAL BUF
353.2	Nitrogen, Nitrate-Nitrite	MCAWW	TAL BUF
SM 5310D	Organic Carbon, Total (TOC)	SM	TAL BUF
VFA-IC	Volatile Fatty Acids, Ion Chromatography	TestAmerica SOP	TAL BUF

Protocol References:

MCAWW = "Methods For Chemical Analysis Of Water And Wastes", EPA-600/4-79-020, March 1983 And Subsequent Revisions.

RSK = Sample Prep And Calculations For Dissolved Gas Analysis In Water Samples Using A GC Headspace Equilibration Technique, RSKSOP-175, Rev. 0, 8/11/94, USEPA Research Lab

SM = "Standard Methods For The Examination Of Water And Wastewater",

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

TestAmerica SOP = TestAmerica, Inc., Standard Operating Procedure

Laboratory References:

TAL BUF = TestAmerica Buffalo, 10 Hazelwood Drive, Amherst, NY 14228-2298, TEL (716)691-2600

Sample Summary

Client: CDM Smith, Inc.
TestAmerica Job ID: 480-19566-1
Project/Site: New York state project

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
480-19566-1	RU10-050112	Water	05/01/12 11:15	05/03/12 09:00
480-19566-2	RU19-050112	Water	05/01/12 14:15	05/03/12 09:00
480-19566-3	RU19D-050112	Water	05/01/12 14:20	05/03/12 09:00
480-19566-4	RU20-050112	Water	05/01/12 17:20	05/03/12 09:00
480-19566-5	FB-050112	Water	05/01/12 00:00	05/03/12 09:00
480-19566-6	TRIP BLANK	Water	05/01/12 00:00	05/03/12 09:00
480-19566-7	RU21-050112	Water	05/01/12 20:10	05/03/12 09:00
480-19566-8	RU8-050112	Water	05/02/12 10:15	05/03/12 09:00

TestAmerica Buffalo
10 Hazelwood Drive
Amherst, NY 14228-2298
Phone (716) 691-2600 Fax (716) 691-7991

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information			
Client Contact: Neil Smith	Sampler: S. Cleaver	Lab PM: Gray-Erdmann, Peggy	Carrier Tracking No(s):
	Phone: (570) 441-3806	E-Mail: peggy.gray-erdmann@testamericainc.com	
Company: CDM Smith, Inc.			COC No: 480-24027-6093.1
Address: 555 17th Street Suite 1100	Due Date Requested:		Page: Page 1 of 1
City: Denver	TAT Requested (days): Standard		Job #:
State, Zip: CO, 80202			
Phone: 303-383-2447(Tel)	PO #: Purchase Order not required		
Email: smithnl@cdmsmith.com	WO #:		
Project Name: New York state project	Project #: 48005099		
Site: Olean, NY	SSOW#:		

Analysis Requested

Preservation Codes:
A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA
M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2SO3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - ph 4-5, Z - other (specify)
Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No) Metals	Perform MS/MSD (Yes or No)	VFA_IC - Local Method	300.0_28D - Local Method	353.2_Pres - Nitrate Nitrite as N	6010B, 7470A	8260B - TCL list OLM04.2	SM5310D - Local Method	RSK_175 - Local Method	Total Number of containers	Special Instructions/Note:
			Preservation Code:		X	X	N	N	S	D	A	A	A	X	
RU10-050112	5/1/12	1115	G	Water	N	N	X	X	X	X	X	X	X	14	Forgot to filter 6010B metals please filter at lab.
RU19-050112	5/1/12	1415	G	Water	Y	N	X	X	X	X	X	X	X	14	
RU19D-050112	5/1/12	1420	G	Water	Y	N	X	X	X	X	X	X	X	14	
RU20-050112	5/1/12	1720	G	Water	Y	N	X	X	X	X	X	X	X	14	
FB-050112	5/1/12		G	Water	N	N					X			3	
TRIP BLANK	5/1/12	NA	G	Water	N	N					X			3	
~~Trip Blank~~ RU21-050112	5/1/12	2010	G	Water	Y	N	X	X	X	X	X	X	X	14	
RU8-050212	5/2/12	1015	G	Water	Y	N	X	X	X	X	X	X	X	14	

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

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

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:		
Relinquished by: S. Cleaver	Date/Time: 5/2/12	Company: CDM Smith	Received by: [signature]	Date/Time: 5/3/12 900	Company: [signature]
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks: 2.0 #1

Login Sample Receipt Checklist

Client: CDM Smith, Inc.

Job Number: 480-19566-1

Login Number: 19566
List Number: 1
Creator: Janish, Carl

List Source: TestAmerica Buffalo

Question	Answer	Comment
Radioactivity either was not measured or, if measured, is at or below background	True	
The cooler's custody seal, if present, is intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	False	Metals volume for -01 received preserved, requires lab filtration, discarded
Sample bottles are completely filled.	False	Poured off ~50 mls UP volume for metals - lab to filter and preserve
Sample Preservation Verified	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	True	
If necessary, staff have been informed of any short hold time or quick TAT needs	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Sampling Company provided.	True	CDM
Samples received within 48 hours of sampling.	True	
Samples requiring field filtration have been filtered in the field.	True	
Chlorine Residual checked.	N/A	

Alcoa Site in Olean, New York
Quantitative PCR Analytical Summary

May 21, 2012

Overview:

The objective of this project was to quantify the number of *Dehalococcoides sp.* (DHC) 16S rRNA gene copies and reductase functional genes (*tceA*, *vcrA*, and *bvcA* copies) contained in groundwater collected from the Alcoa Site in Olean, New York using quantitative polymerase chain reaction (QPCR). The client is CDM Smith. Table 1 describes the sample matrix and the condition of the samples upon arrival to the analytical laboratory.

Table 1. Description of samples and volume filtered for DNA extraction.

Sample ID	Matrix	Date Sampled	Condition Received	Volume Filtered (L)
RU10-050112	Groundwater	5/1/2012	Bottle Intact, 4˚C	0.3
RU19-050112	Groundwater	5/1/2012	Bottle Intact, 4˚C	0.5
RU20-050112	Groundwater	5/1/2012	Bottle Intact, 4˚C	0.5
RU21-050112	Groundwater	5/1/2012	Bottle Intact, 4˚C	0.15
RU8-050212	Groundwater	5/2/2012	Bottle Intact, 4˚C	0.5

The samples arrived in good condition and were preserved with glycerol. Upon arrival, the sample groundwater was filtered. The filter was frozen for storage at -80°C until the DNA extraction was performed. Following DNA extraction, the samples were first subjected to quantitative polymerase chain reaction (QPCR) using probes in order to detect the presence and amount of *Dehalococcoides* in each sample. For samples that did not amplify during QPCR reactions, universal PCR was used to amplify nearly full-length 16S rDNA genes from *Bacteria* in order to verify that amplifiable DNA was present. The results of these studies are described in this report.

Methods:

DNA Extraction: For groundwater shipped to the laboratory, the groundwater volume indicated in Table 1 was filtered using a sterile 0.2-µm acetate filter. The filter was frozen at -80°C and then shattered. Next, the sample tube was amended with 2 mL of DNA-free water, vortexed vigorously for 5 minutes, and the liquid volume was partitioned into DNA extraction tubes. The DNA extraction was performed using the Bio101 DNA Extraction Kit according to the manufacturer's instructions. DNA product was cleaned with ethanol precipitation. Community DNA was eluted in 100 µL of 0.1x Tris HCL and stored at -20°C.

Detection of Dehalococcoides: The QPCR methods for assessing the 16S rRNA gene, and the reductase genes *tceA*, *bvcA*, and *vcrA*, are very sensitive in detecting specific DNA fragments. A mixed laboratory culture containing *Dehalococcoides* was used to obtain the quantitative standards used in these analyses. Plasmid DNA containing DNA inserts of targets 16S rRNA gene, *tceA*, *bvcA*, and *vcrA* from *Dehalococcoides* were purified and quantified fluorometrically. Based on the known size of the plasmid and insert, DNA concentrations were converted to insert copy numbers. A dilution series spanning seven orders of magnitude was generated using known concentrations of each plasmid. Amplification and detection of the DNA was performed using a BIO-RAD Chromo4 Real Time Detector System. The acceptance criterion for the standard curve is a linear R^2 value of greater than 0.995.

TaqMan Protocol. The 16S rRNA gene, and reductase genes *tceA*, *bvcA*, and *vcrA*, QPCR reactions were performed using TaqMan chemistry. The Taqman probes for the 16S rRNA gene and for the *tceA* gene were synthesized using the FAM label on the 5-foot end and the BHQ quencher (Biosearch Technologies). For the *bvcA* gene probe, a Cy5 label is used on the 5-foot end and for the *vcrA* gene probe, a HEX label is used on the 5-foot end, both are coupled to the BHQ quencher. Reaction volumes of 25 µL contained forward and reverse primers at a concentration of 700 nM, a probe at a concentrations of 200 nM, 1 x TaqMan Universal PCR Master Mix(Roche) and 5 µL of sample DNA. The BIO-RAD Chromo 4 Real Time Detector System was used for all reactions. The settings for cycle number and reaction conditions used for all runs were 95°C for 10 minutes, and 45 cycles of 95°C for 15 seconds and 58°C for 1 minute. Standards and unknowns were run in triplicate to ensure reproducibility. Cycle thresholds (C_t) were set to minimize the standard deviation of standard curve triplicate C_t values, and also to obtain a standard curve slope as close to negative 3.5 as possible.

Amplification of Bacteria: For samples that did not amplify during QPCR reactions, universal PCR was used to amplify nearly full-length 16S rDNA genes from *Bacteria* in order to verify that amplifiable DNA was present. Each 25-µL PCR reaction includes a final reagent concentration of: 1X GoTaq Hot Start Green Master Mix (Promega), 0.25µM 8F and 0.25µM 1492R primers (Invitrogen), 1µL genomic DNA, and molecular-grade water (Promega). Each reaction was repeated using 5µL of genomic DNA with 20µL of PCR master mix and a third time with 1µL of genomic DNA, 1µL of 8F/1492R plasmid DNA as a matrix spike and 23µL of PCR master mix. Amplification was performed on a BIO-RAD DNA Engine Dyad and Disciple Peltier Thermal Cycler using the following regime: 94°C (5 min) followed by 40 cycles of 94°C (1 min), 53.5°C (1 min), and 72°C (1 min). The reaction was finished with an additional 7 minutes at 72°C. PCR products were examined in a 1.0% agarose gel stained with ethidium bromide to confirm specificity of the amplification reactions.

Results:

Table 2 summarizes the QPCR analysis of the samples. The DNA extraction negative control and all PCR negative controls did not amplify any product. In addition, all calibration control checks were within acceptable values.

Table 2. Results of molecular analyses for the samples.

Sample ID	DNA (ng/L groundwater)	Universal PCR#	*Dehalococcoides* 16S rRNA (copy/L groundwater)	*Dehalococcoides* tceA (copy/L groundwater)	*Dehalococcoides* bvcA (copy/L groundwater)	*Dehalococcoides* vcrA (copy/L groundwater)
RU10-050112	4587	N/A	6.78E+03* ± 5.52E+02	±	±	±
RU19-050112	2188	N/A	6.79E+06 ± 1.20E+05	4.18E+06 ± 6.60E+05	0.0 ±	1.74E+06 ± 2.95E+05
RU20-050112	3344	N/A	2.87E+03* ± 4.93E+02	±	±	±
RU21-050112	22520	N/A	1.16E+09 ± 1.70E+08	6.74E+08 ± 9.91E+07	0.0 ±	2.39E+08 ± 3.73E+07
RU8-050212	410	N/A	4.98E+02* ± 7.74E+01	±	±	±

***: indicates that the value presented is below the reporting limit**

#: a '+' sign indicates that amplification of *Bacteria* was successful, and a '-' sign indicates that amplification was not successful, N/A: (not applicable) means the analysis wasn't performed.

The DNA concentration of the DNA extraction (in ng/L of groundwater) is reported as an indicator of relative biomass levels for the samples so that relative comparisons can be made. *Dehalococcoides* 16S was detected in samples RU19-050112 and RU21-050112 and was detected below the reporting limit in three samples RU10-050112, RU20-050112 and RU8-050212. The reductase genes tceA and vcrA were detected in samples RU19-050112 and RU21-050112.

The data presented in this report are produced using lab-specific methods. All results are intended to be used as a screening tool and should not be used as definitive data. Users should verify the suitability of the data for their own specific purpose.

North Wind
A CIRI COMPANY

North Wind
A CIRI COMPANY

NORTH WIND CHAIN-OF-CUSTODY RECORD

Company Name: CDM Smith	Sampler: S. Cleaver	Page 1 of 1
Address: 555 17th Street, STE 1100	Phone: (570) 441-3806 Fax:	Date: 5/2/12
City: Denver	Email: cleaversw@cdmsmith.com	COC #:
State: CO Zip: 80202	Project Manager: Neil Smith	
Project Name: Alcoa Bioremediation Pilot Study	Phone: (303) 383-2447 Fax:	Carrier/Airbill #: 1Z120X0601 7742 1467
Project Location: Olean, NY	Email: smithnl@cdmsmith.com	

Analyses Requested: DHC + functional genes

Sample Number	Sample Location	Date	Time	Depth	Sample Preservative	Sample Matrix	DHC + functional genes					Type, Volume, and No. of Containers	Remarks/Special Instructions:
RU10-050112		5/1/12	1115	15' btoc	Glycerol	Water	☒	☐	☐	☐	☐	1L X 1	
RU19-050112		5/1/12	1415	15' btoc	Glycerol	Water	☒	☐	☐	☐	☐	1L X 1	
RU20-050112		5/1/12	1720	35' btoc	Glycerol	Water	☒	☐	☐	☐	☐	1L X 1	
RU21-050112		5/1/12	2010	15' btoc	Glycerol	Water	☒	☐	☐	☐	☐	1L X 1	
RU8-050212		5/2/12	1015	15' btoc	Glycerol	Water	☒	☐	☐	☐	☐	1L X 1	
							☐	☐	☐	☐	☐		
							☐	☐	☐	☐	☐		
							☐	☐	☐	☐	☐		
							☐	☐	☐	☐	☐		

Possible Hazard Identification
☐ Non-Hazardous ☐ Skin Irritant ☐ Rad ☐ Flammable ☐ Poison ☐ Unknown

Sample Disposal
☐ Return to Client ☒ Disposal by Lab

Other Comments

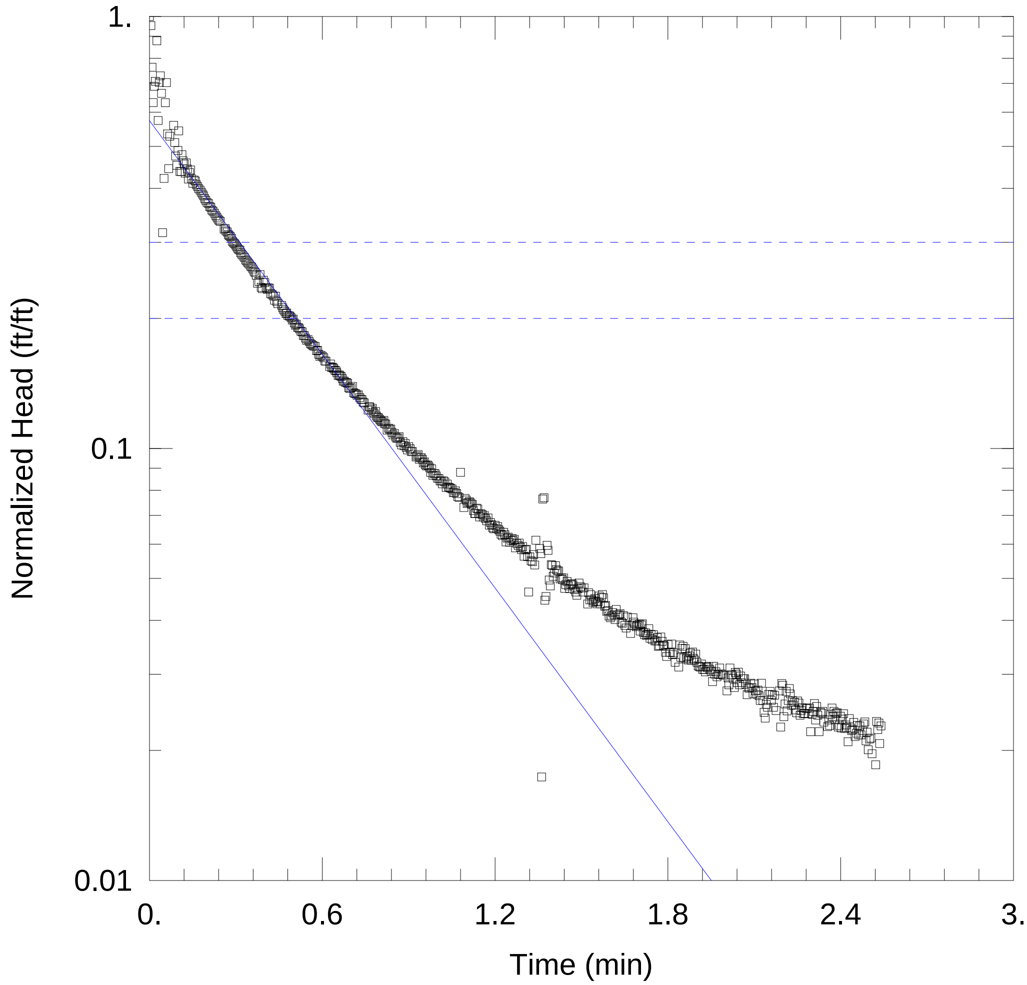
Relinquished by: (Signature/Company)	Date	Time	Received By: (Signature/Company)	Date	Time	Ship to:
[signature] / CDM Smith	5/2/12	1600	[signature]	5-3-12	11:30	ATTN: Erin O'Leary-Jepsen
Relinquished by: (Signature/Company)	Date	Time	Received By: (Signature/Company)	Date	Time	
Relinquished by: (Signature/Company)	Date	Time	Received By: (Signature/Company)	Date	Time	

Distribution: White copy accompanies samples during transfer of custody; Yellow copy is retained by customer.

ENVF-021.1_Rev 2
Effective 01/01/11

Appendix C

Hydraulic Conductivity Testing Results



WELL TEST ANALYSIS

Data Set: X:\...\RU19_Nov11_slugin_1.aqt
Date: 06/22/12 Time: 14:53:31

PROJECT INFORMATION

Company: CDM
Client: Olean
Location: NY
Test Well: RU-19
Test Date: 11/17/2011

AQUIFER DATA

Saturated Thickness: 12.29 ft Anisotropy Ratio (Kz/Kr): 1.

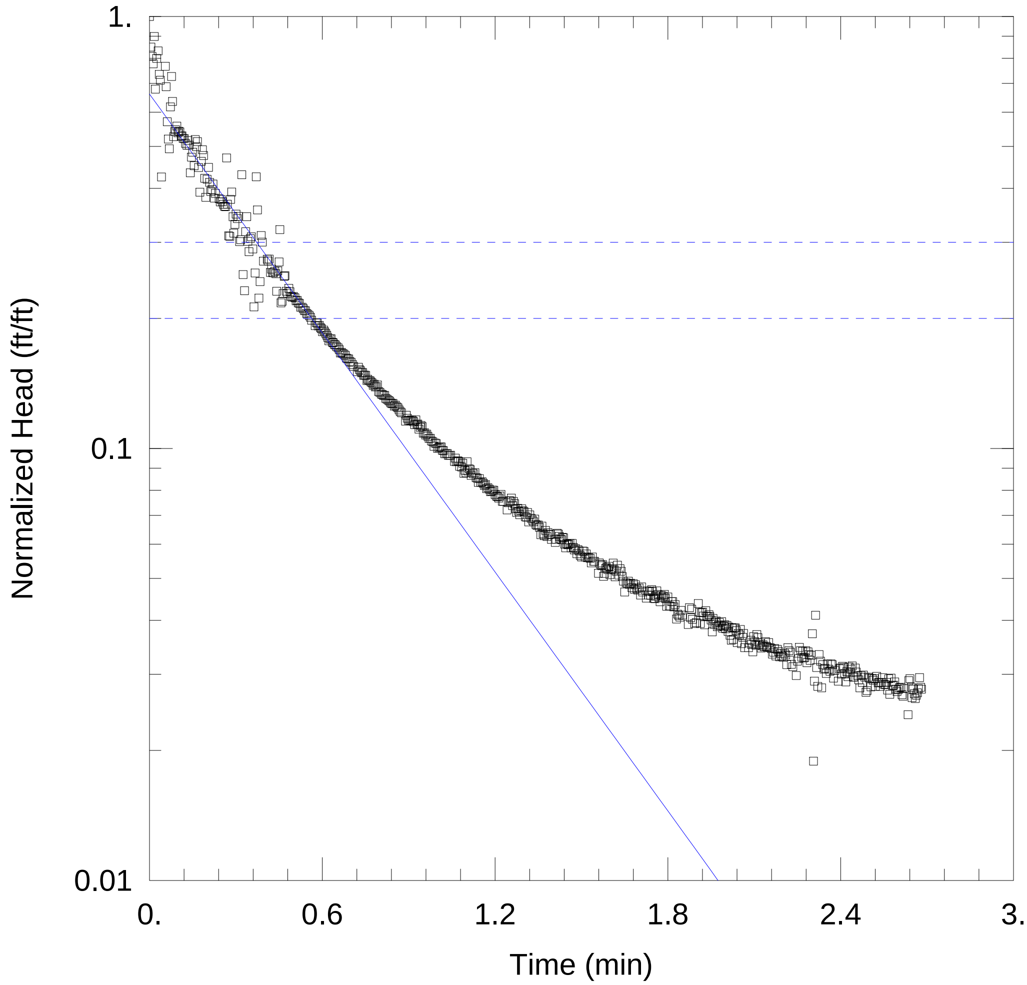
WELL DATA (RU-19)

Initial Displacement: 2.13 ft Static Water Column Height: 12.29 ft
Total Well Penetration Depth: 12.29 ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.001302 cm/sec y0 = 1.222 ft



WELL TEST ANALYSIS

Data Set: X:\...\RU19_Nov11_slugin_2.aqt
Date: 06/22/12 Time: 14:54:41

PROJECT INFORMATION

Company: CDM
Client: Alcoa
Location: Olean
Test Well: RU-19
Test Date: 11/17/2011

AQUIFER DATA

Saturated Thickness: 12.29 ft Anisotropy Ratio (Kz/Kr): 1.

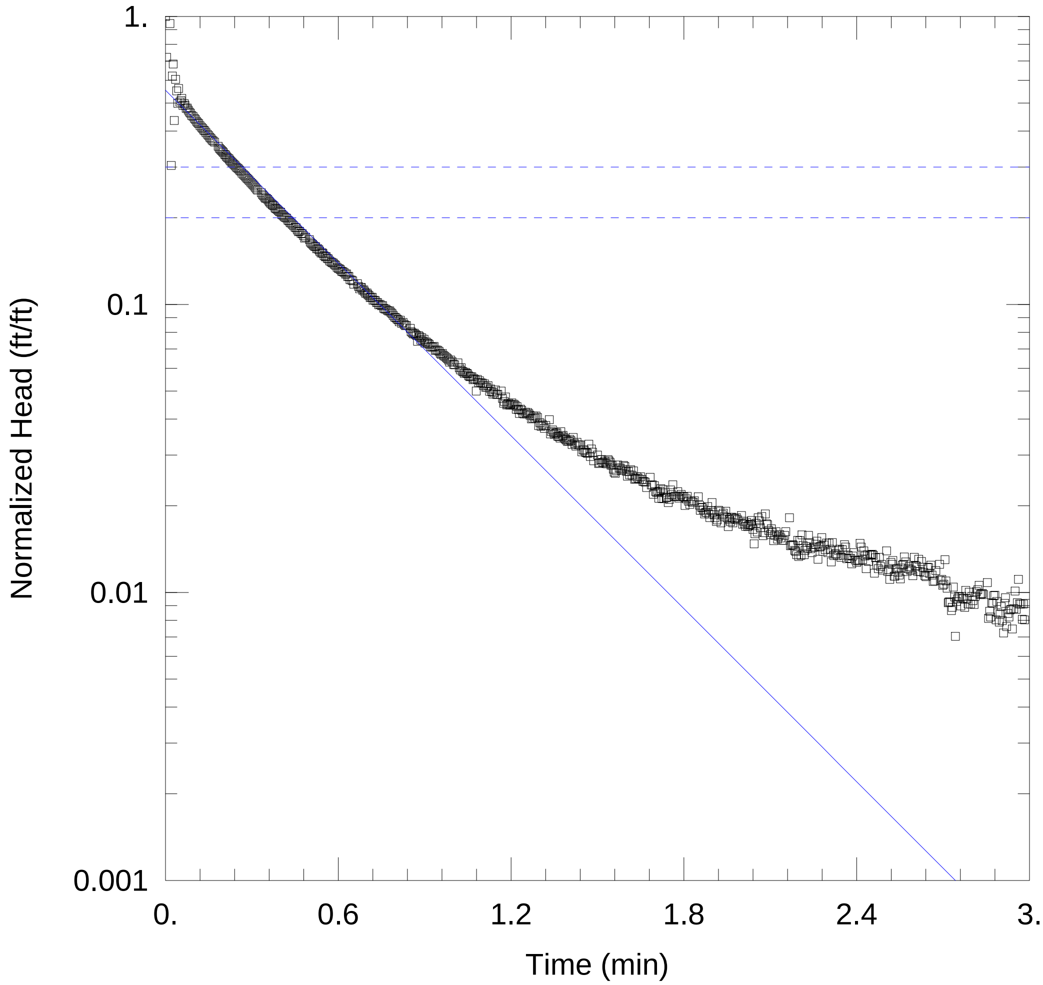
WELL DATA (RU-19)

Initial Displacement: 1.93 ft
Total Well Penetration Depth: 12.29 ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.29 ft
Screen Length: 10. ft
Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.001331 cm/sec y0 = 1.276 ft



WELL TEST ANALYSIS

Data Set: X:\...\RU19_Nov11_slugout_1.aqt
Date: 06/22/12 Time: 14:55:45

PROJECT INFORMATION

Company: CDM
Client: Alcoa
Location: Olean
Test Well: RU-19
Test Date: 11/17/2011

AQUIFER DATA

Saturated Thickness: 12.32 ft Anisotropy Ratio (Kz/Kr): 1.

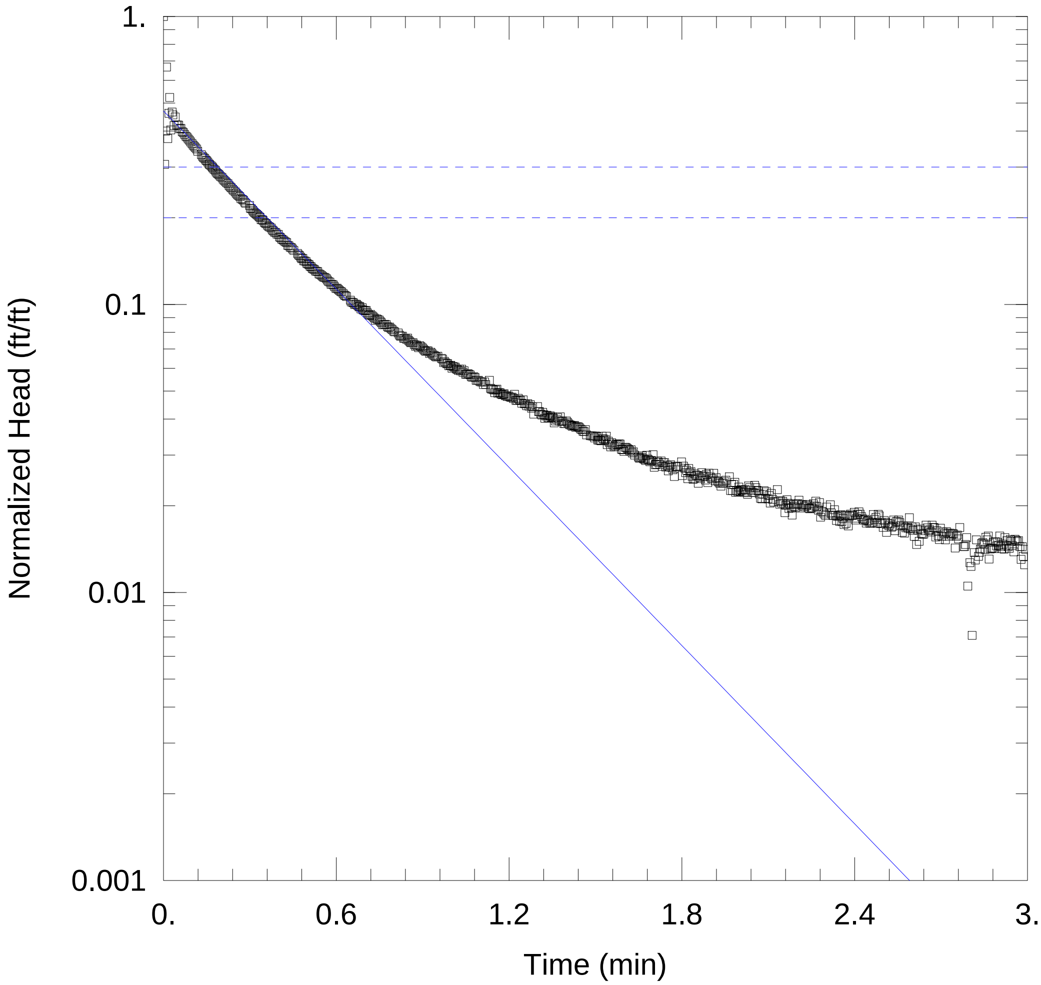
WELL DATA (RU-19)

Initial Displacement: 2.77 ft Static Water Column Height: 12.32 ft
Total Well Penetration Depth: 12.32 ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.001445 cm/sec y0 = 1.535 ft



WELL TEST ANALYSIS

Data Set: X:\...\RU19_Nov11_slugout_2.aqt
Date: 06/22/12 Time: 14:56:25

PROJECT INFORMATION

Company: CDM
Client: Alcoa
Location: Olean
Test Well: RU-19
Test Date: 11/17/2011

AQUIFER DATA

Saturated Thickness: 12.33 ft Anisotropy Ratio (Kz/Kr): 1.

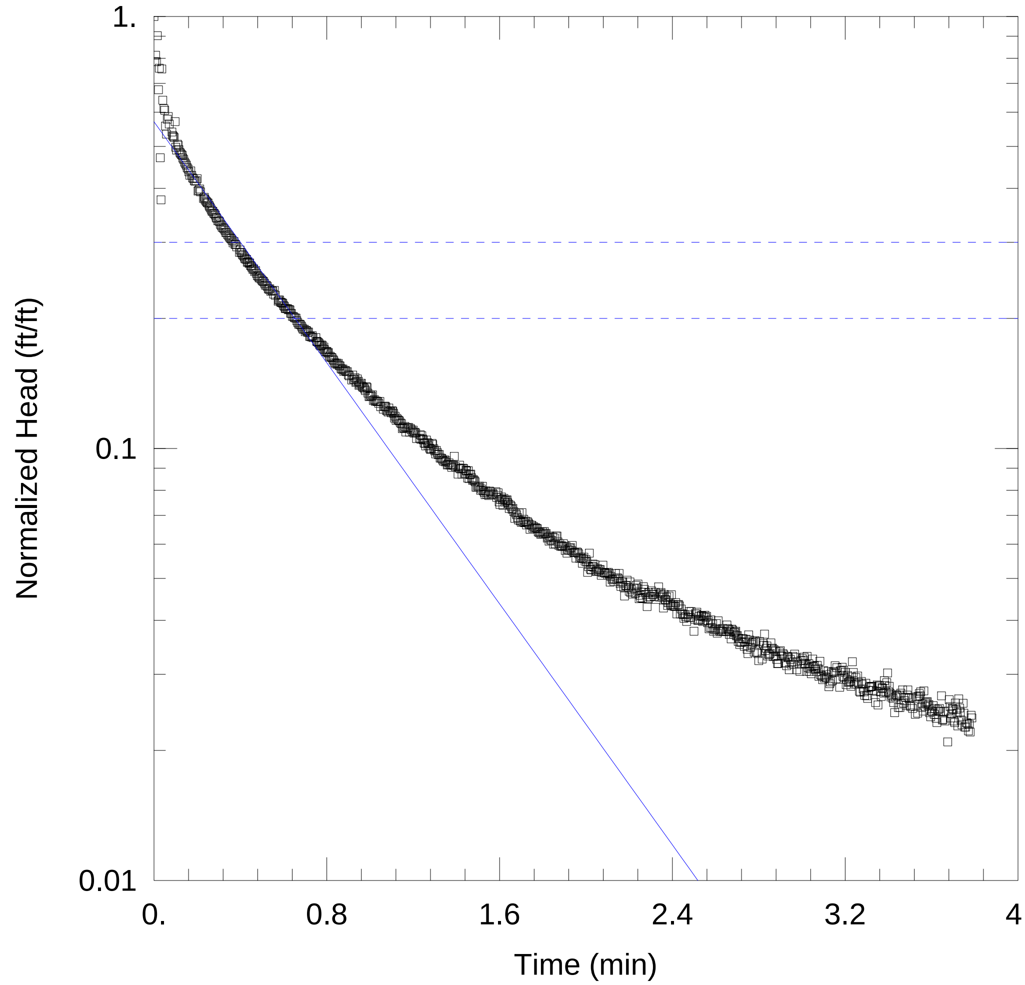
WELL DATA (RU-19)

Initial Displacement: 3.29 ft
Total Well Penetration Depth: 12.33 ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.33 ft
Screen Length: 10. ft
Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.00149 cm/sec y0 = 1.545 ft



WELL TEST ANALYSIS

Data Set: X:\...\RU21_Nov11_slugin_1.aqt
Date: 06/22/12 Time: 14:57:04

PROJECT INFORMATION

Company: CDM
Client: Alcoa
Location: Olean
Test Well: RU-21
Test Date: 11/17/2011

AQUIFER DATA

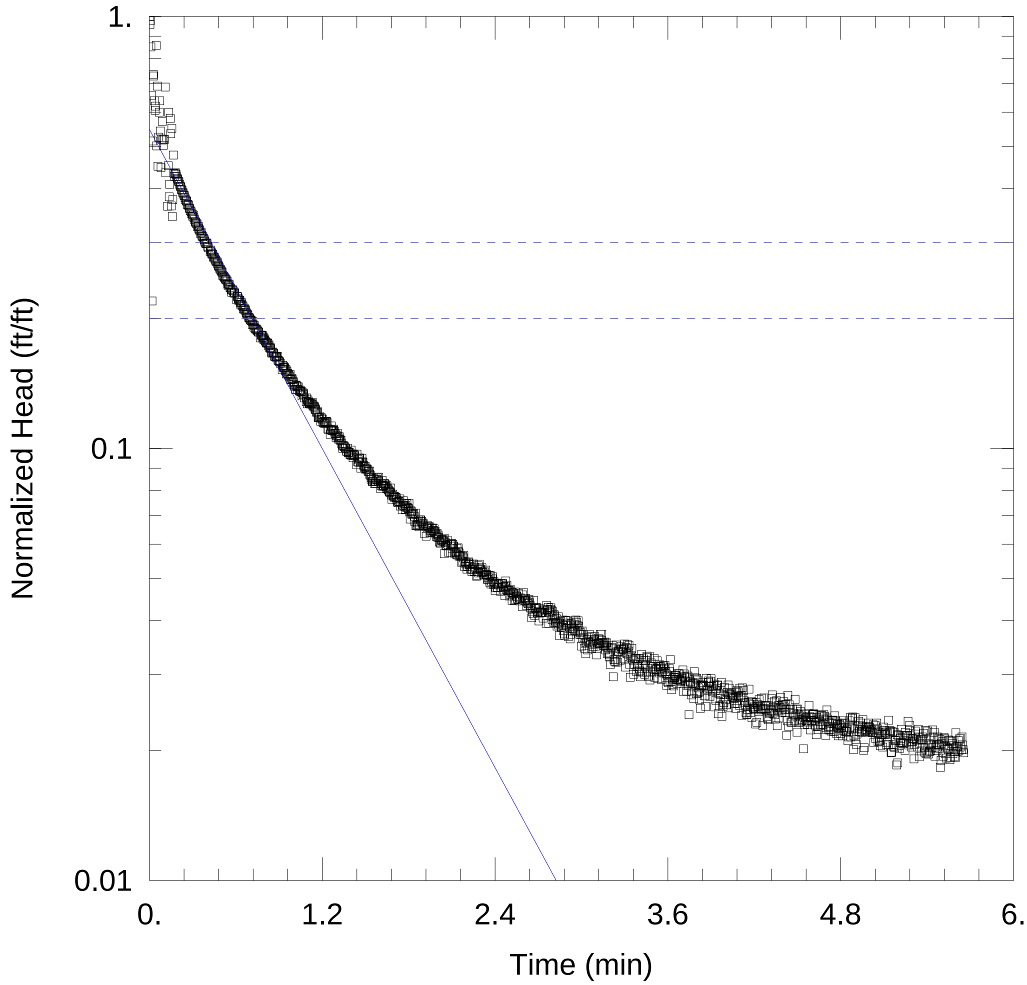
Saturated Thickness: 12.85 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (RU-21)

Initial Displacement: 1.96 ft Static Water Column Height: 12.85 ft
Total Well Penetration Depth: 12.85 ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice
K = 0.001015 cm/sec y0 = 1.118 ft



WELL TEST ANALYSIS

Data Set: X:\...\RU21_Nov11_slugin_2.aqt
Date: 06/22/12 Time: 14:57:52

PROJECT INFORMATION

Company: CDM
Client: Alcoa
Location: Olean
Test Well: RU-21
Test Date: 11/17/2011

AQUIFER DATA

Saturated Thickness: 12.85 ft Anisotropy Ratio (Kz/Kr): 1.

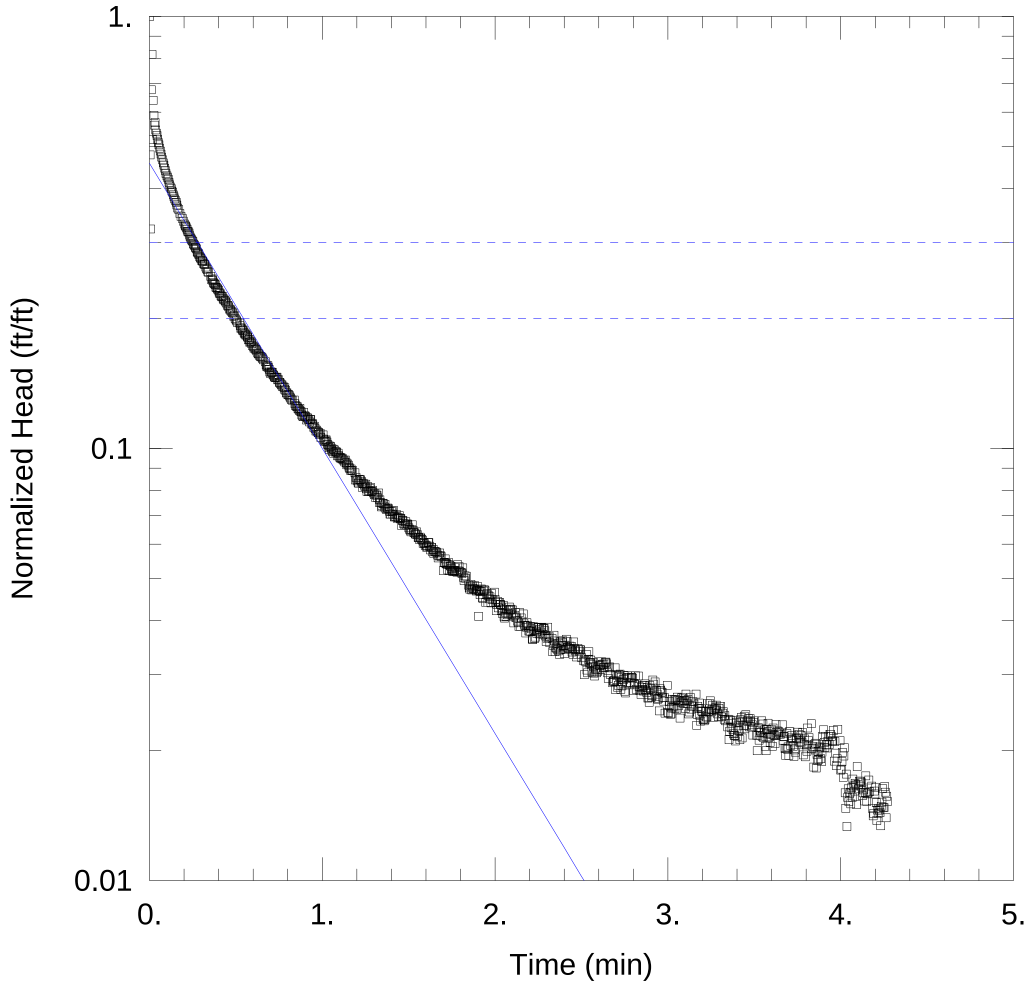
WELL DATA (RU-21)

Initial Displacement: 1.89 ft
Total Well Penetration Depth: 12.85 ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.85 ft
Screen Length: 10. ft
Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.0008952 cm/sec y0 = 1.033 ft



WELL TEST ANALYSIS

Data Set: X:\...\RU21_Nov11_slugout_1.aqt
Date: 06/22/12 Time: 14:58:42

PROJECT INFORMATION

Company: CDM
Client: Alcoa
Location: Olean
Test Well: RU-21
Test Date: 11/17/2011

AQUIFER DATA

Saturated Thickness: 12.89 ft Anisotropy Ratio (Kz/Kr): 1.

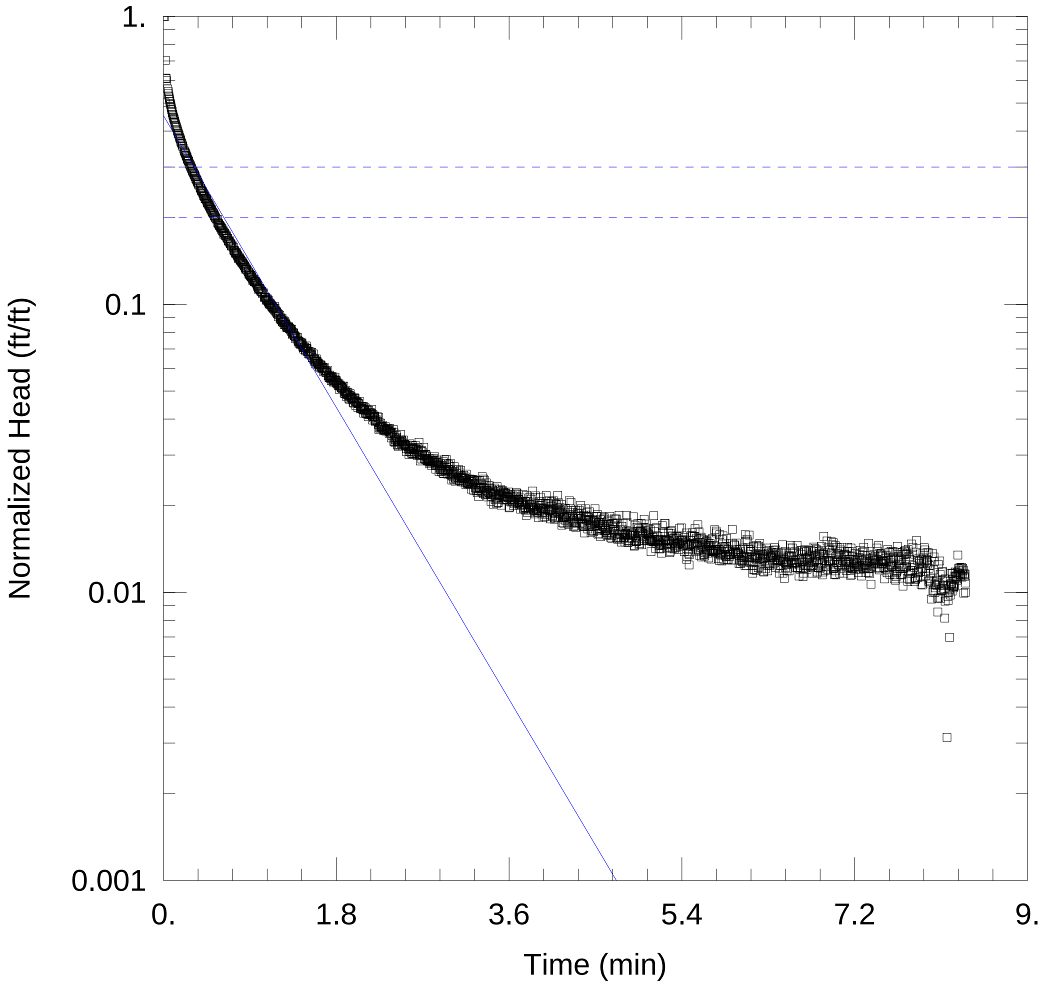
WELL DATA (RU-21)

Initial Displacement: 2.69 ft Static Water Column Height: 12.89 ft
Total Well Penetration Depth: 12.89 ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.0009606 cm/sec y0 = 1.23 ft



WELL TEST ANALYSIS

Data Set: X:\...\RU21_Nov11_slugout_2.aqt
Date: 06/22/12
Time: 14:59:59

PROJECT INFORMATION

Company: CDM
Client: Alcoa
Location: Olean
Test Well: RU-21
Test Date: 11/17/2011

AQUIFER DATA

Saturated Thickness: 12.88 ft
Anisotropy Ratio (Kz/Kr): 1.

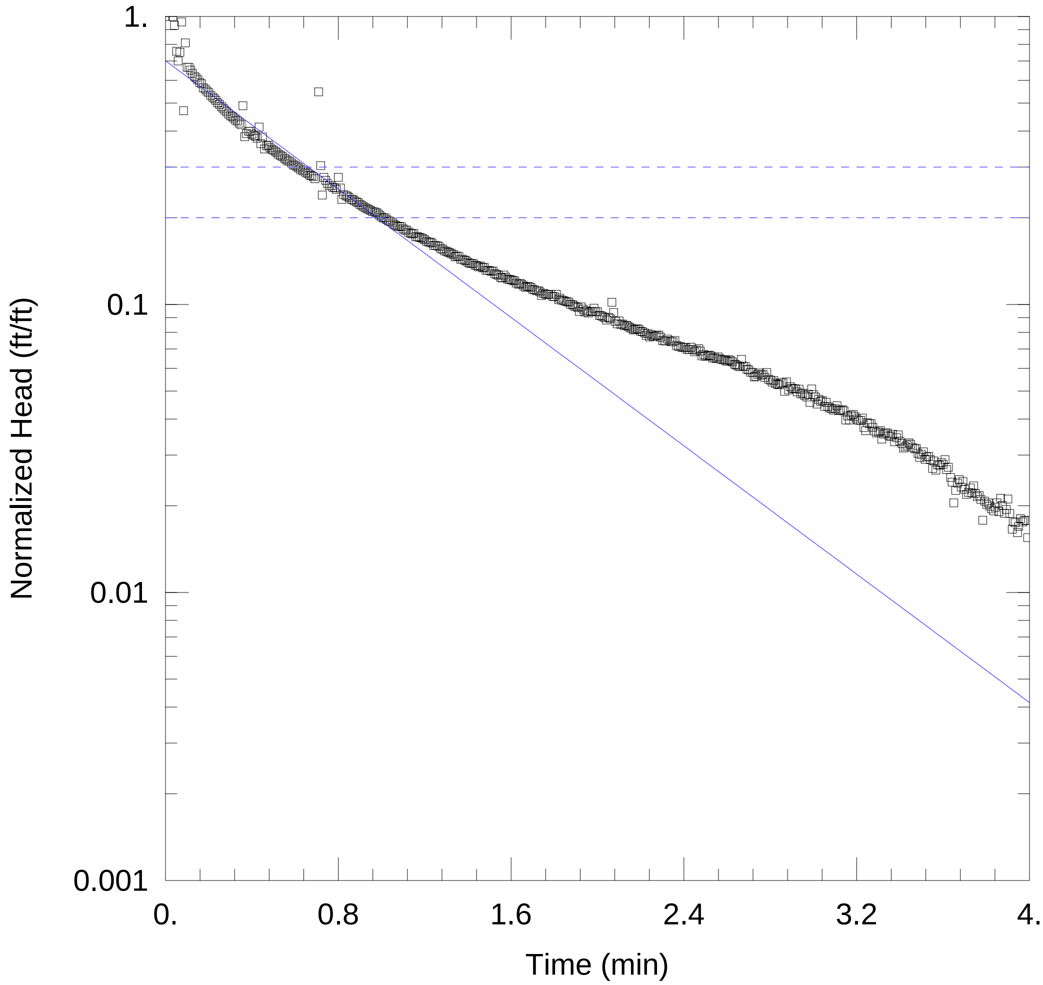
WELL DATA (RU-21)

Initial Displacement: 2.52 ft
Static Water Column Height: 12.88 ft
Total Well Penetration Depth: 12.88 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.004553 cm/sec
y0 = 1.14 ft



WELL TEST ANALYSIS

Data Set: X:\...\RU19_Apr12_slugin_1.aqt
Date: 06/05/12 Time: 17:45:35

PROJECT INFORMATION

Company: CDM
Client: Alcoa
Location: Olean
Test Well: RU-19
Test Date: 4/16/2012

AQUIFER DATA

Saturated Thickness: 11.87 ft Anisotropy Ratio (Kz/Kr): 1.

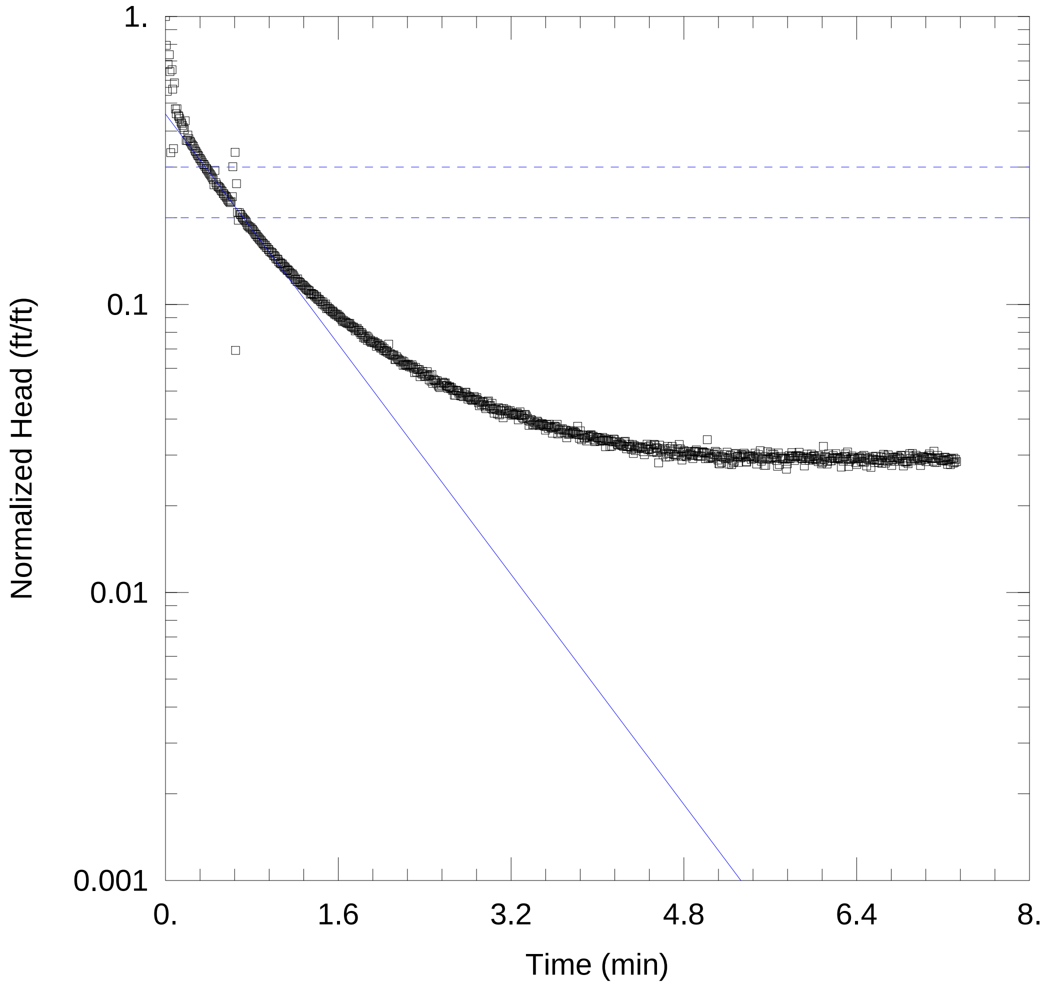
WELL DATA (RU-19)

Initial Displacement: 2.146 ft Static Water Column Height: 11.87 ft
Total Well Penetration Depth: 11.87 ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.0007997 cm/sec y0 = 1.505 ft



WELL TEST ANALYSIS

Data Set: X:\...\RU19_Apr12_slugin_2.aqt
Date: 06/05/12 Time: 17:49:42

PROJECT INFORMATION

Company: CDM
Client: Alcoa
Location: Olean
Test Well: RU-19
Test Date: 4/16/2012

AQUIFER DATA

Saturated Thickness: 11.8 ft Anisotropy Ratio (Kz/Kr): 1.

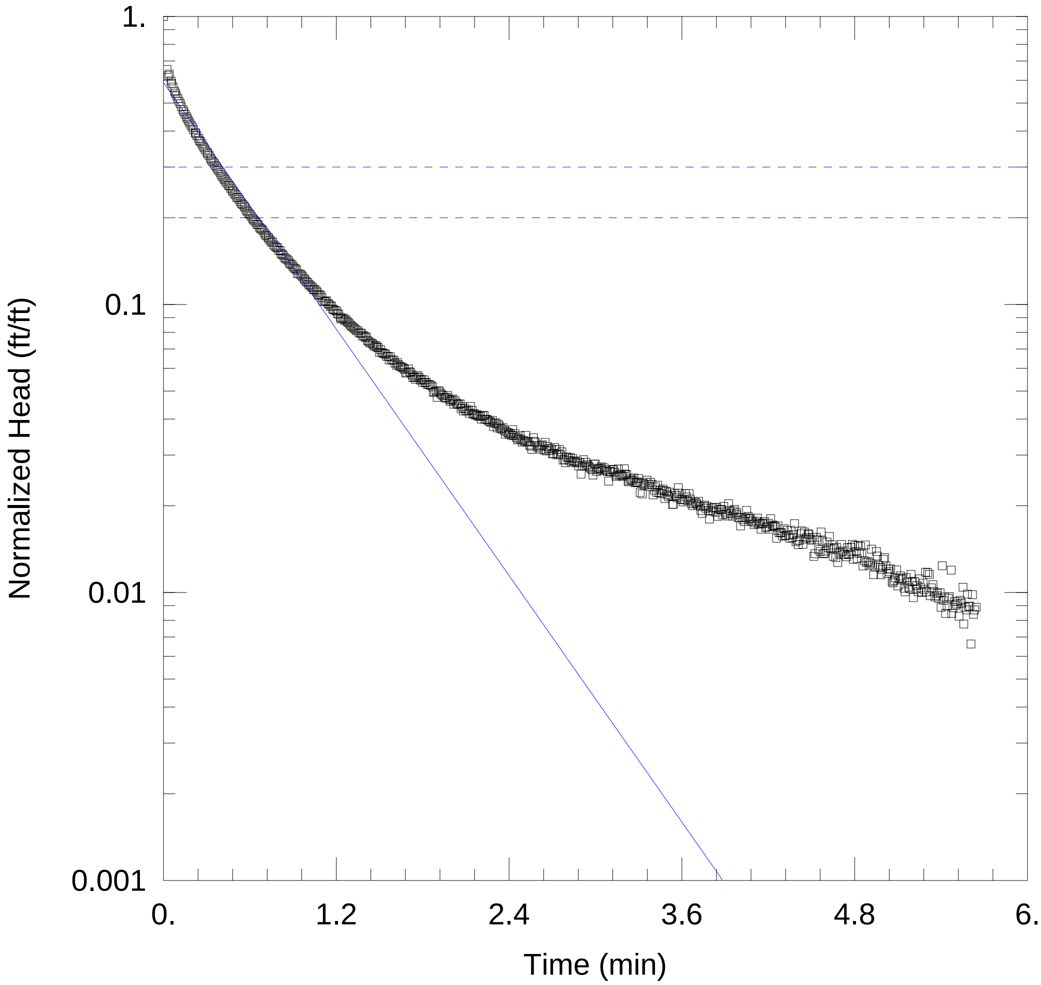
WELL DATA (RU-19)

Initial Displacement: 2.578 ft
Total Well Penetration Depth: 11.8 ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.8 ft
Screen Length: 10. ft
Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.0007163 cm/sec y0 = 1.181 ft



WELL TEST ANALYSIS

Data Set: X:\...\RU19_Apr12_slugout_1.aqt
Date: 06/05/12 Time: 17:52:05

PROJECT INFORMATION

Company: CDM
Client: Alcoa
Location: Olean
Test Well: RU-19
Test Date: 4/16/2012

AQUIFER DATA

Saturated Thickness: 11.8 ft Anisotropy Ratio (Kz/Kr): 1.

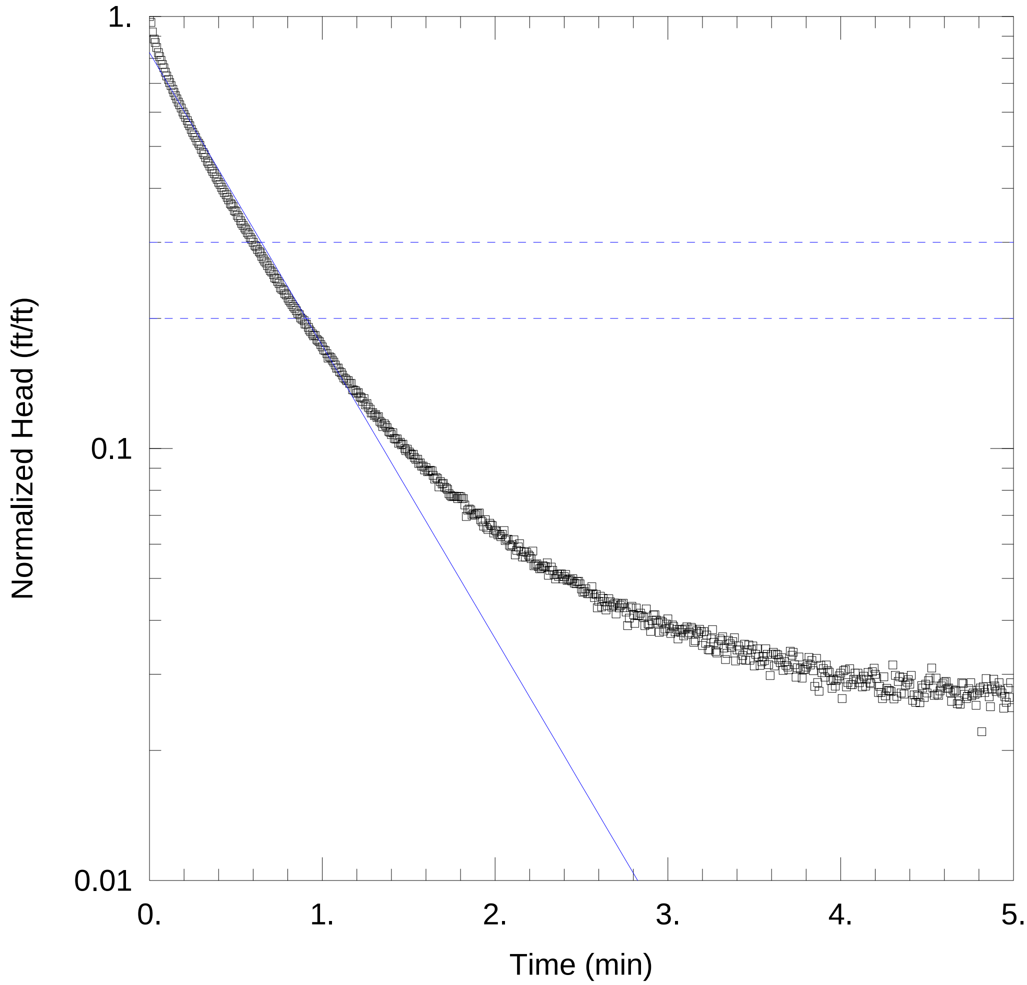
WELL DATA (RU-19)

Initial Displacement: 2.638 ft Static Water Column Height: 11.8 ft
Total Well Penetration Depth: 11.8 ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.001023 cm/sec y0 = 1.555 ft



WELL TEST ANALYSIS

Data Set: X:\...\RU19_Apr12_slugout_2.aqt
Date: 06/22/12 Time: 14:46:57

PROJECT INFORMATION

Company: CDM
Client: Alcoa
Location: Olean
Test Well: RU-19
Test Date: 4/16/2012

AQUIFER DATA

Saturated Thickness: 11.9 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (RU-19)

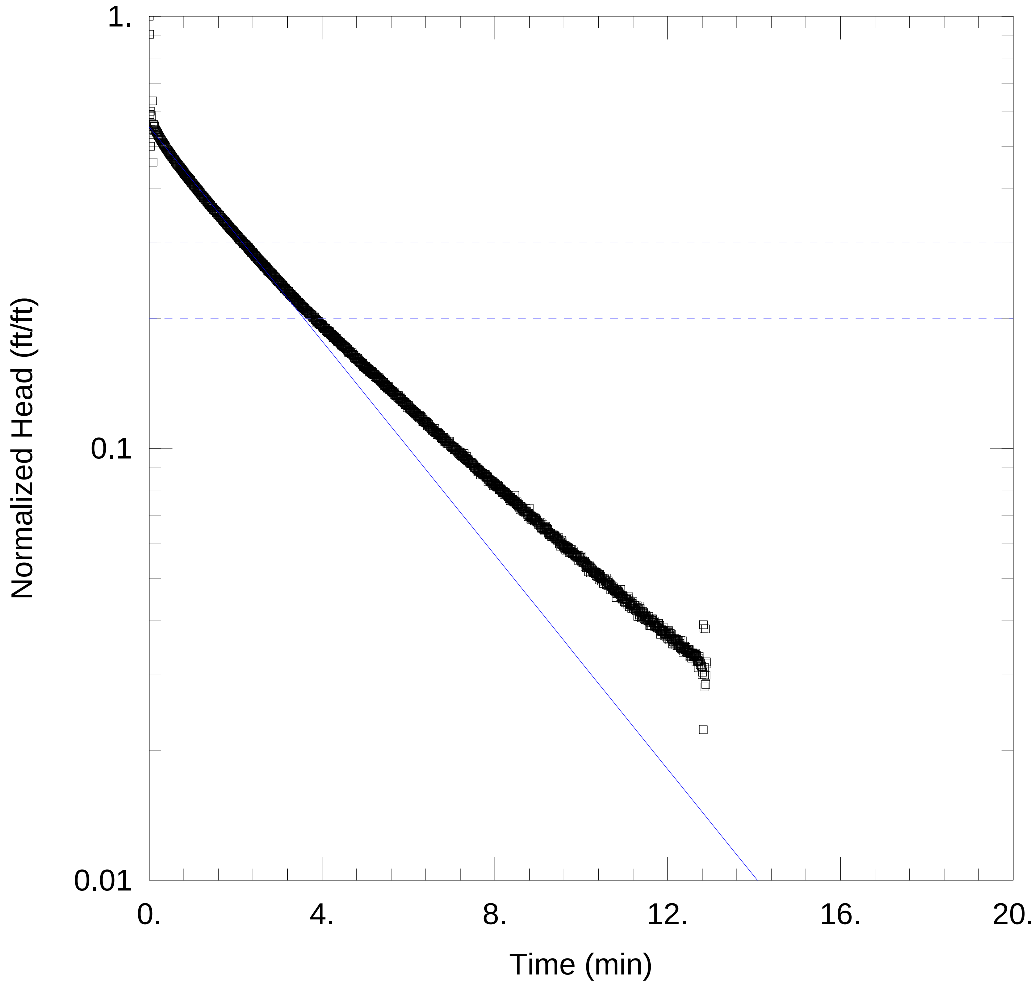
Initial Displacement: 1.817 ft
Total Well Penetration Depth: 11.9 ft
Casing Radius: 0.083 ft

Static Water Column Height: 11.9 ft
Screen Length: 10. ft
Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.0009738 cm/sec y0 = 1.498 ft



WELL TEST ANALYSIS

Data Set: X:\...\RU21_Apr12_slugin_1.aqt
Date: 06/22/12 Time: 14:48:01

PROJECT INFORMATION

Company: CDM
Client: Alcoa
Location: Olean
Test Well: RU-19
Test Date: 4/16/2012

AQUIFER DATA

Saturated Thickness: 12.04 ft Anisotropy Ratio (Kz/Kr): 1.

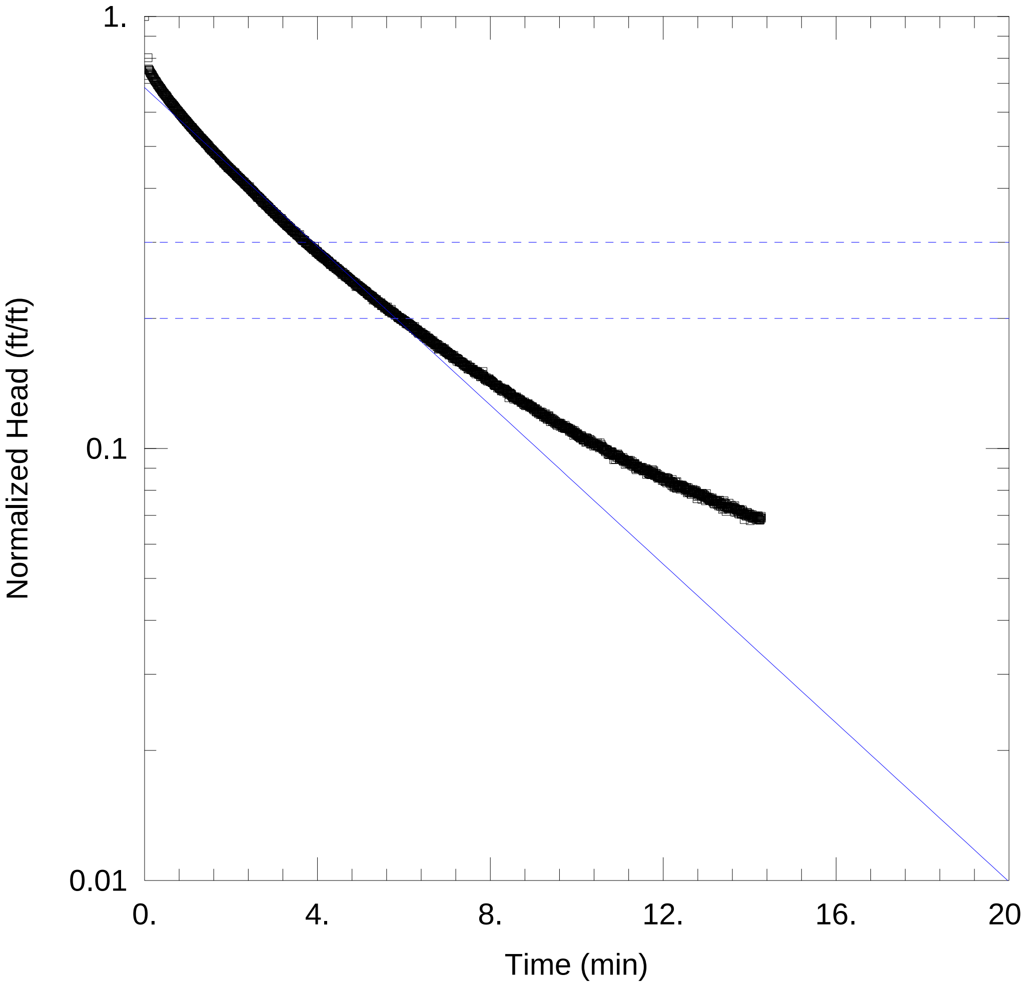
WELL DATA (RU-21)

Initial Displacement: 3.452 ft Static Water Column Height: 12.04 ft
Total Well Penetration Depth: 12.04 ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.0001782 cm/sec y0 = 1.912 ft



WELL TEST ANALYSIS

Data Set: X:\...\RU21_Apr12_slugin_2.aqt
Date: 06/22/12 Time: 14:49:32

PROJECT INFORMATION

Company: CDM
Client: Alcoa
Location: Olean
Test Well: RU-21
Test Date: 4/16/2012

AQUIFER DATA

Saturated Thickness: 11.95 ft Anisotropy Ratio (Kz/Kr): 1.

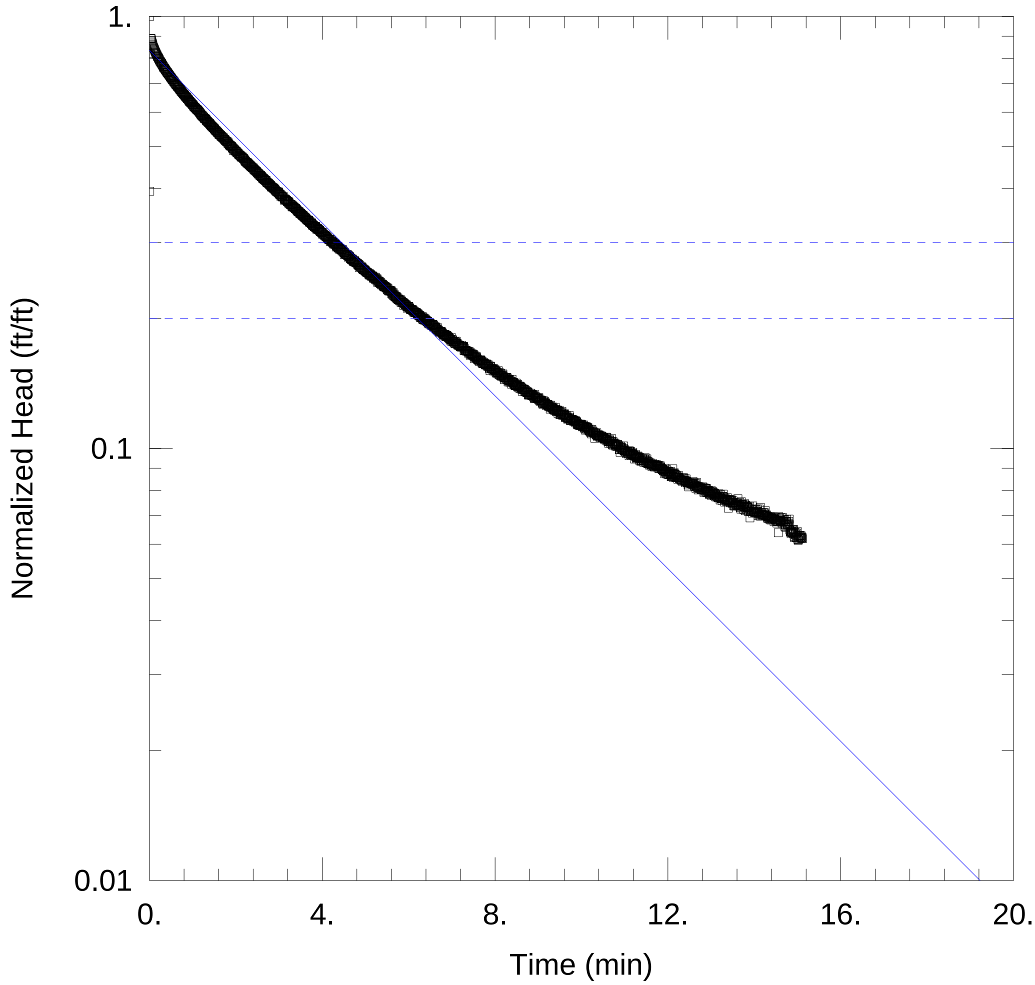
WELL DATA (RU-21)

Initial Displacement: 2.562 ft Static Water Column Height: 11.95 ft
Total Well Penetration Depth: 11.95 ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.0001321 cm/sec y0 = 1.753 ft



WELL TEST ANALYSIS

Data Set: X:\...\RU21_Apr12_slugout_1.aqt
Date: 06/22/12 Time: 14:50:16

PROJECT INFORMATION

Company: CDM
Client: Alcoa
Location: Olean
Test Well: RU-21
Test Date: 4/16/2012

AQUIFER DATA

Saturated Thickness: 12.1 ft Anisotropy Ratio (Kz/Kr): 1.

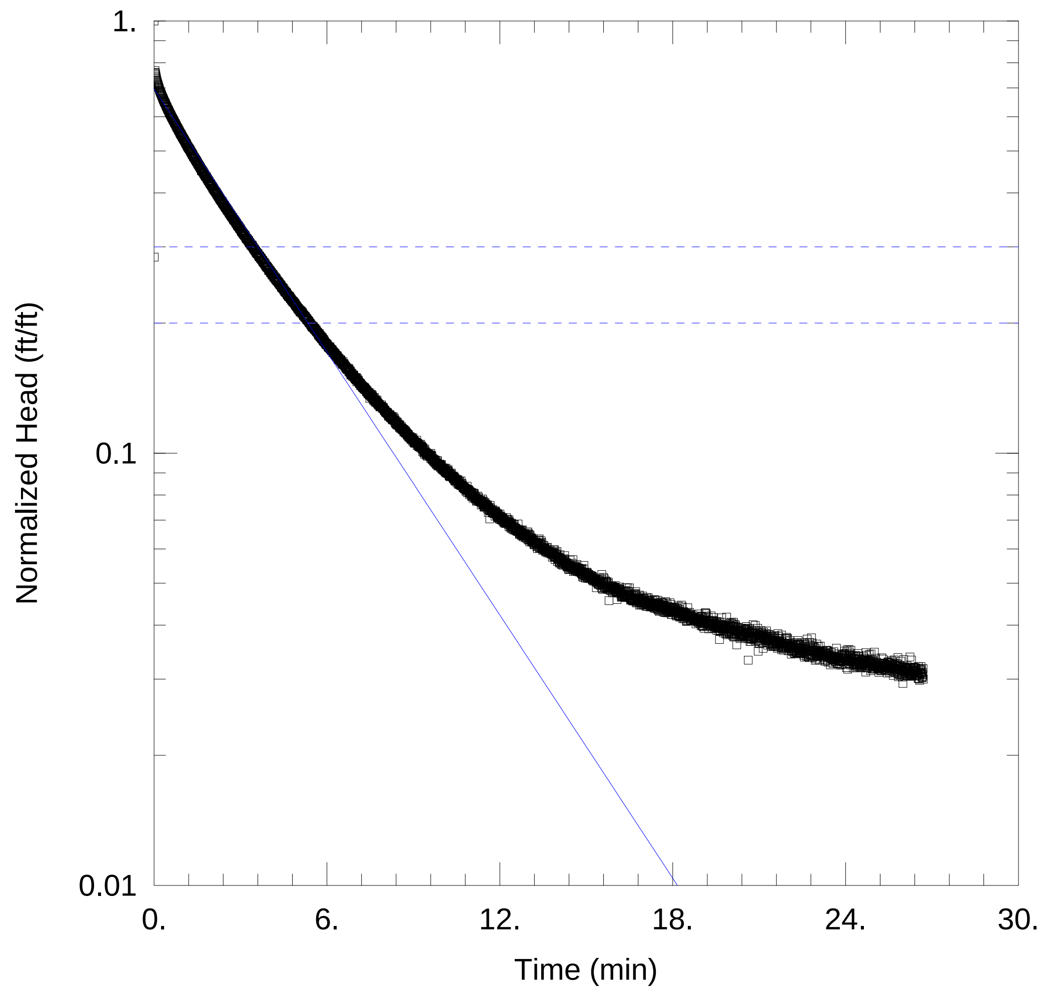
WELL DATA (RU-21)

Initial Displacement: 2.293 ft Static Water Column Height: 12.1 ft
Total Well Penetration Depth: 12.1 ft Screen Length: 10. ft
Casing Radius: 0.083 ft Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.0001439 cm/sec y0 = 1.913 ft



WELL TEST ANALYSIS

Data Set: X:\...\RU21_Apr12_slugout_2.aqt
Date: 06/22/12 Time: 14:51:25

PROJECT INFORMATION

Company: CDM
Client: Alcoa
Location: Olean
Test Well: RU-21
Test Date: 4/16/2012

AQUIFER DATA

Saturated Thickness: 12.1 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (RU-21)

Initial Displacement: 2.695 ft
Static Water Column Height: 12.1 ft
Total Well Penetration Depth: 12.1 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.0001461 cm/sec
y0 = 1.876 ft