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March 25, 2014

Ms. Gloria Sosa
Western New York Remediation Section
New York Remediation Branch
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290 Broadway, 20th Floor
New York, NY 10007-1866

Dear Ms. Sosa:

NECCO PARK 2013 ANNUAL REPORT

Enclosed are two copies of the *Remedial Action Post-Construction Monitoring 2013 Annual Report* for the DuPont Necco Park Hydraulic Controls System (HCS), Groundwater Treatment Facility (GWTF), and landfill cap.

This ninth annual report for the Necco Park Remedy has been prepared pursuant to Administrative Order (AO) Index No. II CERCLA-98-0215 dated September 28, 1998, issued by United States Environmental Protection Agency (USEPA). This report describes hydraulic and chemistry monitoring conducted in 2013 as required by the *Long-Term Groundwater Monitoring Plan,* dated April 2005 for the DuPont Necco Park Site located in Niagara Falls, New York, and subsequent revisions (2010 and 2012).

Construction and start-up of the HCS and GWTF was substantially complete on April 5, 2005. Thereafter, the systems have been operated in accordance with the Operations and Maintenance Plan (O&M Plan). System operation uptime for 2013 was 90.9 %, and the groundwater elevations, geochemical results and DNAPL monitoring indicate HCS continues to be effective at controlling source area groundwater at the DuPont Necco Park site.

Please call me at (716) 278-5496 if you have any questions or comments regarding this submittal.

Sincerely,

CORPORATE REMEDIATION GROUP

Paul F. Mazierski
Project Director

Enc. 2013 Annual Report

cc: M. Hinton/NYSDEC
E. Felter/Parsons

PARSONS

Remedial Action Post-Construction Monitoring
2013 Annual Report

DUPONT NECCO Park
Niagara Falls, New York

Prepared for:

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March 2014

DuPont PN 507637
Parsons PN 445357

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ACRONYMS

Acronym	Definition / Description
AOA	Analysis of Alternatives
BFBT	Blast-fractured bedrock trench
cis-DCE	cis-1,2-dichloroethene
CMMP	Cap Maintenance and Monitoring Plan
CRG	DuPont Corporate Remediation Group
CVOC	Chlorinated Volatile Organic Compounds
DDR	Data deliverable review
DNAPL	Dense non-aqueous phase liquid
DuPont	E. I. du Pont de Nemours and Company
gpm	Gallon(s) per minute
GWTF	Groundwater Treatment Facility
HCBD	Hexachlorobutadiene
HCS	Hydraulic controls system
HDPE	High-density polyethylene
LCS	Laboratory control sample
LCSD	Laboratory control sample duplicate
LTGMP	Long-Term Groundwater Monitoring Plan
MDL	Method detection limit
µg/l	Micrograms per liter
MNA	Monitored natural attenuation
MS	Matrix spike
MSD	Matrix spike duplicate
Necco Park	DuPont Necco Park Site
NYSDEC	New York State Department of Environmental Conservation
O&M	Operation and maintenance
PDI	Pre-design investigation
POTW	Publicly-owned treatment works
PQL	Practical quantitation limit
QA/QC	Quality assurance/quality control
QAPP	Quality Assurance and Project Plan
RPD	Relative percent difference
SAMP	Sampling, Analysis, and Monitoring Plan
SAR	Source area report
SFR	Subsurface formation repair
SIU	Significant Industrial User
SOW	(Necco Park) Statement of Work
SVOC	Semi-volatile organic compound

Acronym	Definition / Description
TCE	Trichloroethene
TIC	Tentatively identified compound
TVOC	Total volatile organic compound
USEPA	United States Environmental Protection Agency
VC	Vinyl chloride
VOC	Volatile organic compound

EXECUTIVE SUMMARY

This Remedial Action Post-Construction Monitoring 2013 Annual Report has been prepared pursuant to Administrative Order Index No. II-CERCLA-98-0215 issued by United States Environmental Protection Agency (USEPA) on September 28, 1998. This is the ninth such report and describes hydraulic and chemistry monitoring conducted in 2013 at the E. I. du Pont de Nemours and Company (DuPont) Necco Park Site in Niagara Falls, New York. Monitoring activities were conducted in accordance with the agency approved Long-Term Groundwater Monitoring Plan (LTGMP) dated April 2005 (DuPont Corporate Remediation Group [CRG] 2005a).

The Necco Park Remedial Action consists of an upgraded cap over the landfill and a groundwater hydraulic control system (HCS). The HCS includes a network of five groundwater recovery wells and a groundwater treatment facility (GWTF). Construction and startup of the HCS and GWTF was substantially complete on April 5, 2005. Thereafter, the systems have been operated in accordance with the Operations and Maintenance Plan (DuPont CRG 2005b). System operation uptime for 2013 was 90.9%. Summaries of system operations and hydraulic head data were previously provided to the USEPA and the New York State Department of Environmental Conservation in the 2013 Quarterly Data Packages (Parsons 2013a, 2013b, 2013c, and 2014). This Annual Report provides a detailed evaluation of system effectiveness with respect to the performance standards presented in the Necco Park Statement of Work.

Hydraulic monitoring data from 2013 show that, overall, the HCS has maintained hydraulic control of the source area in the A- through F-Zones. Improved hydraulic control in the upper bedrock in the western portion of the site began in fourth quarter 2008 when a combined blast-fractured bedrock trench and a new B/C-Zone recovery well (RW-11) were put into operation. Well RW-11 was installed to replace recovery well RW-10 which exhibited diminished hydraulic efficiency after startup in 2005. One well rehabilitation event was completed in 2013 in July. Rehabilitation methods using vacuum and low pressure jetting techniques were employed beginning in 2012 and continued in 2013, allowing for more efficient removal of well sediments, and an inherently safer occupational health approach. RW-11 was rehabilitated on July 10, RW-5 on July 11, and RW-4 on July 12. Well yield increased at RW-11 and RW-4 and 4.1 and 0.3 feet of sediment removed from the bottom of the wells, respectively. Rates were not significantly improved at RW-5; however, 3.5 feet of sediment was removed from the bottom of the well.

In accordance with the LTGMP (DuPont CRG 2005a), annual groundwater sampling began in 2008 after three years of biannual (twice a year) sampling had been conducted. The monitored natural attenuation (MNA) event frequency and the number of sampling locations were reduced in 2010. In 2013, the MNA and 2005 LTGMP sampling programs were conducted as part of the revised program.

The 2013 groundwater sampling results continue to show an overall decrease in concentrations of total volatile organic compounds (TVOCs) for all flow zones compared to historical results. The 2013 results indicate:

- Four of the seven A-Zone wells sampled were below 1 micrograms per liter and the other three wells, which were closer to the source area, ranged from 17.9 micrograms per liter to 295.1 micrograms per liter.
- TVOC concentrations at key source area limit wells in the B and C zones, such as 150B, 172B, and 137C, continue to have stable/decreased concentrations and/or declining trends.

- Decreasing or stable TVOC concentrations are apparent in the D/E/F zones at key source area limit wells such as 136F, 146E, and 146F.
- Overall, the TVOC concentrations are decreasing for all groundwater flow zones in the source area and far-field. In the few the cases where there were increasing TVOC trends, the concentrations were within historical range or inside the source area near a recovery well.

DNAPL was monitored for every month throughout 2013. DNAPL was identified in March, April, June, and July in RW-5, and a total of 102 gallons were removed. Additionally, 21 gallons of DNAPL were removed from RW-4 in April. A total of 8,750 gallons of DNAPL has been removed since initiation of the recovery program in 1989.

Twenty-one (20) monitoring wells that were screened in the shallow AT-Zone (listed in the table below) were abandoned at Necco Park in October 2013.

List of AT wells abandoned in 2013									
119AT	129AT	180AT	184AT	185AT	186AT	187AT	188AT	189AT	190AT
192AT	193AT	194AT	195AT	196AT	197AT	198AT	199AT	200AT	191AT

All AT wells were less than approximately 10-20 feet deep and screened across a discontinuous perched zone. Well abandonment was performed by pulling casing and grouting and/or grouting in place. Additionally, well 191AR was installed in October 2013 to replace 191A (also abandoned), which was determined to allow direct precipitation into the well.

The 2013 groundwater elevations, geochemical results and DNAPL monitoring indicate HCS continues to be effective at controlling source area groundwater at the DuPont Necco Park site through 2013. Groundwater potentiometric contour maps depict a capture zone encompassing the source area in the B-, C-, D-, E- and F-Zones, and vertical gradient downward from the A to the B zone were maintained. Overall the TVOC concentrations were decreasing for all groundwater flow zones in the source area and far-field. It is recommended that the long-term monitoring program continue in its current form, including the revisions from 2010 and 2011.

Data on chlorinated ethenes in Necco Park is consistent with lines of evidence required for natural attenuation of contaminants (USEPA, Monitored Natural Attenuation Directive, 1999). Analytical results from 2013, such as concentrations of degradation products and geochemical conditions, continue to support the recommendation that MNA assessments be conducted every five years. The next MNA monitoring event is scheduled for 2018.

1.0 INTRODUCTION

1.1 Site Location

The 24-acre E. I. du Pont de Nemours and Company (DuPont) Necco Park inactive industrial waste disposal site is located approximately 1.5 miles north of the Niagara River in a predominantly industrial area of Niagara Falls, New York (Figure 1-1).

1.2 Source Area Remedial Action Documentation and Reporting

The approved remedy for the Necco Park Site included construction of the Bedrock and Overburden Source Area Hydraulic Controls System (HCS) and the Landfill Cap Upgrade. Completion of the remedy and compliance with the performance standards described in the Statement of Work (SOW) are documented in the Remedial Action Report (DuPont Corporate Remediation Group [CRG] 2007). This 2013 Annual Report presents hydraulic and chemical monitoring results from the ninth year of operation of the hydraulic controls. In addition, this 2013 Annual Report includes historical groundwater chemistry results for assessment of groundwater quality trends, and the Monitored Natural Attenuation Analysis (MNA) which is performed every 5 years.

2.0 HCS OPERATIONS SUMMARY

The Necco Park groundwater Operations and Maintenance (O&M) Plan (DuPont CRG 2005b), in conjunction with vendor O&M Manuals, describes normal operation and shutdown procedures, emergency shutdown procedures, alarm conditions, trouble-shooting, and preventative maintenance procedures for the HCS and the Groundwater Treatment Facility (GWTF). This section of the report summarizes 2013 HCS operations.

2.1 Operational Summary

Operational information for the HCS is provided in the 2013 Quarterly Data Packages (Parsons 2013a, 2013b, 2013c, and 2014) and summarized in the table below.

	HCS Uptime (%)	HCS Uptime [excluding scheduled maintenance downtime] (%)	Groundwater Treated (Gallons)	DNAPL[1] Removed (Gallons)
1Q13	93.4	93.4	4,200,081	40
2Q13	88.6	88.6	4,115,050	57
3Q13	90.3	90.3	3,758,479	25
4Q13	91.2	91.2	3,559,683	0
2013 Total	**90.9**	**90.9**	**15,633,293**	**122**

[1] DNAPL – dense non-aqueous phase liquid

A summary of monthly groundwater quantities and uptime for each recovery well is provided in Table 2-1.

The HCS remained fully operational throughout 2013, averaging 90.9% total system uptime through December 31, 2013. GWTF downtime has been minimized by continuously monitoring operating conditions and implementing mechanical and procedural changes to the process equipment and the Honeywell Experion® PKS[1] (Process Knowledge System) operating system.

HCS downtime in 2013 resulted from the various unscheduled maintenance typically due to process component malfunction (e.g. pH interlock and/or intermittent power outages, etc). For details on each minor outage, please refer to the quarterly data packages. There were no reportable scheduled maintenance activities in 2013. The following table summarizes HCS reportable downtime in 2013 by component malfunction and scheduled maintenance:

Reason	Contributing Downtime %	Comments
Process component malfunction	8.6%	Unexpected process-related downtime as a result of alarms and interlocks.
Scheduled maintenance shutdowns and system upgrades/inspections	0.0%	Routine inspections, interlock verification, preventative maintenance, equipment inspection and mechanical upgrades to process-related infrastructure.

HCS downtime is considered reportable when any recovery well is not operating for a period of more than 48 consecutive hours (DuPont letter to USEPA, January 27, 2012).

2.2 GWTF Process Sampling

In accordance with the Sampling, Analysis and Monitoring Plan (SAMP), quarterly process sampling is conducted to assess the effectiveness of the treatment system in removing volatile organic compounds (VOCs) from groundwater. Two influent samples are collected, one from the B/C-Zone influent tank and one from the D/E/F-Zone influent tank. One effluent sample is collected from the combined effluent tank. Beginning in 2012 and as approved by USEPA, these process samples are analyzed for VOCs only. The USEPA agreed to this change with the caveat that semi-volatile organic compound (SVOC) monitoring should resume if significant changes occur to the hydraulic or chemical load. A summary of results for the process sampling conducted in 2013 is provided in Table 2-2.

2.3 Sewer Sampling Summary

A Significant Industrial User (SIU) permit with the City of Niagara Falls publicly-owned treatment works (POTW) regulates the treated groundwater effluent discharged from Necco Park. Results from the quarterly sampling conducted at the permitted discharge point (MS#1) are used to determine POTW compliance. The permit (SIU Permit No. 64) was renewed in May 2009, and is valid until May, 1 2014.

As documented in the 2012 Annual Report, two limit exceedances were reported in fourth quarter 2012 (4Q12) sample: the daily maximum limit for hexachlorobutadiene (HCBD) and the annual average limit for hexachloroethane. The permit was revised January 31, 2013 as a result of the exceedances as well as addition of hexachlorobenzene to the permit.

In 2013, a POTW compliance sample collected February 7, 2013 (1Q13) exceeded the annual average limit for hexachlorobutadiene – a similar semi-volatile observance also noted in 4Q12. After internal process testing, it was determined that the likely cause of the exceedance was related to influent from RW-4. Subsequently, the RW-4 pump intake was raised and additional samples were collected, and analyzed for hexachlorobutadiene, within 30 days in compliance with permit requirements. In addition, DuPont requested and received an annual average limit increase for hexachlorobutadiene from the Niagara Falls Water Board (NFWB). A revised permit with updated semi-volatile limits was issued effective May 1, 2013. There were no Self-Monitoring Report (SMR) exceedances since the intake was raised. The GWTF was operating within normal parameters during all sampling. The permit will be renewed prior to expiration in May 2014. Additionally, NFWB annual system verification sample exceeded the daily maximum permit limit for cyanide of 3.0 pounds. The cause of the anomalous cyanide level is unknown. Cyanide loadings since this single result have been in the normal range of <0.4 lbs.

2.4 Recovery Well Rehabilitations and Maintenance

One well rehabilitation event was completed in 2013 and included wells RW-11 (July 10), RW-5 (July 11), and RW-4 (July 12). While RW-5 has been rehabilitated annually, this was only the third year RW-11 has been rehabilitated since it was installed in 2008. New techniques, using vacuum extraction and high pressure water jetting were implemented for the rehabilitations beginning in 2012. This technique allowed for safer removal of the sediments, improved the pressure control, and allowed larger quantities of water to be withdrawn at a high pumping rate (i.e. over-pumping).

At RW-5 in 2013, the flow rates were similar before and after the event and similar to historical rates. However, 3.5 feet of sediment was removed from the bottom of the well. At RW-11 and RW-4, approximately 4.1 feet and 0.3 feet of sediment was removed from the bottom of the wells, respectively. The flow rates after the rehabilitation were improved at RW-11 and RW-4. This was the second time RW-4 had been rehabilitated since it was installed in 2001.

Well painting, labeling and protective casing repairs were performed in 2013 as part of continual site monitoring well maintenance. Approximately 41 well casings were painted/re-labeled, several well caps were repaired or replaced, and a hinge on a protective casing was replaced.

2.5 Well Abandonment and Replacement

Twenty-one (20) monitoring wells that were screened in the shallow AT-Zone (listed in the table below) were abandoned at Necco Park in October 2013.

List of AT wells abandoned in 2013									
119AT	129AT	180AT	184AT	185AT	186AT	187AT	188AT	189AT	190AT
192AT	193AT	194AT	195AT	196AT	197AT	198AT	199AT	200AT	191AT

All AT wells were less than approximately 10-20 feet deep and screened across a discontinuous perched zone. Well abandonment was performed by pulling casing and grouting and/or grouting in place. Two of the abandoned wells (119AT and 129AT) were previously installed through the landfill cap with a protective boot. These were grouted in place and the protective boot was cut below the cap surface to remove the protective casing. Temporarily, grout was used to prevent water from infiltration through the cap. More permanent liner repairs are scheduled for summer 2014.

Additionally well 191A was abandoned and replaced with well 191AR due to a suspect casing. The replacement well was installed adjacent to the location of 191A, and the new well specifications were identical to the abandoned well.

A Parsons geologist oversaw the decommissioning procedures and documented the field activities. Well drilling and abandonment logs can be found in Appendix A.

3.0 HCS PERFORMANCE

3.1 Hydraulic Head Monitoring

Potentiometric surface maps based on water level elevations are the primary evidence of groundwater control. Supporting lines of evidence are well hydrographs and groundwater chemistry changes. Sections 3.1 and 3.2 discuss the results of hydraulic head monitoring and the associated potentiometric maps and hydrographs. Section 3.3 discuses the groundwater chemistry. As described in correspondence between DuPont and USEPA (January 27, 2012), a revised list of water level measurements was instituted in 2012. Quarterly drawdown analysis plots were also replaced by hydrographs in 2012.

Groundwater hydraulic head measurements are used to evaluate control of groundwater in the overburden and bedrock groundwater flow zones by the HCS at Necco Park. Monitoring and recovery well locations are shown in Figure 3-1. Depth-to-water measurements and measuring point elevation data are used to calculate the elevation of groundwater and to generate hydrographs that show groundwater elevation trends in individual monitoring wells. Long-term hydrographs for select wells and piezometers within each water-bearing zone are included as Figures 3-2 through 3-7.

These water level measurements are also used to generate potentiometric surface-contour maps, which depict groundwater elevation distribution for assessing flow directions and hydraulic gradients. These presentations are used to evaluate the extent and effectiveness of the HCS hydraulic control effect at Necco Park. Quarterly groundwater level measurements collected during 2013 were provided in the Quarterly Data Packages (Parsons 2013a, 2013b, 2013c, and 2014). Potentiometric surface-contour maps for the A-Zone (overburden), and bedrock zones B, C, D, E, and F were also included in the 2013 Quarterly Data Packages. A list of groundwater level monitoring locations is provided in Table 3-1.

Potentiometric surface-contour maps included in this report (Figures 3-8 and 3-10 through 3-14) were selected from maps prepared and presented in the 2013 Quarterly Data Packages. Unless otherwise noted, a Kriging algorithm with a linear semi-variogram model and a slope of 1 was used as the standard method to interpolate groundwater elevations between wells.

3.2 Hydraulic Control Assessment

As described in the Post-Construction Monitoring 2008 Annual Report (DuPont CRG 2009), measures were taken in 2008 to improve B/C-Zone hydraulic control in the western portion of Necco Park. These measures included replacement of recovery well RW-10 with a new recovery well (RW-11) installed within a blast fractured bedrock trench (BFBT). Assessment results indicate continued improved hydraulic control through the operation of recovery well RW-11. A detailed discussion of the hydraulic influence of well RW-11 was provided in the Post-Construction Monitoring 2008 Annual Report for the Site (DuPont CRG 2009).

3.2.1 A-Zone

The overburden materials comprising the A-Zone are generally characterized by high clay content and low hydraulic conductivity. Groundwater flow in the A-Zone is primarily downward to the more transmissive fractured bedrock, as expected in this low permeability formation.

The hydrographs in Figure 3-2 demonstrate the long-term drawdown from groundwater extraction in context of the seasonal variability. The decreases in the water elevations are due to the combined effect of the impermeable landfill cap and continuous downgradient groundwater extraction from the recovery wells. The decreasing hydrographs represent long-term drawdown in an unconfined low-permeability unit and storage depletion. The water content of the unit continued to decrease by reductions in infiltration from the cap and groundwater recovery in the underlining water bearing unit (B Zone). While there are fluctuations in the hydrographs, the overall trend is a clear decrease in the water elevations. In a few cases there is an increasing trend from originally large drawdown observed, however these remain well below static conditions (approximately 2 -3 feet).

Figures 3-8 and 3-9 present A-Zone potentiometric surface contours and vertical gradient maps. The potentiometric map demonstrated that the groundwater flow was toward the capture systems. The cones of depression surrounding recovery wells RW-5 and RW-11 are significant, ranging from 3 to 4 feet of closed contours in the A-Zone (Figure 3-8). The 2013 water levels in the area of RW-11 suggest the well rehabilitations have helped sustain a large cone of depression around this location in the A-Zone.

Vertical gradients were downward (negative) between the A/B-Zones as presented in Table 3-2 (2013 average gradients) and shown in Figure 3-9 (November 20, 2013, gradients). These gradients demonstrate that the predominate flow potential is downward therefore there the horizontal flow (i.e. to the south) is insignificant.

3.2.2 B and C Bedrock Water-Bearing Zones

Groundwater flow directions in the B-Zone and C-Zone were consistent throughout 2013 (Figure 3-10). Hydraulic controls in the B-Zone and C-Zone were maintained throughout 2013, which is attributable to high recovery well up time and well pumping rates. Additionally, long-term monitoring demonstrates the continuation of capture zone improvements in the area of RW-11. The improvements were the result of installation and maintenance of the BFBT and the hybrid recovery well RW-11.

B-Zone

Groundwater elevation hydrographs, along with potentiometric surface contour maps, illustrate the hydraulic effects of the HCS in the B-Zone. RW-4, RW-5 and RW-11 have induced inward (toward the recovery wells) hydraulic gradients over a large area (Figures 3-3 and 3-10), capturing site groundwater in the source area. Figure 3-3 is a plot of well hydrographs from B-Zone wells in the area near and surrounding RW-11. This plot demonstrates the improved effectiveness of capturing groundwater from installation of the BFBT and RW-11. Water level reductions are initially noticed after start-up of RW-10, and then a further reduction is observed once RW-10 was replaced by RW-11. Wells near or in the trench area (201B ,PZ-B, 137B, and 111B) show significant decreases after the transition of groundwater recovery from RW-10 to RW-11. These changes in water levels are notable, not only due to the actual change in water level, but also in context to the set point of RW-11 compared with RW-10. The water level set-up for recovery in RW-11 has been maintained approximately five feet higher than RW-10 (Figure 3-3). Thus, the installation of the BFBT was of such hydraulic significance that lower water levels in and around the BFBT area are achieved even with a higher water level in the actual recovery well. This is due to the change in hydraulic conductivity of the rock formation resulting from the BFBT. Wells in the eastern section of the site are less affected by the recovery wells; therefore some do not exhibit the same response as those on the west. This is a factor of hydraulic properties and distance from the recovery well and does not indicate a lack of capture. The primary evidence for capture is the water level contour maps, as discussed below.

Primary evidence of groundwater control is observed in the potentiometric contour map provided in Figure 3-10. The contour map demonstrates large cones of depression established for each of the recovery wells. The contour patterns related to the BFBT and RW-11 are relatively wider and shallower than those for RW-4 and RW-5 due to the increased transmissivity in and near the BFBT. The overlay of the source areas lines and the groundwater contours demonstrates that the HCS is hydraulically controlling the source areas.

C-Zone

Groundwater elevation hydrographs and potentiometric surface-contour maps illustrate the hydraulic effects of the HCS in the C-Zone (Figures 3-4 and 3-11). The C-Zone influence attributed to RW-4, RW-5, and RW-11 extends north to wells 115C, 123C, and 159C, and west to 136C. The southern extent of influence extends to well 137C and is obscured by the CECOS Landfill between the recovery wells and monitoring wells 150C, 160C and 168C. Beginning in 2008, hydraulic control in the C-Zone was improved significantly with the rehabilitation of RW-5 and the start-up of RW-11. In 2013, RW-4, RW-5, and RW-11 were rehabilitated . The annual rehabilitations of these recovery wells is a preventative action taken prior to well loss; therefore, the effect is relatively small in the short-term scale of one year.

3.2.3 D, E, and F Bedrock Water-Bearing Zones

Groundwater elevation hydrographs and potentiometric surface-contour maps illustrate the effectiveness of the HCS in maintaining hydraulic control in the D-, E-, and F-Zones (Figures 3-5 through 3-7 and 3-12 through 3-14). The hydrographs clearly indicate the initial and sustained drawdown of groundwater elevation in the recovery wells and the surrounding monitoring wells. Potentiometric maps demonstrate the consistent cone of depression and associated hydraulic gradients were toward the recovery wells throughout 2013, indicating the HCS is effectively controlling groundwater migration. This is further demonstrated in the spatial relationship of the source area depiction and the flow patterns depicted in Figures 3-12 through 3-14.

3.3 Groundwater Chemistry Monitoring

3.3.1 Background

Extensive monitoring has been conducted at Necco Park dating back to the early 1980s. Monitoring includes (but is not limited to) pre-design investigations, remedial investigations, geologic investigation, analysis of remedial alternatives, and source area investigations. Groundwater monitoring continues to meet the following objectives as defined in the SOW:

- Monitor reductions in aqueous chemistry in zone-specific source area wells as a consequence of the hydraulic control from recovery well pumping;

- Monitor the far-field groundwater chemistry to determine if the recovery system is controlling off-site migration of chemical constituents associated with the Necco Park site;
- Monitor for the presence of DNAPL;
- Monitor natural attenuation and intrinsic bioremediation in the source area and far-field; and
- Continue to evaluate the effectiveness of the remedial action.

The first annual status report following completion of hydraulic control elements of the Necco Park remedy (2005 Annual Report) included an extensive discussion of the first monitoring results and how these results compared to source area criteria introduced in the 1995 Analysis of Alternatives (AOA) report (DuPont Environmental Remediation Services 1995). This 2013 report provides an update of groundwater chemistry trends in relation to the long-term remedy for groundwater as well as an update to the Source Area Criteria. The Source Area Criteria are provided in Table 3-3, with the 2013 results and comparison to criteria provided in Tables 3-4 and 3-5.

Monitoring completed in 2013 represents the sixth year of annual sampling. In accordance with the Long-Term Groundwater Monitoring Plan (LTGMP) (DuPont CRG 2005a), chemical monitoring was conducted on a semi-annual basis during the first three years of system operation. Sampling has been annual since the beginning of the fourth year of system operation, with modifications to the number of wells sampled. In 2010, DuPont proposed to reduce the number of wells monitored annually based on existing data showing either very low concentrations or concentrations decreasing over time. USEPA agreed to the changes in a letter dated July 16, 2010, but required that the full list of wells be sampled on a three- or five-year schedule to monitor source area groundwater chemistry trends. The 2013 annual sampling event included wells on the 3 to 5 years schedule. The list of wells used for long-term monitoring was prepared and is included Table 3-6. The monitoring well locations are shown in Figure 3-1.

3.3.2 Sample Collection and Analysis

The annual sampling event was completed between August 12 and August 22, 2013. TestAmerica of Amherst, New York, completed sampling with oversight by Parsons for DuPont. Samples and associated quality assurance/quality control (QA/QC) samples were analyzed by TestAmerica Laboratories located in North Canton, Ohio.

As described in the Necco Park SAMP, groundwater sampling was conducted using USEPA low-flow sampling methodology and air-driven bladder pumps equipped with disposable Teflon© bladders. The pumps were fitted with dedicated Teflon©-lined high-density polyethylene (HDPE) tubing. All monitoring wells were purged and sampled at flow rates between 100 and 600 milliliters per minute to minimize potential volatilization. Geochemical parameters (pH, temperature, dissolved oxygen, oxidation/reduction potential, specific conductivity, and turbidity) were recorded at 5-minute intervals throughout the entire purging period to determine when stabilization was achieved. Geochemical parameters were considered stable when all parameter values were within 10 percent of the previously recorded value, with the exception of plus or minus 0.2 units for pH.

Samples were collected at 56 monitoring well locations during the 2013 annual event. The well locations are listed in Table 3-6. Analytical indicator parameters are listed in Table 3-7. Analytical results for the sampling event conducted in 2013 are provided as

Appendix B. For reporting purposes, the results are discussed as total VOCs (TVOCs). This is consistent with historic reporting where TVOCs are indicator compounds used to assess groundwater contamination and trends over time. Results for the respective flow zones are discussed below. For a more detailed discussion on chlorinated VOCs, please refer the Monitored Natural Attenuation Analysis in Section 3.5.

As follow-up to studies conducted in the mid-1990's, the New York State Department of Environmental Conservation (NYSDEC) collected groundwater samples to reassess point and non-point sources of contaminants to the Niagara River. Six Necco Park wells were sampled by Ecology and Environment under contract by the NYSDEC. The sampled were analyzed for all USEPA Priority Pollutants, but the primary focus of the reassessment was on the NRTMP "priority toxics" that are still present in the Niagara River at concentrations exceeding water quality standards (NYSDEC, 2013). These substances are: PCBs, dieldrin, benzo(b/k)fluoranthene, mirex, hexachlorobenzene, chrysene/triphenylene, benzo(a)pyrene, 2,3,7,8-tetrachlorodibenzodioxin, and total DDT (including ppDDT and ppDDE; ppDDD no longer exceeds criteria). This parameter list is specific to the NRTMP. Although none of these compounds are related to wastes at Necco all NRTMP participants are required analyze for them. During the sampling DuPont took split samples and analyzed for the same compounds. The results are provided in Appendix B. Results indicated that the compounds of focus were ND. Other results (VOCs, site SVOCs) were comparable to annual samples taken under the LTGMP.

3.3.3 Source Areas Delineation

The 2013 groundwater sampling results have been compared to the same historically employed criterion to evaluate source area limits. Consistent with the AOA, any location where DNAPL was observed at least once was included in the source area. Groundwater chemistry data for the 2013 sampling event was also compared to solubility criteria to evaluate source area extent. Consistent with previous assessments, these included effective solubility for a given compound and one percent of a given compound's pure-phase solubility.

Effective solubility is defined as the theoretical upper-level aqueous concentration of a constituent in groundwater in equilibrium with a mixed DNAPL. Effective solubility is equal to pure-phase solubility of a given constituent multiplied by the mole fraction of that component in DNAPL. Use of effective solubility criteria is believed to be more representative of sites with DNAPL that consist of relatively complex mixtures of organic compounds (Feenstra et al. 1991), such as those that are found at the Necco Park site. Calculated solubility criteria for DNAPL compounds evaluated during this study are presented in Table 3-3. A comparison of 2005 through 2013 data to the effective solubility and one percent of pure-phase solubility criteria are provided in Tables 3-4 and 3-5, respectively. Refinement of the monitoring program reduced the number of well comparisons from 2010 – 2012 in Tables 3-4.

Due to the qualitative nature of using the one percent pure phase solubility in a transient flow field, this solubility criteria was established to be used with other lines of evidence for determining source areas. The "observed DNAPL" criterion and effective solubility criteria are used as an absolutely measure to identify source area wells. Meanwhile, the 1% pure phase solubility criteria were never intended to have the same weighting as the other criteria. As noted in the November 17, 2011, meeting and associated correspondence between DuPont and the USEPA, the observed DNAPL criteria and the effective solubility criteria have more merit than the 1% pure phase solubility. Meeting the one-percent criteria alone (for example) does not absolutely define a well as a source area well. While the one-percent “rule-of-thumb” may infer DNAPL presence, with more or less certainty depending on the strength of the overall data (Cohen and Mercer 1993), it does not identify the distance upgradient where the DNAPL is located. This is due to such elements as the complexities of groundwater transport and well location in reference to the plume centerline. The one percent “rule-of-thumb” should not be used in isolation to determine DNAPL presence (Kueper., B.H. et al. 2003); therefore, the original (and present) intension of the solubility criteria were to assist in determining source areas in conjunction with other converging lines of evidence.

A discussion of the source area results by flow zone is provided below. It should be noted that some of the wells which are within the source area are sampled in the 3 to 5 year cycle and therefore are not sampled annually. The 2013 sampling event included these wells on the 3 to 5 year schedule.

A-Zone

The A-Zone source area has been defined as the Necco Park property and a limited area south of the property line. The A-Zone source limits have not changed from those provided with the 100% design submittal. The 2013 sample results indicate no exceedance of the solubility criteria. There has been only one exceedance of the solubility criteria since long term monitoring began: the 2005 first round results for well D-11 reported HCBD above the one percent solubility criteria.

Monthly DNAPL observations conducted at A-Zone well locations in 2013 indicated no DNAPL present at the monthly or semi-annual monitoring locations. The most recent DNAPL observation at an A-Zone well was at well 131A in May 2006. This well is located on the landfill.

Groundwater flow in the A-Zone is predominantly downward to the B-Zone. Therefore, hydraulic control of the upper bedrock groundwater flow will capture flow from the A-Zone. As discussed in Section 3.3, the installation of the BFBT and recovery well RW-11 (November 2008) enhanced the degree of A-Zone hydraulic control. Based on the results of the 2013 source area criteria and DNAPL monitoring, the system is effective in controlling the A-Zone source area.

B/C-Zone

The B/C-Zone source limits have not changed from those provided with the 100% design submittal. Two B/C zone wells (105C and 136C) exceeded the effective solubility criteria. Five B/C wells exceeded the conservative one percent criteria in 2013: 136B, 139B, 172B, 105C, and 136C. These results are consistent with past rounds of sampling, and indicates that the source area is stable and/or decreasing.

The frequency of observed DNAPL in B/C-Zone wells has decreased over the course of the monitoring program. In 2013, the only B/C-Zone wells where DNAPL was identified was RW-4 and RW-5. The total DNAPL removed in 2013 was 21 gallons from RW-4 and 102 gallons from RW-5. At well 204C, installed in November 2008, trace DNAPL was observed in January, February, and April.

Results of the source area criteria analysis and DNAPL monitoring suggests that operation of recovery wells RW-4, RW-5, and RW-11 has achieved and maintained control of the B/C-Zone.

D/E/F-Zone

Only one well (105D) exceeded the effective solubility criteria in the D/E/F wells that are part of the sampling program. Well 105D is within the limits of the landfill and is on the 5 year schedule for sampling. There were only two wells in the D/E/F-Zone that exceeded the more conservative one percent pure-phase criteria: 105D and 165E. Both locations are within the limit of the D/E/F-Zone source area. Exceedance of the criteria at 105D and 165E is consistent with the previous sampling results.

Source zone criteria comparison analysis conducted during 2013 confirms that the operation of recovery wells RW-8 and RW-9 has achieved and maintained source control of the D/E/F-Zone.

3.4 Groundwater Chemistry Results and Trends

An analysis of 2013 chemistry results and trends has been completed to assess the effectiveness of the HCS and the former extraction system in reducing organic compound concentrations in groundwater. This analysis used TVOC concentration data from monitoring wells to identify chemistry trends in the flow zone units. The evaluation also serves to identify locations where TVOC concentrations exhibit significant changes (generally, changes greater than an order of magnitude). Where applicable, historic TVOC data were used to assess long-term chemistry trends. TVOC concentration versus time plots for A-Zone overburden and B- through F-Zone bedrock monitoring wells are presented in Appendix C.

In general, operation of the HCS and the former groundwater recovery system, combined with the presence of the landfill cap and Subsurface Formation Repair (SFR), have contributed to an overall trend of declining TVOC concentrations in the A-Zone overburden and bedrock fractures zones. More recently, TVOC concentration decreases at several near source area and far-field wells are significant and coincide strongly with the onset of HCS operations in April 2005, thereby demonstrating the effectiveness of containments and remediation of site groundwater. Natural attenuation processes are also contributing to the reduction in chemical mass in the bedrock fracture zones.

A-Zone Overburden

Results from the seven LTGMP A-Zone wells indicate TVOC concentrations are all below 300 μg/l at these locations. Sampling results for well 137A (295.1 μg/l) represents the location of the highest reported A-Zone TVOCs. Well D-11 was near this upper range at 240.8 μg/l, while other locations well locations were lower: D-9 (0.66 μg/L), D-13 (17.9 μg/L), 145A (0.41 μg/L), 146AR (0.52 μg/L), and 150A (0.70 μg/L). The 2013 results are consistent with historical results in that they show no significant off-site horizontal chemical migration in the overburden.

Three of the four annual wells used to monitor the A-Zone (145A, 146AR, and 150A) exhibit near consistently low (<10 μg/l) TVOC concentrations without a discernable trend over the years that they have been sampled (Appendix C).

Closer to the landfill, well 137A has shown the greatest decline of the A-Zone wells with concentrations ranging close to 1,200 μg/l in 2005 to as low as 100.2 μg/l in 2009. A downward trend between 2005 and 2013 is evident at 137A, and suggests groundwater extraction in the RW-10/RW-11 area has effectively controlled offsite groundwater flow in this location.

The three wells near the southern edge of the landfill sampled in 2013 (D-9, D-11, and D-13) were all last sampled in 2009. Well D-9 has shown a three orders of magnitude in decline from the year 2000 results and has been below 4 μg/L TVOC since 2005. Well D-11 has been below a high value of 750 μg/L TVOC (in 2006) and the analytical results do not indicate either an increasing or decreasing trend over time. Well D-13 has been below a high value of 45 μg/L TVOC (in 2005) and appears to indicate a decreasing trend since 2005 even as the 2013 TVOC results are slightly greater than the last few years that the well was sampled. These 2013 results are consistent with historical results in that they demonstrate an insignificant downgradient plume in the overburden.

B-Zone

Results from the fourteen LTGMP B-Zone wells indicate TVOC concentrations were generally below 2,500 μg/l; with three exceptions (111B, 139B, and 168B), which are all source area wells. TVOC concentrations at five of the locations were below 50 μg/l. Six of the fourteen wells exhibit large decreases in TVOC over time, thereby demonstrating effective groundwater capture by the recovery wells (Appendix C).

Within the source area, well 111B has demonstrated an order of magnitude decline in TVOC concentrations from approximately 250,000 μg/l in 1996 to 18,700 μg/l in 2013. This well is located immediately north of the RW-11 and the BFBT.

Source area limit wells 171B and 172B show a continued overall TVOC declining trend. At well 171B TVOC concentrations have decreased from over 110,000 μg/l in 2002 to under 200 μg/l in 2013 (the lowest TVOC concentration observed at this well location to date). At 172B TVOC concentrations have declined from over 50,000 μg/l in 2002 to under 2,000 μg/l. These trends are indicative of effective groundwater control, where source area concentrations are being captured by the extraction wells, thereby preventing downgradient transport of VOCs. These wells give supporting evidence to the demonstration of hydraulic control in these areas. Additionally the concentrations suggest that there is an active natural attenuation component to the VOCs. Biogenic degradation compounds including cis-1,2-dichloroethene (cis-DCE) and vinyl chloride (VC) dominate TVOC results at these well locations. The trend towards increased degradation compounds coupled with an absence of source area constituents is evident at well location 171B based on the 2007 through 2013 VOC results. Additionally, well 145B, just outside the source area in the southeast corner, also provides evidence of hydraulic control as concentrations have decreased significantly. Concentrations were over 30,000 μg/l in 2006 and have decreased to below 10,000 μg/l for the last four years. The TVOC results in 2013 were the lowest observed at this location to date.

Far-field well 146B and 150B also demonstrates the effectiveness of the groundwater control system. Concentrations have decrease by one order of magnitude at 146B since 2000, and greater than two orders of magnitude at 150B.

Five B-Zone wells (136B, 137B, 139B, 151B, and 168B) have no apparent decreasing trend but remain within historical ranges. At locations 136B and 168B (west and south of the source area, respectively), the TVOC concentrations are within the 2000 through 2012 ranges, but appear to be increasing when from 2005 through 2013. Due to the high concentrations, this trend may not be meaningful. Future sampling monitoring results will indicate if these trends continue. At well 137B, along the southern source area boundary, there is no apparent increasing or decreasing trend. TVOC concentrations at 137B have ranged from 271.1 μg/l to 2,112 μg/l and were 466.2 μg/l in 2013, the lowest observed in the last four years. TVOC concentrations at 139B have ranged from 1,323.7 μg/l to 89,410 μg/l and were 53,160 μg/l in 2013. Well 139B is in the source area and is west of pumping well RW-4. Well 151B is a farfield well and has had concentrations of TVOC range from not detected to 8.4 μg/l.

Well 153B, a side gradient well, now on a five-year sampling schedule was below the analytical detection limits between 2005 and 2008 and had a TVOC concentration of 1.6 μg/l in 2013. Well 149B, downgradient of the CECCOS secure landfill cells, now also on a five-year sampling schedule, has relatively low concentrations but may have an increasing trend from 16.2 μg/l in 2009 to 47.8 μg/l in 2013. The results for sample collected as part of the Niagara River Toxics Study (Appendix B), collected in May 2013, was 21.5 (comparable TVOCs) there for 47.8 μg L may be anomalous.

C-Zone

Results from the nine of the ten C-Zone wells analyzed for long term trends indicate TVOC concentrations are consistent with previous long-term monitoring results and source area is controlled.

Well 105C is within the source area and directly upgradient of RW-11. This location had the highest concentrations of the C-Zone wells (as it typical) at 460,760 μg/l, during the 2013 sampling event. While TVOC concentrations have declined annually since 2010, the concentrations appear to be stable.

Wells 136C, 137C, 145C, and 168C are used to delineate the C-Zone source area limit. These wells had TVOC concentrations in 2013 between 1,300 μg/l and 12,220 μg/l. Well 136C does not have a defined TVOC trend and concentrations have ranged from 4,050 μg/l to 6,979 μg/l. At well 137C a decreasing trend from 2005 to 2013 is evident. TVOC concentrations have dropped an order of magnitude from over 65,000 μg/l in 2005 to 8,162 μg/l the lowest observed at this location in 2013. At 145C concentrations were lowest in the record, however no trend can be discerned, due to the large variability in TVOC concentrations. Since this is a source area well, it is expected to take an extended period for concentrations to decline. At downgradient well 168C, the concentration initially decreased after 2005 start-up but later increased to a 10,000 to 15,000 μg/l range. The concentrations have been slightly decreasing again since 2010.

Wells 146C, 149C, 150C, and 151C are downgradient of the source area under ambient groundwater flow conditions, and therefore they are key locations to understand groundwater flow with respect to plume behavior. TVOC concentrations at 146C were over 20 μg/l prior to 2006; however, the concentrations decreased in 2006 and have remained below 15 μg/l. TVOC concentrations at well 149C show a seemingly increasing trend since 2005, however concentrations are low with TVOC concentrations in 2013 at 25.9 μg/l. At location 150C, concentrations had decreased by 95% since sampling began, from near 250 μg/l to below 15 μg/l in 2010 and 2012. However, the TVOC result for 2013 show a marked increase to, 463.3 μg/l, most of which was attributed to DCE and VC. However, duplicate sampling from the Niagara River Toxics study (Appendix B.) were 38.6 μg/l for TVOCs which are compared to previous results from previous years. Analytical results in 2014 will be evaluated to determine if this result is anomalous or is indicative of increased TVOC concentrations. Well 151C showed the greatest TVOC declines between 2000 (11,150 μg/l) and 2005 (18.5 μg/l). Since 2006 TVOC concentrations have stabilized between 8 and 22 μg/l. Steep declines in 150C, 151C, and 146C are readily apparent in the 2005 through 2006 period. This suggests that the groundwater recovery system is capturing the source area plume and reducing downgradient concentrations.

D-Zone

Results from the eleven D-Zone wells indicate TVOC concentrations are generally low and/or declining over time at these monitoring locations.

Four of the eleven wells sampled were within the D-Zone source area: 105D, 137D, 139D, and 165D. While the plot of 105D appears to show an increasing TVOC trend, the concentrations in this source area range up to 1,218,560 μg/l therefore this trend in insignificant. Well 137D does not show a clear long term trend but TVOC concentrations at this location have decreased by two orders of magnitude from 257,600 μg/l in 2007 to 7,474 in 2013. Well 139D has shown a decrease in TVOC concentrations from 36,410 μg/l in 2000 to between 1,000 and 3,000 μg/l in 2006 through 2013. Well 165D had TVOC concentrations of 7.6 μg/l, which have been declining since the peak of approximately 1600 μg/l in May 2006. The 2013 TVOC concentration of 7.6 μg/l is the lowest observed at 165D to date.

TVOC concentrations at far-field wells (123D, 136D, 145D, 147D, 148D, 149D, and 156D) ranged from 1.1 μg/l (156D) to 1,290 μg/l (136D). At well 123D, just north of the D-Zone source area, TVOC concentrations significantly decreased from 427 μg/l to stabilize at less than 15 μg/l between 2005 and 2013. At wells 136D and 145D, the concentrations have continued to decline since the historical concentrations as high as approximately 3,000 μg/l. In 2013, the TVOC concentrations in wells 136D and 145D have decreases to 1,093 μg/l – 1,290 μg/l (duplicate) and 829 μg/l, respectively. At far field well 147D, TVOC concentrations have shown a fairly steady decrease over time from 394 μg/l in 1996 to approximately 112 μg/l in 2013, the lowest observed at this location to date. At far field well 148D, the concentrations remained low at approximately 4 μg/l and within the range of concentrations from 1996 to present. There is an upward trend in TVOC concentrations at 148D from 2000 to 2013, however, due to the low concentrations (< 5 μg/l) there is little meaning to the trend. At far field well location 149D, TVOC concentrations remained below 5 μg/l, consistent with previous results. At far field well 156D TVOC concentrations have shown a decrease from 6.9 μg/l in 2000 to below 2 μg/l since 2008.

Consistent with previous long-term monitoring results, biogenic degradation compounds including cis-DCE and VC dominate TVOC results for wells 123D,136D, 145D, 147D, 148D, 149D, 156D, and 165D (see Section 3.5 for more details on MNA). Furthermore monitoring has shown hydraulic control from the HCS extends beyond the D/E/F-Zone source area limits, and concentrations in D-Zone wells demonstrate that the HCS is effectively controlling groundwater flow as designed.

E-Zone

Results from the six E-Zone wells (136E, 146E, 150E, 156E, 165E) indicate TVOC concentrations were below 3,000 μg/l, with the exception of the two wells within the E-Zone source area (146E at 5,636.4 μg/l and 165E at 35,660 μg/l). All E-Zone groundwater monitoring locations are stable or on a declining trend. Degradation products including cis-DCE and VC dominate TVOC results for all the E-Zone wells, except for well 136E where 1,2-dichloroethane was the dominant VOC and well 156E that did not have any VOC above analytical detection limits. As discussed in Section

3.5, the presence of these degradation compounds is indicative of the occurrence of active natural attenuation processes.

Well 165E is a source area well and has shown an increasing TVOC trend between 2006 and 2011 however, the 2012 and 2013 TVOC results have possibly indicated the beginning of a declining trend. The TVOC concentrations are high (now typically between 57,550 and 35,660 μg/l, 2012 and 2013), therefore the significance of any potential trend is difficult to identify. This well is located within the source area and less than 100 feet up-/side-gradient to RW-9. It is likely that the effectiveness of capture on the E-Zone at RW-5 is related to the increasing concentrations, as expected in this type of capture scenario.

TVOC results for well 146E located, at the edge of the source area limits, have been trending lower, with concentrations typically over 10,000 μg/l prior to 2009 and between 4,700 and 6,300 μg/l for the last five years. Well 150E also located near, but outside, the source area limits has maintained initial decreases observed in 1996, with concentrations ranging from 6,590 μg/l (1996) to 486 μg/l (2000) and typically between 500 and 1,300 μg/l in recent years.

At 136E, which is outside the source area but only 200 feet (approximately) west of RW-8 there was a spike in concentrations to 8,110 μg/l in 1998, but since then the concentration have declined to as low as 27.29 μg/l (2008), with the 2013 TVOC result (27.7 μg/l) just above the 2008 low concentration.

Well 145E is in the far field to the southeast of the site and has show declining TVOC concentrations. The 2013 TVOC analytical result (2,840 μg/l) is the lowest observed since 1997. Well 156E is also in the far field, to the northwest of the site and TVOC concentrations here have shown a decline over time. The 2013 TVOC result at this location showed all VOCs below the analytical detection limits. TVOC concentrations here have been as high as 14 μg/l in 2000.

Groundwater concentrations in E-Zone wells demonstrate that the HCS is effectively controlling groundwater flow as designed.

F-Zone

Results from the five F-Zone wells indicate TVOC concentrations ranged from 7.4 μg/L to 10,255 μg/l, and all five locations showed decreasing trends. Three of the five wells (136F, 146F, and 150F) showed the lowest TVOC concentration in 2013 for their location. Similar to the results from the E-Zone wells TVOC, results for all the F-Zone wells are dominated by biogenic degradation compounds cis-DCE and VC.

In 2013 TVOC concentrations at well 146F, at the edge of the F-Zone source area, were the lowest observed at this location to date and have decreased from a high of 36,700 μg/l in 2000 to 10,255 μg/l in 2013. TVOC concentrations at near source well 136F have also steadily declined since HCS startup from 8,348 μg/l (2005) to 71.1 μg/l (2013), the lowest observed TVOC concentration at 136F to date. TVOC concentrations at location 150F have shown a steady trend lower since 1998, with concentrations decreasing from initially over 4,500 μg/l to 547.5 μg/l in 2013, the lowest observed TVOC concentration at this location to date.

Far field wells 147F and 156F continued a decreasing trend of TVOC concentrations in 2013. TVOC concentrations at 147F have been below 10 μg/l since 2005, down from

TVOC concentrations in the thousands in 1996 and 1997. TVOC concentrations at 156F have decreased from in the thousands (in 2000 prior) to below 20 μg/l in 2012 and 2013.

TVOC concentrations have apparently decreased at these F-Zone locations in response to the startup of the HCS, which indicates that the HCS is effectively controlling groundwater flow as designed.

G-Zone

Results for wells 147G1, 147G2, and 147G3 indicate an overall trend of declining TVOC since 2005. Biodegradation daughter compounds dominate TVOCs reported at these locations. A short-term increase at these locations in 2005 was followed by declining TVOC concentrations from 2006 through 2013. In 2013, well 147G2 had the lowest TVOC concentration to date at this location, 147G1 had the lowest since 2005, and 147G3 had the lowest since 1998.

3.5 Monitored Natural Attenuation (MNA) Assessment

This section focuses on natural attenuation of chlorinated solvents ethenes via anaerobic biodegradation in groundwater at the Necco Park Site. Primary constituents of concern are tetrachloroethene (PCE) and trichloroethene (TCE). Degradation products, including three isomers of dichloroethene (DCE) – cis-DCE, trans-DCE, and 1,1-DCE – and VC are also present in the groundwater.

Necco Park was one of the first sites in the country studied to identify active anaerobic dechlorination to ethene, in fact the USEPA scoring techniques used in this analysis (1998) references the study completed at Necco (Lee et al, 1993). As such, monitored natural attenuation is an effective remedy in the source area and the far field, as this report and previous annual reports demonstrate.

3.5.1 MNA Background

One of the requirements of the Record of Decision (ROD) for the Necco Park Source Area Operable Unit was to further characterize groundwater in the far-field area. As defined in the ROD, the far-field is the area outside the source area where chemical constituents generally attributable to the Necco Park site have been found to have contaminated groundwater. The annual reports from 2005 through 2013 confirmed that concentrations of the target constituents (PCE, TCE and reduced byproducts) decrease as groundwater flows south and west away from the Necco Park site. Additionally, in many wells, historic TVOC results showed significant reduction in target constituents over time. These results are consistent with a published reference showing active anaerobic microbial degradation transforming PCE and TCE to cis-DCE, VC and ultimately ethene in all zones (Lee et al, 1993).

The first MNA assessment as part of the routine monitoring program for this site is contained in the 2005 Annual Report. The 2005 report presented data on the concentrations of chlorinated solvents in the groundwater and DNA results indicating the presence of a microbial population competent for degrading chlorinated ethenes. The three recognized lines of evidence for monitored natural attenuation of contaminants are as follows (USEPA, 1999):

- Reduction of contaminant concentrations over time or distance,

- Geochemical data that demonstrate conditions favorable for contaminant destruction, and
- Microbiological data from field or microcosm studies that directly demonstrate the occurrence of a natural attenuation process and its ability to degrade contaminants of concern.

Based on past and present sampling results, all three of these lines of evidence are observable at Necco Park. With regard to chlorinated degradation, additional evidence is found in the creation of degradation products DCE, VC, ethene and ethane (USEPA, 1998), which is considered part of the first line of evidence (i.e. reduction of concentrations).

Details of the Necco Park MNA monitoring program are presented in the *Long Term Groundwater Monitoring Plan* (CRG, 2005b). The MNA monitoring wells were sampled for a full suite of MNA parameters in 2000 and from the period of 2006 through 2009, and again in 2013. The documentation of MNA has been provided in the previous Annual Reports for the accompanying MNA data set. The following sections provide a full discussion of MNA in the B/C-Zone and the D/E/F-Zone. Appendix D provides the time series molar concentrations for tracking trends, and Appendix E provides the MNA scoring evaluation details following procedures provided in USEPA, 1998, and Appendix A provides the 2013 groundwater sampling results which help support the analysis.

As part of the response to the USEPA five year review, DuPont provided an Vapor Intrusion and MNA analysis report on December 20, 2013. The report included the 2013 MNA data as included in this annual report.

3.5.2 B/C Zone Results

The results of the MNA monitoring program for the 13 B/C-Zone wells are shown in the figures in Appendix D. For each of the B/C-Zone wells, the data from the sampling events are plotted as a function of time so that concentration trends are apparent. Concentrations are plotted in millimoles (molar equivalents) so that the relationships between parent compounds and daughter compounds (degradation products) are comparable on a molar basis. Observations of data trends, along with select data from the most recent sampling event in parts per billion (ppb), are posted on the left side of the figures. A summary of the MNA results in all of the B/C-Zone wells is presented in Table 3-8, including the MNA scoring value which was calculated using methods provided by the USEPA (1998) and discussed in sections below. The wells listed in each of these tables are arranged in the order of Upgradient, Source Area then Downgradient/Side-gradient. They are discussed below in that order. Following these line of evidence presented above, each area of the site is evaluated. In cases where the concentrations are low (near or below MCLs) then the discussion is simplified.

Upgradient B/C-Zone Wells

Both upgradient B/C-Zone wells, 141B and 141C are essentially free of (or very low concentrations) of CVOCs. At 141B the concentrations were ND (< 0.33 µg/L) and only very low levels of CVOCs (each below 20 µg/L) were detected in 141C. In 2013, minor ethene/ethane concentrations were observed at 141B (35 µg/L) compared to typically lower concentrations near the detection limit.

Source Area B/C-Zone Wells

As part of the analysis, wells 111B, 137B, 139B, 105C, and 137C are analyzed for MNA parameters and represent source area conditions.

Primary Evidence – Degradation Compounds

All source area wells (except 139B where concentration exceed the 1% pure phase solubility criteria for PCE) demonstrated declining chlorinated ethene levels from 2000 to 2013. In the source area B/C-Zone wells, total chlorinated ethene levels decreased on average by about one-half. In two of the B/C-Zone source wells (111B and 139B), the predominant chlorinated ethene species are the daughter products cis-DCE and VC. All wells exhibited moderate or good production in the ultimate daughter products, ethene / ethane. In several cases the ethene concentrations are near the equivalent value in moles as the primary compounds, thereby indicating a strong degradation rate. The degradation in the source area indicated source control and / or destruction of CVOC, which provides an indication that the plume downgradient will decrease as the flux from the source substantially decreased.

Secondary Evidence – Geochemical Conditions

Geochemical conditions conducive to reductive dechlorination support the primary evidence that natural attenuation is active in the Source Area (see Appendix D and E). All of the wells in the B/C zone have a deeply negative ORP values (all less than -355) indicating strongly anaerobic conditions. Dissolved oxygen, nitrate and sulfate are reduced demonstrating that the biological processes of iron, sulfate reduction and methanogenesis (both processes occurring under low redox conditions) are active. Concentrations of methane are elevated indicating deeply anaerobic conditions in the source area. PH is generally between 6 and 9 which is conducive to biological degradation, with the exception of 137B where pH was 12.9, however this concentration is anomalous in historical context. Furthermore, total VOC concentrations are low (497 µg/L) relative to source area concentrations.

Tertiary Evidence – DNA analysis

Source wells 137C, 111B, 105C and 137C were positive for *Dehalococcoides sp*. in 2008 and previous years indicating that the key microbes for complete degradation of chlorinated ethenes are present at elevated population levels. These wells were sampled as non-routine confirmation samples (in 2008) and the results remain relevant due to the similar conditions in the groundwater.

MNA Scoring method

Using the USEPA (1998) natural attenuation scoring methods, the wells were evaluated to determine the presence of adequate conditions for MNA using 2013 data. Table 3-8 provides the results of B/C well scoring and Appendix E a summary and details of the analysis. Due to the conditions listed above all of the source areas B/C wells scored above 20 points indicating there is “strong evidence for anaerobic biodegradation of chlorinate organics” (USEPA, 1998).

Downgradient / Side-gradient B/C-Zone Wells

Primary Evidence – Degradation Compounds

There are five downgradient wells (145B, 145C, 149C, 151B, and 151C) and one side-gradient well (153B) in the B/C zone. The side-gradient well (153B) has had consistently very low levels of chlorinated ethenes (<0.85 and less for each chlorinated parameter), and therefore is not discussed herein. Figures in Appendix D provide the time series plots and 2013 concentrations.

At far-field well 145B concentrations have readily decreased from the 2006-2007 period after system start up. The dominate species of CVOCs are cis-DCE and VC, indicating strong biodegradation. Since 2006, the concentration of cis-DCE, in particular, has decreased such that cis-DCE concentrations are similar in molar equivalent as VC. Ethene and ethane are produced at a significant rate: in 2013 ethene and ethane were 77 µg/L, and in the past the concentrations were as high as approximately 3,000 ug/L. The high values of ethene and ethane further support strong anaerobic biodegradation.

At 145C concentrations have decreased over time and the predominant species are degradation products (cis-DCE and VC) indicating degradation of CVOCs. Concentrations of cis-DCE have fluctuated since 2000 but the trend is clearly decreasing with concentrations in 2013 at 1,100 µg/L, down from a high value of 19,000 µg/L in 2000. Concentrations of ethene / ethane were lower in 2013 yet the combined value was 57 µg/L, indicating biodegradation is occurring. Concentrations of ethene / ethane followed a similar decreasing trend as cis-DCE and VC indicating the decrease in CVOCs concentrations produced lower ethene / ethane.

At location 149C all CVOCS are low (below the USEPA MCL), with the exception of VC at 8.4 µg/L. The concentrations of ethene / ethane in 2013 were 32.4 µg/L, indicating that there is active bioremediation.

Two of the downgradient wells (151B and 151C) and the side gradient well (153B), exhibited very low levels of chlorinated ethenes during the 2013 sampling. These wells are characterized mainly by reductive dechlorination daughter products cis-DCE and trans-DCE, and VC all of which were 2.1 ug/L and below with the exception of cis-DCE at 6.4 ug/L at 151C.

Secondary Evidence – Geochemical Conditions

All B/C zone wells had strongly negative ORP levels, depleted DO, depleted nitrate and reduced sulfate. In most locations methane was elevated i.e. > 0.5 mg/L (149C, 151B and 153B). Average TOC for these wells was 35.8 mg/L indicating there is a carbon source supporting the microbiology. These conditions are indicative of conditions favorable to natural attenuation through sequential dechlorination. The only condition unfavorable was pH at 145B and 149C (10.01 and 9.64, respectively). However at 145B this was anomalous compared to previous years.

Tertiary Evidence – DNA analysis

In past sampling events (e.g. 2005) samples were analyzed for microbial populations and confirm the presence of Dehalococcoides in wells 149C, 151B and 151C.

MNA Scoring method

The wells were evaluated to determine the presence of adequate conditions for MNA using the USEPA (1998) natural attenuation scoring methods for 2013. Table 3-8 provides the results of B/C well scoring and Appendix E includes the thorough analysis. Four of the five B/C wells (145B, 149C, 151C, and 153B) scored in the range of 16 - 20 points, with an average of 17.8 points. At 145C the score was 13 which is defined as “limited evidence of natural attenuation”. This score was was biased by a higher than typical pH of 10.05 SU, and otherwise would have scored 17. For scores ranging from 15-19 points this indicates there is “adequate evidence for anaerobic biodegradation of chlorinate organics" (USEPA, 1998). Well 151B was not included in the above statistic as the concentrations are below MCL.

The results of the scoring confirm the other lines of evidence that natural attenuation is sufficiently occurring in the far-field and side gradient.

Downgradient and Side-gradient Percent reductions

In order to demonstrate the effectiveness of MNA in the downgradient and side gradient area, percent reductions were calculated for the three of the 5 B/C-Zone downgradient and side gradient MNA wells. Two wells (151B and 149C) were omitted due to the low concentrations. Table 3-9 provides the results of percent reduction from 2000-2005 molar TVOC average to 2013 molar TVOC average in downgradient and side-gradient wells. The reductions in moles ranged from 57% to 100%, with an average of 73% in this approximate eight years span. At location 151C concentrations have significantly decreased to near the USEPA's MCLs. These reductions indicate that the far-field B/C plume is retracting and degrading due to the source area control and the strong monitored natural attenuations capacity of the groundwater system.

3.5.3 D/E/F-Zone Results

A summary of the MNA results in all of the D/E/F-Zone wells is presented in Table 3-10, including the MNA scoring summary. Figures in Appendix D provide the time series plots and 2013 concentrations. Support for the MNA scoring summary is in Appendix E.

Source Area D/E/F-Zone Wells

Primary Evidence – Degradation Compounds

There are three source area wells (137D, 139D, and 165D) in the D/E/F zone that are part of the MNA analysis. At each location there is indication that the MNA is very active in the D/E/F source area.

At source area location 137D there was a significant decrease in all CVOCs in 2013, from above the 1% pure phase solubility to a Total CVOC concentration of 4,670 µg/L (mostly TCE at 3,400 µg/L). Ethene / ethane concentrations were 82 µg/L indicating active natural attenuation and completion of the biological degradation pathway.

At source area location 139D concentrations remained significantly lower than the 2000 – 2005 period before recovery wells RW-8 and RW-9 were activated. The primary compound is TCE (1,900 µg/L in 2013) which is indicative of the source area groundwater. There remained moderate ethene / ethane production with concentrations at 53 µg/L, indicating active natural attenuation and completion of the degradation pathway.

At source area location 165D, which is near the source area boundary, concentrations continued a steep decreased from 2005 when the recovery wells RW-8 and RW-9 were activated. At this well, which is considered a source area well due to previously high concentrations, the CVOCs have decreased to 3.3 µg/L and lower. The primary compounds are VC and cis-DCE indicating source area is no longer in this area and biodegradation is strong. Ethene / ethane concentrations were 87 µg/L which is relatively significant when compared to the low concentrations of the CVOCs (3.3 µg/L and less). This indicated that along the source area boundary, where CVOCs were once migrating downgradient creating the plume, the groundwater recovery system has re-direct the groundwater flow across the source area boundary toward the recovery well.

This provides evidence that source control is a clear way to further improve downgradient groundwater and enhance MNA recovery.

Secondary evidence

All D/E/F source area MNA wells had strongly negative ORP levels, depleted DO, and depleted nitrate. ORP ranged from -203 to -489 with an average of -391 mV and DO was below 0.5 mg/L in each location. PH was slightly high at 9.33 in 165D, but 8.16 and 7.04 at 137D and 139D respectively. At 165D the pH exhibits a large range in variability from 7.22 to 9.49 over the 2005 to 2013 monitoring period. These conditions are indicative of conditions favorable to natural attenuation through sequential dechlorination.

Tertiary Evidence – DNA analysis

Source area well 139D was positive for *Dehalococcoides sp*. in 2008, with concentration at approximately 3 x 10^{-4} cells/liter, indicating that the key microbes for complete degradation of chlorinated ethenes are present at elevated population levels. The microbial sampling was a non-routine confirmation sample and the results remain relevant due to the similar conditions in the groundwater.

MNA Scoring method

Using the USEPA (1998) natural attenuation scoring methods, the D/E/F source area wells were evaluated to determine the presence of adequate conditions for MNA using 2013 data. Table 3-10 provides the results of D/E/F well scoring and Appendix E provides the scoring details. Due to the conditions listed above and on Table 3-10 all of the source areas D/E/F wells (105D, 137D, 139D, and 165D) scored in the range of 18 – 26 points, with an average of 22 points. For scores ranging from 15-19 points this indicates there is “adequate evidence for anaerobic biodegradation of chlorinate organics” and above 20 indicating there is “strong evidence for anaerobic biodegradation of chlorinate organics” (USEPA, 1998). The results of the scoring confirm the other lines of evidence that natural attenuation is sufficiently occurring in the source area.

Downgradient D/E/F-Zone Wells

Primary Evidence – Degradation Compounds

There are eleven downgradient and side-gradient wells (136D, 147D, 148D, 149D, 156D, 136E, 145E, 146E, 156E, 146F, and 150F) included in the MNA analysis. Overall the decreasing concentrations, conversions from primary to degradation products, ethene production and geochemical conditions demonstrates that MNA is readily occurring in the far-field and side gradient areas. Figures in Appendix D provide the time series plots and 2013 concentrations. The MNA scoring summary is provided in Table 3-10. Support for the MNA scoring summary is in Appendix E.

At well 136D, which is downgradient but directly adjacent to the source area, the concentrations are primarily cis-DCE and VC and all CVOCs have decreased since the 2000-2006 period prior to source area control. The molar concentrations ratio of cis-DCE to vinyl chloride have inverted indicating that cis-DCE is degrading to VC. Furthermore, there is a strong ethene / ethane component with moles of ethene and ethane exceeding TVOCs for most of 2007 – 2009, and near equivalent ethene / ethane with total CVOCs in 2013. Primary compounds (PCE and TCE) have decreased 2 orders of magnitude from 2000 – 2013.

At well 147D, located in the far-field, concentrations of PCE and TCE are depleted to near or below detection limits. Concentrations in total moles of CVOCs are decreasing over time and there is a clear inversion of moles of cis-DCE and VC. Cis-DCE concentrations have decreased to below the USEPA MCL of 70 µg/L, and VC increased and then decreased to 45 µg/L in 2013.

At well 148D, also located in the far-field, there has been a slight increase in CVOCs such that total CVOCs are 4.8 µg/L but all concentrations are below the USEPA MCLs. Ethene / ethane concentrations are relatively high 37.2 µg/L compared with the very low concentrations of CVOCs. This indicates that there is a strong natural attenuation activity upgradient and the biological degradation processes are preventing CVOCs from reaching this well.

At well 149D, located side gradient from the source area, the CVOC concentrations are all below the USEPA MCLs and concentrations of ethene exceed those of CVOCs.

At well 156D, located downgradient and away from the site, CVOC concentrations have been low through the monitoring period (Total CVOCs approximately 6 µg/L in 2000), however there has been an observable decreasing trend. In 2013 the trend continued and total CVOCs were 1.1 µg/L.

At well 136E, located near the source area boundary, concentrations have decreased since 2000-2005 from approximately 73 µg/L to 15.7 µg/L. Throughout the sampling period 2000 to 2013 there has been a strong ethene / ethane signal with concentrations ranging from 146.9 to 1,113 µg/L. This indicates a strong source of CVOCs is degrading from nearby creating the ethene and ethane (either upgradient or from diffusing from bedrock).

At well 145E, located side gradient, concentrations of total CVOCs have steadily decreased throughout the monitoring period. TCE has decreased to below 2.8 µg/L, and degradation products are the main component. Since 2000 there has been a clear inversion on moles of cis-DCE and VC, without VC accumulation, indicating strong biological degradation. Ethene concentrations are approximately the molar equivalent of VC providing strong indication of degradation pathway completion.

At well 146E, downgradient but near the source area, concentrations of total CVOCs have decreased over the monitoring period, furthermore TCE has significantly decreased, and cis-DCE has decreased to below VC molar concentrations. Ethene production is nearly the equivalent of VC, indicating strong degradation.

At well 156E located in the far-field concentrations have decrease by more than a order of magnitude since 2000 to below detection limits (<0.22 µg/L).

At well 146F, downgradient but near the source area, concentrations have steadily decreased during the monitoring period. TCE has decreased by more than an order of magnitude and concentrations of cis-DCE and VC, have inverted, all of which provide a clear indication that MNA is an active process.

At well 150F, located side gradient, there has been a steady decrease in Total CVOCs (from approximately 3,390 µg/L to 540 µg/L) during the monitoring period. There has also been a clear inversion of cis-DCE to VC molar ratio, without VC accumulation, all of which indicates a strong biological degradation. Ethene / ethane production (up to 251 µg/L) provides evidence that the pathways is complete.

Secondary evidence

All D/E/F downgradient and side gradient MNA wells had strongly negative ORP levels, depleted DO, and depleted nitrate. ORP ranged from -247 to -587 mV with an average of approximately of -417 mV. DO concentrations were below 0.5 mg/L at all locations (typically < 0.25), and nitrate was < 1 mg/L. PH was higher than the optimal level (9 Standard Units) at 148D, 149D, 165D and 156E (10.29, 9.66, 9.33, and 9.34 respectively), however these higher pH values were either anomalous, did not appear to affect the natural attenuation or were in locations that are at or near the detection limits. These conditions are indicative of conditions favorable to natural attenuation through anaerobic sequential dechlorination.

Tertiary Evidence – DNA analysis

In 2005 microbial populations samples were taken on all the far-field D/E/F wells. At all locations Dehalococcoides was detected, confirming the presence of this dehalogenating microbe. These samples were only taken as confirmatory, meanwhile other lines of evidence infer that the populations remain in groundwater.

MNA Scoring method

Using the USEPA (1998) natural attenuation scoring methods, the D/E/F source area wells were evaluated to determine the presence of adequate conditions for MNA using 2013 data. Table 3-10 provides the results of D/E/F well scoring and Appendix E includes the thorough analysis. Wells 148D, 149D, 156D and 156E all scored low due the lack of CVOCs in groundwater. At these locations the concentrations have decreased to below MCLs and in some locations below detection limits. Therefore, these locations were listed as “not applicable”. At locations 136D, 136E, 145E, 146E, 147D, and 150F the scores ranged from 11 to 24 points, with an average of 20 points, indicating that overall there is “strong evidence of biodegradation of chlorinated solvents” (USEPA, 1998).

At only one location (147D) was the score lower than the others (11 points) and listed in the category of “limited evidence”. However, at this locations there have been observed decreasing trends and inversion of cis-DCE and VC molar ratios, both aspects that the scoring method does not recognize. Furthermore, the scoring analysis is conservative as some MNA parameters were not analyzed for, or background is undetermined (e.g. hydrogen, volatile fatty acids) and therefore the score may be higher than current indications. Regardless, the concentrations are low compared to other groundwater with Total CVOCs at 112 µg/L and degrading over time.

Downgradient and Side-gradient Percent reductions

In order to demonstrate the effectiveness of MNA in the downgradient and side gradient area, percent reductions were calculated for the eleven MNA wells. Table 3-11 provides the results of percent reduction from 2000-2005 molar TVOC average to 2013 molar TVOC average. The reductions in moles ranged from 33% to 86%, with an average of 62% in approximately eight years. Two of the eleven far-field wells were below MCLs with no trend, therefore a percent reduction was not calculated. At three of the wells the concentrations have decrease to below or near MCLs during the monitoring period. These reductions indicate that the far-field plume is retracting and degrading due to the source area control and the strong monitored natural attenuations capacity of the groundwater system.

3.5.4 MNA Summary

Monitor Natural Attenuation of chlorinated solvents is an active process at Necco Park and downgradient throughout the far-field. Through the process of anaerobic biodegradation and potentially abiotic degradation there are observable decreasing trends suggesting that the plume is retracting. The source area control is preventing concentrations from migrating into the far-field which allows the strong natural attenuation to decrease concentrations and retract the plume. In the first 8 years of source area control the downgradient and side gradient groundwater molar CVOCs have decreased an average of 68%, which is considerable for recalcitrant compounds such as chlorinated solvents. This is supported by the USEPA natural attenuation scoring methods (1998), in which, the combined average score was 21 points, for all B/C and D/E/F MNA locations for 2013, while omitting wells near or below MCLs. For the side and downgradient wells only, the average score was 19 points. The scores indicate that there is adequate to strong evidence for anaerobic biodegradation of chlorinated organics (USEPA 1998).

3.5.5 MNA Recommendations

The review of MNA parameters presented in this section demonstrates that biological activity continues to actively reduce concentrations of chlorinated ethenes in groundwater and contribute to the prevention of groundwater plume expansion. These results are consistent with the results from previous evaluations completed from 2005 to 2008, and consistent with early studies which identified natural attenuation of chlorinated solvents (Lee et.al. 1993) at the Site. Given the robust ability of the natural attenuation, it is recommended that MNA monitoring continue on the 5 year frequency as previously accepted by the USEPA.

3.6 DNAPL Monitoring and Recovery

As described in the LTGMP and the DNAPL Monitoring and Recovery Plan, monitoring for the occurrence of DNAPL has been conducted routinely at the Necco Park site since the early 1980s. A monitoring and recovery program was instituted in 1989 to remove free-phase DNAPL from monitoring and groundwater recovery wells. The historically established monitoring program was modified based on results of the PDIs. The 2013 monthly DNAPL monitoring results are summarized in Table 3-12.

In 2013, 102 gallons of DNAPL was recovered from RW-5 (40 gallons in March, 12 gallons in April, 25 gallons in June, and 25 gallons in July). In April, a total of 21 gallons were removed from RW-4. At well 204C, installed in November 2008, trace DNAPL was observed in February, March, and April of 2013. A total of approximately 8,750 gallons of DNAPL have been recovered since the program was put in place.

3.7 Quality Control/Quality Assurance

The 2013 annual groundwater samples were submitted to TestAmerica Laboratories in North Canton, Ohio, for all chemical analyses.

3.7.1 Sample Collection

The samples were collected in accordance with the scope and technical requirements defined in the project Work Plan and Quality Assurance Project Plan (DuPont CRG 2005c). Samples were submitted in nine delivery groups received at the laboratories between August 13 and August 23, 2013. Based on laboratory receipt records, all samples were received in satisfactory condition and within USEPA holding time and temperature requirements (<4 degrees centigrade). Field QC samples collected during the sampling round included four field duplicate pairs, nine daily equipment blank samples, and nine trip blanks (volatile organics).

In-House Data Collection

The quality of the data set was evaluated by the URS Analytical Data Quality Management Group, using the analytical results provided in hard-copy contract laboratory protocol-type data packages in conjunction with an automated data evaluation of the electronic data deliverables (the DuPont Data Deliverable Review [DDR] process described below). The laboratory data packages presented a review of the QA/QC procedures conducted by the laboratory and included case narratives identifying any significant issues associated with sample receipt, preparation, and analysis.

The electronic data was processed through an automated program developed by DuPont, referred to as the DDR, where a series of checks were performed on the data, essentially resulting in a summary level validation. The data were evaluated against holding time criteria, checked for laboratory blank, equipment blank, and trip blank contamination, and assessed against the following:

- Matrix spike(MS)/matrix spike duplicate (MSD) recoveries
- Relative percent differences (RPDs) between MS/MSD samples
- Laboratory control sample (LCS)/control sample duplicate (LCSD) recoveries
- RPDs between LCS/LCSD
- RPDs between laboratory replicates
- Surrogate spike recoveries
- RPDs between field duplicate samples

The DDR also applied the following data qualifiers to analysis results, as warranted:

DEFAULT QUALIFIERS

Qualifier	Definition
B	Not detected substantially above the level reported in the laboratory or field blanks.
R	Unusable result. Analyte may or may not be present in the sample.
J	Analyte present. Reported value may not be accurate or precise.
UJ	Not detected. Reporting limit may not be accurate or precise.

All sample analyses were completed within the USEPA recommended holding times. The laboratory control spike associated with well 137D and 105C was recovered above the control limit window for the target volatile carbon tetrachloride. The positive detections of this analyte in both samples were J-qualified as estimated due to possible high bias. In addition, the tetrachloroethene, dichloroethene, and trichloroethene detections in well 137B, and the vinyl chloride detection in well 147G1 were J qualified due to low matrix spike recoveries.

The semi-volatile analysis included a targeted tentatively identified compound reported as TIC 1. All positive results reported for TIC 1 should be considered estimated concentrations. The analytical results provide a total of 3-methylphenol and 4-methylphenol due to the inability of the laboratory instrumentation to separate the two under the chromatographic conditions used for sample analysis.

A number of samples required dilutions for analysis for volatiles and semi-volatiles, resulting in elevated reporting limits for the affected analytes. As a result of the dilutions, some volatile and semi-volatile surrogate recoveries could not be determined (diluted out) or were recovered outside the laboratory control window. Trace level detections of target organics were reported in several trip blank, equipment blank, and laboratory blank samples, including methane, cis-1,2-dichloroethene, methylene chloride, and vinyl chloride. The methylene chloride detections in wells 105D and 139D were B-qualified as unreliable detections.

Dissolved manganese was detected at low concentrations in several equipment blanks and the laboratory method blanks. Several wells had dissolved manganese concentrations in the same range as the blanks (less than five times the analytical result for the blanks), and were B-qualified as unreliable detections. The sulfide matrix spikes associated with field samples 137D, 137C, 137B and its field duplicate, 145E, and 145B were recovered above the laboratory control limit. The sulfide detections in these samples were J-qualified as estimated due to possible high bias. In addition, the alkalinity matrix spikes analyzed with field samples 136E and its field duplicate, 137B, 145E, and 145B, were recovered low (less than 10 percent), and the alkalinity concentrations in these samples were also J-qualified due to possible low bias.

Relative percent difference (RPD) between field duplicate pairs that exceeded 30 percent were J-qualified as estimated. One or more analytes from field samples from 136D, 137B, and 136E were qualified.

All analytes reported between the method detection limit (MDL) and practical quantitation limit (PQL) were J qualified as estimated concentrations.

3.7.2 Independent Data Validation

In addition to the in-house evaluation, a minimum of 10% of the sample locations and associated field and laboratory QC samples were submitted for independent data validation by Environmental Standards, Inc., of Valley Forge, Pennsylvania. The wells were selected for validation based on their importance to the program (key perimeter wells) and include well locations 136D, 146E, 145C, 172B and associated QC samples, BLIND1 (field blind duplicate sample of 136D), EB-081213, and TB-081213. A copy of the Data Validation Summary report is included in Appendix F as an electronic file.

A number of validation qualifiers were applied to the samples due to field duplicate imprecision, quantitation of TIC results, serial dilution imprecision, and quantitation below the PQL. No sample results were qualified as unusable.

4.0 CAP MAINTENANCE

The cap was substantially completed in 2005, and all remedial items were completed by August 2006. A lawn maintenance contractor maintains both the landfill cap and ditch vegetation. Landfill cap maintenance activities are conducted in accordance with the Cap Maintenance and Monitoring Plan (CMMP). Results of the landfill cap maintenance inspection conducted on November 25, 2013, are provided in Appendix G. No leachate seeps or settlement was identified, and all aspects of the landfill that were inspected were found acceptable.

As discussed in the Section 2.5 two AT wells, installed through the landfill cap, were abandoned by pulled casing and grouting techniques. Since these wells were booted to the cap, a small section of the cap was cut to remove the casing. Temporarily, grout was used to prevent water from infiltration through the cap. More permanent liner repairs are scheduled for summer 2014.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Hydraulic Control Effectiveness

5.1.1 Conclusions

The HCS continues to be effective at controlling source area groundwater at the DuPont Necco Park site. The following observations support this conclusion:

- Water levels in the A-Zone continue a long-term decreasing trend due to the in-place remedial measures including the impermeable landfill cap and groundwater extraction. The A-Zone is dewatering vertically from the hydraulic depression created by the HCS. This is evident in vertical gradients, drawdown calculations, and time series plots of water level elevations.
- Groundwater potentiometric contour maps depict a capture zone encompassing the source area in the B-, C-, D-, E- and F-Zones.

The addition of RW-11 and the associated B-Zone BFBT in 2008 has led to improved A-, B-, and C-Zone hydraulic control in the southwestern part of the site. The increases in flow zone transmissivities by *in-situ* blasting have resulted in an increase in recovery well pumping rates, an increase in the extent of hydraulic influence, and measureable drawdowns in distant wells. Water levels within and surrounding the BFBT at RW-11 decreased after the transition from RW-10 to RW-11. This is direct evidence of the increased capture zone resulting from installation of the BFBT. Between 2008 and 2009, there was also significant improvement in the hydraulic control of the A-Zone as shown in a comparison of previous to 2013 A-Zone potentiometric contours. This improvement, likely due to the BFBT, was maintained during 2013.

5.1.2 Recommendations

Based on the site history, years of monitoring, and observations made in 2013, the following recommendations are made:

- Rehabilitate RW-4, RW-5, RW-11 on an annual basis
- Monitor RW-11 yield and total depth to develop an understanding of the proper maintenance schedule needed for this location
- Review and present options for continual or permanent rehabilitation or modification of RW-5

5.2 Groundwater Chemistry Monitoring

5.2.1 Conclusions

The 2013 and historical chemistry monitoring results indicate the following:

- Overall the TVOC concentrations are decreasing for all groundwater flow zones in the source area and far-field. In the few locations where there were increasing trends of TVOC, the concentrations were within historical range or inside the source area near a recovery well.
- Analytical results for 2013 would not change the A-Zone and B/C-Zone source area limits as delineated in the SAR.

- Analytical results for 2013 (including well 146E) support the 2005 Annual Report conclusion of a reduced source area limit for the D/E/F-Zone as delineated in the SAR based on the analytical results from well 146E.
- Results from groundwater sampling events completed since HCS startup show that the HCS is effectively controlling zone-specific source areas.

5.2.2 Recommendations

The 2013 sampling results represent the 12th groundwater sampling event in the long-term monitoring program. It is recommended that the long-term monitoring program continue in its current form, including the revisions from 2010 and 2011.

5.3 MNA Conclusions and Recommendations

5.3.1 Conclusions

Data on chlorinated ethenes in Necco Park is consistent with lines of evidence required for natural attenuation of contaminants (USEPA, Monitored Natural Attenuation Directive, 1999). Specifically, the results summarized above and in the 2013 report continue to show the following:

- Contaminant concentrations in groundwater decrease along flowpaths from the source area to the down gradient zone.
- Geochemical conditions are indicative of low redox conditions required for reductive dechlorination.
- Previous results (2005) confirmed the presence of bacteria with the ability to complete dechlorination of chlorinated ethenes to ethane. The continued evidence of natural attenuation of chlorinated solvents is consistent with the presence of these organisms.

Overall, the observed stable to decreasing trends in total chlorinated solvents and the presence of dechlorinated intermediates (cis-DCE, VC and ethene) strongly supports the interpretation that natural attenuation of chlorinated ethenes continues to occur at this site.

5.3.2 Recommendations

Analytical results from 2013, such as concentrations of degradation products and geochemical conditions, continue to support the recommendation that MNA assessments be conducted every five years. The continuation of MNA monitoring every five years is adequate to provide relevant data that will impact the remedy that is currently in place. The next MNA monitoring event is scheduled for 2018.

5.4 DNAPL Monitoring and Recovery

5.4.1 Conclusions

Results of the 2013 DNAPL monitoring and historical recovery efforts indicate the following:

- Monitoring for the presence of DNAPL was completed monthly during 2013.
- A total of 102 gallons of DNAPL was removed from RW-5 in 2013.
- A total of 21 gallons of DNAPL was removed from RW-4 in 2013.
- Approximately 8,750 gallons of DNAPL have been recovered since the recovery program was initiated in 1989.

5.4.2 Recommendation

Continue DNAPL monitoring and recover DNAPL where encountered.

5.5 Landfill Cap

5.5.1 Conclusions and Recommendations

With establishment of a continuous vegetative cover, the landfill cap construction is complete and will be now be maintained in accordance with the CMMP. At the two AT-Zone well abandonment locations that were through the cap, it is recommended that the temporary grout plugs be replaced with formal cap repairs, as scheduled for summer of 2014.

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TABLES

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Table 2-1

HCS Recovery Well Performance Summary - 2013

Remedial Action Post-Construction Monitoring - 2013 Annual Report
DuPont Necco Park, Niagara Falls, New York

	B/C-ZONE						D/E/F-ZONE			
	RW-4		RW-5		RW-11		RW-8		RW-9	
	Total Gallons Pumped	**Uptime°**	**Total Gallons Pumped**	**Uptime°**	**Total Gallons Pumped**	**Uptime°**	**Total Gallons Pumped**	**Uptime°**	**Total Gallons Pumped**	**Uptime°**
January	83,911	99.9%	94,704	95.5%	353,626	85.3%	481,896	99.3%	421,602	100.0%
February	46,777	89.6%	76,601	82.3%	349,595	87.0%	466,419	98.1%	422,847	98.1%
March	41,529	91.1%	89,692	86.5%	343,597	88.3%	521,315	100.0%	458,539	100.0%
April	21,962	68.8%	86,311	84.4%	290,700	75.7%	450,001	83.8%	421,228	79.4%
May	31,792	99.9%	96,500	96.1%	309,728	79.1%	518,416	100.0%	510,980	100.0%
June	24,162	93.9%	84,426	93.5%	283,077	84.4%	489,765	95.0%	496,002	95.0%
July	35,168	86.5%	76,174	73.7%	227,230	62.5%	461,006	85.4%	461,006	81.0%
August	35,312	99.9%	87,522	97.0%	223,617	96.4%	504,478	100.0%	455,029	100.0%
September	39,013	99.8%	72,676	87.9%	219,319	91.8%	447,538	92.2%	464,687	100.0%
October	23,468	89.4%	72,207	86.6%	230,676	87.1%	434,155	87.6%	408,435	87.6%
November	25,325	91.0%	76,314	87.9%	224,532	74.7%	419,769	91.3%	305,539	85.1%
December	25,382	99.9%	91,997	100.0%	311,672	100.0%	485,582	100.0%	424,630	100.0%
2013 TOTAL / AVG.	433,801	92.5%	1,005,124	89.3%	3,367,369	84.4%	5,680,340	94.4%	5,250,524	93.8%
2012	475,401	94.9%	1,221,900	88.8%	3,538,799	85.4%	5,135,229	97.7%	4,774,110	97.7%
2011	115,439	90.7%	1,380,257	84.6%	2,772,890	85.8%	4,587,729	96.7%	4,763,517	97.1%
2010	144,749	90.3%	1,437,736	86.1%	3,327,973	86.0%	4,091,555	90.8%	4,772,745	90.6%
2009	106,849	93.7%	1,447,179	88.7%	5,585,699	90.8%	4,639,060	97.8%	4,397,025	97.6%
2008	103,262	90.9%	1,101,634	71.4%	1,149,746**	69.0%	3,680,999	96.9%	6,210,570	96.2%
2007	109,853	95.1%	1,391,339	83.6%	362,994*	92.6%	3,857,693	96.2%	5,506,023	95.9%
2006	92,358	90.0%	2,184,288	93.9%	701,579*	87.8%	4,581,348	95.0%	5,236,043	94.4%
2005	70,814	94.0%	1,966,338	93.0%	799,663*	95.0%	2,950,786	93.0%	3,881,318	93.0%

°Time taken for routine maintenance was not calculated as down-time

*RW-10

** RW-10 and RW-11 Combination

Table 2-2

GWTF Process Sampling Results - 2013

Remedial Acton Post-Construction Monitoring - 2013 Annual Report
DuPont Necco Park, Niagara Falls, New York

		B/C INFLUENT				D/E/F INFLUENT				COMBINED EFFLUENT			
Analyte		2/6/13	5/2/13	8/8/13	11/20/13	2/6/13	5/2/13	8/8/13	11/20/13	2/6/13	5/2/13	8/8/13	11/20/13
Field Parameters													
SPECIFIC CONDUCTANCE	µmhos/cm	8654	7043	8323	7264	3920	3709	4275	4085	3269	3223	3581	4051
TEMPERATURE	°C	10.7	10.8	17.4	12.9	10.9	12.4	14	12.2	10.7	13.1	19.2	12.5
COLOR	ns	grey/blue	clear	turbid	cloudy	grey	clear	clear	cloudy	grey/blue	clear	brown	grey
ODOR	ns	moderate	slight	none	slight	moderate	slight	none	slight	slight	slight	none	slight
PH	std units	5.45	4.70	5.71	5.32	6.64	6.94	6.68	6.78	6.99	7.84	7.21	7.45
REDOX	mv	-37	8	-70	-11	-200	-150	-265	-131	115	134	-216	-122
TURBIDITY	ntu	35.4	19	26.6	20.4	27.5	16.2	20.5	22.4	33.3	19	64.6	37
Volatile Organics													
1,1,2,2-TETRACHLOROETHANE	µg/l	6600	4000	4500	2800	1600	1300	1600	1300	870	670	570	550
1,1,2-TRICHLOROETHANE	µg/l	2900	3600	3600	2700	2200	2000	2400	2200	320 J	350	350	330
1,1-DICHLOROETHENE	µg/l	660	520	440	910	340	220	240	310	<0.63	<0.48	<1.9	<1.9
1,2-DICHLOROETHANE	µg/l	420	440	410	420	180	130	150	190 J	19	17	15	19
CARBON TETRACHLORIDE	µg/l	2500	3000	2400	2100	1400	1000	1100	1300	9.1	1.3 J	1.5 J	<1.3
CHLOROFORM	µg/l	13000	15000	13000	16000	3200	3000	3100	4200	110	90	76	90
CIS-1,2-DICHLOROETHENE	µg/l	5200	4300	4300	5500	10000	8300	8400	11000	92	74	80	89
METHYLENE CHLORIDE	µg/l	2200	2000	1700 B	1100	5200	4200	3100 B	4000	84	58	76 B	42
TETRACHLOROETHENE	µg/l	5500	6500	5600	6100	1300	1000	1100	1300	62	7.6	48	6.9 J
TRANS-1,2-DICHLOROETHENE	µg/l	420	350	310	410	730	550	570	690	1.8 J	1.1 J	<1.9	<1.9
TRICHLOROETHENE	µg/l	14000	16000	14000	17000	5200	5300	5500	6700	48	29	29	31
VINYL CHLORIDE	µg/l	2100	1900	820	1700	2600	2200	1300	1900	1.2 J	<0.55	<2.2	<2.2
TOTAL VOLATILES	µg/l	**55,500**	**57,610**	**51,080**	**56,740**	**33,950**	**29,200**	**28,560**	**35,090**	**1,617**	**1,298**	**1,246**	**1,158**

< and ND = Non detect at stated reporting limit
J= Analyte present. Reported value may not be precise.

TABLE 3-1
Quarterly Hydaulic Monitoring Locations

Remedial Action Post-Construction Monitoring - 2013 Annual Report
DuPont Necco Park, Niagara Falls, New York

Well ID	Zone	Well ID	Zone	Well ID	Zone
53	A	159B	B	203D	D
111A	A	160B	B	RW-8	D/E/F
117A	A	161B	B	RW-9	D/E/F
119A	A	163B	B	202D	D
123A	A	167B	B	129E	E
129A	A	168B	B	136E	E
131A	A	169B	B	142E	E
137A	A	170B	B	145E	E
139A	A	171B	B	146E	E
140A	A	172B	B	150E	E
145A	A	201B	B	163E	E
146AR	A	BZTW-1	B	164E	E
150A	A	BZTW-2	B	165E	F
159A	A	BZTW-4	B	202E	E
163A	A	D-23	B	203E	F
168A	A	PZ-B	B	112F	F
173A	A	D-10	B/C	123F	F
174A	A	D-14	B/C	129F	F
175A	A	RW-5	B/C	130F	F
176A	A	RW-4	B/C	136F	F
178A	A	RW-11	B/C	145F	F
179A	A	105C	C	146F	F
184A	A	115C	C	148F	F
185A	A	123C	C	150F	F
186A	A	129C	C	163F	F
187A	A	130C	C	164F	F
188A	A	136C	C	165F	F
189A	A	137C	C	202F	F
190A	A	138C	C	203F	F
191A	A	139C	C	130G	G
192A	A	141C	C	136G	G
193A	A	145C	C	141G	G
194A	A	146C	C	143G	G
D-9	A	149C	C	TRW-6	B/C
D-11	A	150C	C	TRW-7	B/C
RDB-3	A	151C	C		
RDB-5	A	159C	C		
D-13	A	160C	C		
PZ-A	A	161C	C		
168A	A	162C	C		
102B	B	168C	C		
111B	B	204C	C		
112B	B	105D	D		
116B	B	111D	D		
118B	B	115D	D		
119B	B	123D	D		
120B	B	129D	D		
123B	B	130D	D		
129B	B	136D	D		
130B	B	137D	D		
136B	B	139D	D		
137B	B	145D	D		
138B	B	148D	D		
139B	B	149D	D		
145B	B	158D	D		
146B	B	159D	D		
149B	B	163D	D		
150B	B	164D	D		
151B	B	165D	D		

Notes: 1. Well 204C installed in 2008 to replace 112C. Water levels began in 1Q09.
2. Piezometers PZ-A, PZ-B, and 168A installed in 2008.
3. All AT zone wells were eliminated from the hydraulic monitoring program on consent from USEPA letter dated 01/27/2012.

Table 3-2

2013 Average A-Zone to B-Zone Vertical Gradients

Remedial Action Post-Construction Monitoring - 2013 Annual Report
DuPont Necco Park, Niagara Falls, New York

Well Pair		A	B	C	D	
		2013 Average A-Zone Head	**2013 Average B-Zone Head**	**A-Zone Mid-Point of Well Screen**	**B-Zone Fracture Elevation[1]**	**Vertical Gradtient[2,3] (B-A) / (C-D)**
111A	111B	571.82	570.67	573.94	561.80	-0.10
119A	119B	573.28	571.83	571.63	556.90	-0.10
129A	129B	573.16	570.37	570.10	557.80	-0.23
137A	137B	570.66	570.42	570.10	561.30	-0.03
145A	145B	572.03	569.39	564.19	546.30	-0.15
150A	150B	571.81	569.89	564.69	553.18	-0.17
159A	159B	577.37	573.26	580.62	562.90	-0.23
163A	163B	572.79	572.72	572.49	564.96	-0.01
168A	168B	571.26	567.82	555.22	544.90	-0.33

Notes:

1) A B-Zone fracture was not observed in the 145B borehole, therefore the midpoint of the open hole was used.
2) Unitless (ft/ft).
3) Negative values indicate a downward (from A-Zone to B-Zone) gradient.
4) Average gradients were used to better reflect typical vertical gradients at the site.

Table 3-3

DNAPL Components and Solubility Criteria Values

Remedial Action Post-Construction Monitoring - 2013 Annual Report
DuPont Necco Park, Niagara Falls, New York

Contaminant	Mole Fraction in DNAPL (%)	Pure-Phase Solubility (µg/l)	One-Percent Pure-Phase Solubility (µg/l)	Effective Solubility (µg/l)
Hexachlorobutadiene	59	2,000	20	1,180
Hexachloroethane	9	50,000	500	4,500
Hexachlorobenzene	2	11	0.11	0.22
Carbon tetrachloride	5	800,000	8,000	40,000
Chloroform	1	8,000,000	80,000	80,000
Tetrachloroethene	3	150,000	1,500	4,500
1,1,2,2-Tetrachloroethane	5	2,900,000	29,000	145,000
Trichloroethene	4	1,100,000	11,000	44,000

Table 3-4

Effective Solubility Concentration Exceedances for DNAPL Compounds - 2005 through 2013 Annual Sampling

Remedial Action Post-Construction Monitoring - 2013 Annual Report
DuPont Necco Park, Niagara Falls, New York

Well ID	Flow Zone	Analyte	Criteria (ppb)	2005		2006		2007		2008	2009	2010	2011	2012	2013
				1st Event	2nd Event	1st Event	2nd Event	1st Event	2nd Event						
171B	B	Hexachlorobutadiene	1,180	2,100	BC	BC	BC	NS	BC	BC	BC	BC	BC	BC	BC
		Hexachlorobenzene	0.22	BC	4.0	31 J	3.4 J	NS	1.4 J	BC	< 0.4	< 2.5	<0.95	BC	BC
105C	C	Carbon Tetrachloride	40,000	NS	NS	NS	BC	NS	BC	BC	BC	NS	NS	NS	BC
		Hexachlorobutadiene	1,180	1,700	BC	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
		Chloroform	80,000	BC	180,000	NS	120,000	NS	90,000	82,000	BC	NS	NS	NS	100,000
		Tetrachloroethene	4,500	32,000	35,000	NS	36,000	NS	37,000 J	32,000	13,000	NS	NS	NS	24,000
		Trichloroethene	44,000	280,000	190,000	NS	190,000	NS	160,000	140,000	74,000	NS	NS	NS	190,000
136C	C	Tetrachloroethene	4,500	4,100	3,600	3,300	3,100	5,200	3,800	14,800	5,600	NS	NS	NS	5,300
137C	C	Tetrachloroethene	4,500	8,500	22,000	NS	7,900	NS	BC	BC	BC	NS	NS	NS	BC
105D	D	Carbon Tetrachloride	40,000	150,000	83,000	NS	170,000	NS	190,000	BC	200,000	NS	NS	NS	360,000
		Chloroform	80,000	98,000	35,000	NS	80,000	NS	90,000	96,000	120,000	NS	NS	NS	160,000
		Tetrachloroethene	4,500	12,000	57,000	NS	11,000	NS	13,000 J	12,000	16,000	NS	NS	NS	22,000
		Trichloroethene	44,000	120,000	51,000	NS	110,000	NS	120,000	130,000	180,000	NS	NS	NS	250,000
137D	D	Tetrachloroethene	4,500	5,100	4,900	NS	BC	NS	7,200	5,300 J	4,700	NS	NS	NS	BC
		Trichloroethene	44,000	64,000	76,000	NS	BC	NS	91,000	70,000	76,000	NS	NS	NS	BC
		Hexachlorobenzene	0.22	3.0	11.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
139D	D	Hexachlorobutadiene	1,180	1,200	BC	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

BC: Below Criteria
NS: Not Sampled
Note: Only one well that in the current monitor program exceeds the effective solubility limit
"<" = compound not identified above the detection limit.

Table 3-5

1% of Pure-Phase Solubility Concentration Exceedances for DNAPL Compounds - 2005 through 2013 Annual Sampling

Remedial Action Post-Construction Monitoring - 2013 Annual Report
DuPont Necco Park, Niagara Falls, New York

Well ID	Flow Zone	Analyte	Criteria (ppb)	2005		2006		2007		2008	2009	2010	2011	2012	2013
				1st Event	2nd Event	1st Event	2nd Event	1st Event	2nd Event						
D-11	A	Hexachlorobutadiene	20	29	BC	BC	BC	BC	BC	BC	BC	NS	NS	NS	BC
136B	B	Tetrachloroethene	1,500	BC	BC	BC	BC	BC	BC	1,500	1,600	BC	BC	2,000	1,500
139B	B	Tetrachloroethene	1,500	NS	NS	NS	2000 J	NS	4,600	3,100	3,200	NS	NS	NS	2,900
		Hexachlorobutadiene	20	78	BC	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
		1,1,2,2-Tetrachlorethane	29000	NS	NS	NS	29,000	NS	BC	BC	BC	NS	NS	NS	BC
171B	B	Hexachlorobutadiene	20	2,100	130	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC
		Hexachlorobenzene	0.11	BC	4.0	3.1 J	3.4 J	BC	1.4 J	BC	< 0.4	< 0.5	<0.95	BC	BC
172B	B	Hexachlorobutadiene	20	140	89	140 J	110	BC	110	54	170	210	20	130	45
		Tetrachloroethene	1,500	1,800	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC
105C	C	Hexachlorobutadiene	20	1,700	BC	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
		Carbon Tetrachloride	8,000	25,000	BC	NS	BC	NS	BC	BC	BC	NS	NS	NS	BC
		Chloroform	80,000	250,000	180,000	NS	120,000	NS	90,000	82,000	BC	NS	NS	NS	100,000
		Tetrachloroethene	1,500	32,000	35,000	NS	36,000	NS	37,000 J	32,000 J	13,000	NS	NS	NS	24,000
		Trichloroethene	11,000	280,000	190,000	NS	190,000	NS	160,000	140,000	74,000	NS	NS	NS	190,000
136C	C	Tetrachloroethene	1,500	4,100	3,600	3,300	3,100	5,200	3,800	4,800	5,600	NS	NS	NS	5,300
137C	C	Tetrachloroethene	1,500	8,500	22,000	NS	7,900	NS	2,200	2,700	BC	NS	NS	NS	BC
		Trichloroethene	11,000	BC	19,000	NS	16,000	NS	20,000	70,000	BC	NS	NS	NS	BC
168C	C	Hexachlorobutadiene	20	330	64.0	54 J	NS	44 J	BC	BC	NS	<27	21 J	BC	BC
105D	D	Hexachlorobutadiene	20	95.0	BC	NS	NS	NS	NS	NS	N/S	NS	NS	NS	NS
		Carbon Tetrachloride	8,000	150,000	83,000	NS	170,000	NS	190,000	190,000	200,000	NS	NS	NS	360,000
		Chloroform	80,000	98,000	BC	NS	80,000	NS	90,000	96,000	120,000	NS	NS	NS	160,000
		Tetrachloroethene	1,500	12,000	5,700	NS	11,000	NS	13,000 J	12,000 J	16,000	NS	NS	NS	22,000
		1,1,2,2-Tetrachlorethane	29,000	NS	NS	NS	88,000	NS	79,000	76,000	79,000	NS	NS	NS	100,000
		Trichloroethene	11,000	120,000	51,000	NS	110,000	NS	120,000	130,000	180,000	NS	NS	NS	250,000
137D	D	Tetrachloroethene	1,500	5,100	4,900	NS	BC	NS	7,200	5,300	4,700	NS	NS	NS	BC
		Trichloroethene	11,000	64,000	76,000	NS	27,000	NS	91,000	70,000	76,000	NS	NS	NS	BC
139D	D	Hexachlorobenzene	0.11	38.0	11.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
		Tetrachloroethene	1,500	1,900	BC	NS	BC	NS	BC	BC	BC	NS	NS	NS	BC
165E	E	Hexachlorobutadiene	20	27.0	BC	32 J	46 J	BC	45 J	91 J	44 J	79 J	26 J	130 J	65 J
		Tetrachloroethene	1,500	BC	BC	BC	BC	BC	BC	BC	BC	2,000	BC	BC	BC
		Trichloroethene	11,000	BC	BC	BC	BC	BC	BC	BC	BC	11,000	12,000	12,000	BC

BC: Below Criteria
NS: Not
"<" = compound not identified above the detection limit.

Table 3-6
Chemical Monitoring List
Long-Term Monitoring

Remedial Action Post-Construction Monitoring - 2013 Annual Report
DuPont Necco Park, Niagara Falls, New York

MONITORING WELL	ZONE	MONITORING WELL	ZONE
D-11	A	**105D**	D
D-13	A	123D	D
D-9	A	136D	D
137A	A	**137D**	D
145A	A	145D	D
146AR	A	148D	D
150A	A	**139D**	D
111B	B	147D	D
136B	B	149D*	D
137B	B	156D	D
139B	B	165D	D
141B	B	136E	E
145B*	B	145E	E
146B	B	146E	E
149B*	B	150E	E
150B	B	156E	E
151B*	B	165E	E
153B	B	136F	F
168B	B	146F	F
171B	B	147F	F
172B	B	150F*	F
105C	C	156F	F
136C	C	147G1	G1
137C	C	147G2	G2
141C*	C	147G3	G3
145C*	C		
146C*	C		
149C	C		
150C*	C		
151C	C		
168C	C		

*Well does not meet bedrock zone water bearing criteria ($k<10^{-4}$ cm/sec).

Wells shown in **bold** are used solely for the MNA evaluation and will not be used for Long-term chemistry monitoring.

Table 3-7
Indicator Parameter List
Long-Term Groundwater Monitoring

Remedial Action Post-Construction Monitoring - 2013 Annual Report
DuPont Necco Park

Inorganic and General Water Qualit Parameters	Volatile Organic Compounds	Semivolatile Organic Compounds
pH*	Vinyl chloride	Hexachloroethane
Specific conductivity*	1,1-dichloroethene	Hexachlorobutadiene
Temperature*	Trans-1,2-dichloroethene	Phenol
Turbidity*	Cis-1,2-dichloroethene	2,4,6-trichlorophenol
Dissolved oxygen *	Chloroform	2,4,5-trichlorophenol
Redox potential*	Carbon tetrachloride	Pentachlorophenol
Chloride	1,2-dichloroethane	Hexachlorobenzene
Dissolved barium	Trichloroethene	4-methlyphenol
	1,1,2-trichloroethane	TIC-1
	Tetrachloroethene	
	1,1,2,2-tetrachloroethane	

*Field parameter

Table 3-8
MNA Summary B/C Zone Wells
Remedial Action Post-Construction Monitoring - 2013 Annual Report
DuPont Necco Park, Niagara Falls, New York

Well	Location	Last NAPL observation	Conc. Trend 2005 - 2013	Dominant Cl - Ethene species	2013 Ethene Production	2005 Total Cl-Ethenes (ug/L)	2013 Total Cl-Ethenes (ug/L)	Comments	2013 MNA Score	MNA Score Definition
141B	Upgradient	NA	Below detection limits (<0.29 ug/L)	NA	ND	0	0.0		7	Score not applicable - Below MCL
141C	Upgradient	NA	Increase of low concentrations	PCE, TCE, VC	Good	2	35	Low concentration in upgradient well	17	Score not applicable - Below MCL
111B	Source Area	NA	Slight Increase, but remains less than in 2000	cDCE, VC	Good	758	12210	Inversion of DCE and VC over time	27	Strong evidence for anaerobic biodegradation of chlorinated organics
137B	Source Area	NA	Decreasing	TCE, cDCE, VC	Good	1114	459	Inversion of moles of TCE and DCE/VC over time	22	Strong evidence for anaerobic biodegradation of chlorinated organics
139B	Source Area	1992	Steady	PCE, TCE, tDCE, cDCE, VC	Good	1447	35810	Exceeds 1% Pure Phase Solubility Criteria (PCE)	27	Strong evidence for anaerobic biodegradation of chlorinated organics
105C	Source Area	1992	Slight Decrease	PCE, TCE cDCE, tDCE, 1,1 DCE, VC	Good	260800	258400	Exceeds effective solubility and 1% absolute solubility for: PCE and TCE	24	Strong evidence for anaerobic biodegradation of chlorinated organics
137C	Source Area	NA	Decreasing	cDCE, VC	Good	51200	5158	Inversion of TCE and degradation products	26	Strong evidence for anaerobic biodegradation of chlorinated organics
145B	Downgradient	NA	Decreasing	TCE, cDCE, VC	Moderate	4400	1974		13	Limited to strong evidence for anaerobic biodegradation of chlorinated organics, anomalous conditions in 2013 skewed
145C	Downgradient	NA	Decreasing	cDCE, VC	Good	8900	1327		18	Adequate to strong evidence for anaerobic biodegradation of chlorinated organics
149C	Downgradient	NA	Flat	cDCE, VC	Relatively Strong	10	26	Near MCLs. Inversion of CIS and VC	16	Adequate evidence for anaerobic biodegradation of chlorinated organics
151C	Downgradient	NA	Decreasing	cDCE, tDCE, VC	ND	220	11.1	Mostly DCE, VC. Decreases of 2 orders of magnitude	17	Adequate evidence for anaerobic biodegradation of chlorinated organics
151B	Downgradient	NA	Slight Decrease since 2005, near MCLs	VC	ND	0.00	4.50	Concentrations are below or at MCLs (VC = 2.1 µg/L)	21	Score not applicable - Below MCL
153B	Sidegradient	NA	Below MCLs	NA	BDL	0	1.35 J		20	Strong evidence for anaerobic biodegradation of chlorinated organics

NA = Not Applicable
ND= No Data
BDL = Below Detection Limit

MNA Scoring categories (USEPA, 1998)

0 to 5	Inadequate evidence for anaerobic biodegradation of chlorinate organics
6 to 14	Limited evidence for anaerobic biodegradation of chlorinate organics
15 to 20	Adequate evidence for anaerobic biodegradation of chlorinate organics
> 20	Strong evidence for anaerobic biodegradation of chlorinate organics

TABLE 3-9
Summary of Percent Reduction of TVOCs in Downgradient and Side-Gradient B/C Zone Locations

Well ID	Percent reduction since construction of GWRS	Comment
145B	63%	
151B	NA	Total CVOCs range 1.4 - 8.36 ug/L and no trend in concentrations
145C	57%	
149C	NA	Total CVOCs range 0 - 26. Slight increase in DCE (up to 13 ug/L) but below MCL
151C	100%	
Average	73%	

Table 3-10
MNA Summary D/E/F Zone Wells

Remedial Action Post-Construction Monitoring - 2013 Annual Report
DuPont Necco Park, Niagara Falls, New York

Well	Location	Last NAPL Observation	Conc. Trend 2005 - 2009	Dominant Cl - Ethene Species	2013 Ethene Production	2005 Total Cl-Ethenes (ug/L)	2013 Total Cl-Ethenes (ug/L)	Comment	2013 MNA Score	MNA Score Definition
105D	Source Area	NA	High concentrations trend NA	TCE	Moderate	662,635	1,218,560		26	Strong evidence for anaerobic biodegradation of chlorinated organics
137D	Source Area	NA	Strong decrease	PCE, TCE , cDCE, VC, tDCE, 1,1,DCE	Moderate	94,500	4,670	Strong decreases in TCE	24	Strong evidence for anaerobic biodegradation of chlorinated organics
139D	Source Area	1992	Decreasing	TCE, PCE	Moderate	2,690	2,729		19	Adequate evidence for anaerobic biodegradation of chlorinated organics
165D	Source Area - near boundary	NA	Strong decrease	VC	Moderate	1,102	5.6	Decreasing Total CVOCs by greater than 2 orders of magnitude. Source area concentrations have been decreased to near MCLs	18	Adequate evidence for anaerobic biodegradation of chlorinated organics
136D	Downgradient, but near source area	NA	Decreasing	cDCE, VC	Strong	1,819	1,058	Inversion of TCE and degradation product since 2000. Mostly cDCE, VC	19	Adequate to strong evidence for anaerobic biodegradation of chlorinated organics
147D	Downgradient	NA	Decreasing	cDCE, VC	Weak	183	112	Inversion of DCE and VC	11	Limited evidence, however: CVOCs are low, there is an observed decrease of CVOCs and inversion of DCe and VC concentrations
148D	Downgradient	NA	Slight increase, but below MCLs	cDCE	Weak but notable ethane	1	4.3		12	Score not applicable - Below MCL
149D	Side gradient	NA	Flat	cDCE, VC	Weak but relatively notable	0	3.6	Concentrations are below MCLs	14	Limited to adequate evidence for anaerobic biodegradation of chlorinated organics. Limited score in 2013 related sample with CVOCs 1 ug/L and less, therefore the score is not applicable.
156D	Downgradient	NA	Decrease	cDCE, tDCE, VC	ND	5	1.1	Concentrations are below MCLs	12	Score not applicable - Below MCL
136E	Downgradient, but near source area	NA	Decrease	cDCE, VC , tDCE	Strong	17	15.7	Order of magnitude decrease in Total CVOCs 2000-2013	19	Adequate to strong evidence for anaerobic biodegradation of chlorinated organics
145E	Side gradient	NA	Decrease	cDCE, VC	Strong	11,750	2,840	Inversion of DCE and VC	22	Strong evidence for anaerobic biodegradation of chlorinated organics
146E	Downgradient	NA	Decrease	cDCE, VC	Strong	17,120	5510		22	Strong evidence for anaerobic biodegradation of chlorinated organics
156E	Downgradient	NA	Slight Decrease	cDCE, VC	ND	3	0	Below MCLs	12	Score not applicable - Below MCL
146F	Downgradient	NA	Slight Decrease	cDCE, VC	Moderate	20,470	9,490	Inversion of DCE and VC	24	Strong evidence for anaerobic biodegradation of chlorinated organics
150F	Side gradient	NA	Slight Decrease	cDCE, VC	Strong	2,755	540	Inversion of DCE and VC	24	Strong evidence for anaerobic biodegradation of chlorinated organics

NA = Not Applicable
ND= No Data
BDL = Below Detection Limit

MNA Scoring categories (USEPA, 1998)

0 to 5	Inadequate evidence for anaerobic biodegradation of chlorinate organics
6 to 14	Limited evidence for anaerobic biodegradation of chlorinate organics
15 to 20	Adequate evidence for anaerobic biodegradation of chlorinate organics
> 20	Strong evidence for anaerobic biodegradation of chlorinate organics

TABLE 3-11
Summary of Percent Reduction Degradation in Downgradient and Side-Gradient D/E/F Zone Locations

Well ID	Percent reduction since construction of GWRS	Comment
136D	36%	
147D	33%	Degraded to only VC above MCL
148D	NA	At or near detection levels and no trend
149D	NA	At or near detection levels and no trend
156D	66%	Decreased to below detection < 0.5 ug/L
136E	59%	Decreased to TVOCs 15.7 ug/L
145E	82%	
146E	64%	
156E	86%	
146F	59%	
150F	73%	
Average	62%	

Table 3-12

2013 DNAPL Recovery Summary

Remedial Action Post-Construction Monitoring - 2013 Annual Report
DuPont Necco Park, Niagara Falls, New York

Well ID	Frequency	9-Jan		6-Feb		15-Mar		28-Mar		1-Apr		8-Apr		26-Apr		2-May		14-Jun		12-Jul		8-Aug		20-Sep		25-Oct		7-Nov		26-Dec	
		FT	GALS	FT	GALS	FT	GALS	FT	GALS	FT	GALS	FT	GALS	FT	GALS	FT	GALS	FT	GALS	FT	GALS	FT	GALS	FT	GALS	FT	GALS	FT	GALS	FT	GALS
RW-4	Monthly	0.0		0.0		0.0				5.0	20.0	trace	1.0			0.0		0		na		0.0		0.0		0.0		0.0		0.0	
RW-5	Monthly	0.0		0.0		0.0		11.0	40.0			trace		4.0	12.0	0.0		6	25.0	6.0	25.0	0.0		0.0		0.0		0.0		0.0	
RW-11	Monthly	0.0		0.0		0.0						0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
TRW-6	Monthly	0.0		0.0		0.0						0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
TRW-7	Monthly	0.0		0.0		0.0						0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
PZ-A	Monthly	0.0		0.0		0.0						0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
VH-117A	Monthly	0.0		0.0		0.0						0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
VH-123A	Monthly	0.0		0.0		0.0						0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
VH-129A	Monthly	0.0		0.0		0.0						0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
VH-190A	Monthly	0.0		0.0		0.0						0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
D-23	Monthly	0.0		0.0		0.0						0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
PZ-B	Monthly	0.0		0.0		0.0						0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
VH-160B	Monthly	0.0		0.0		0.0						0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
VH-161B	Monthly	0.0		0.0		0.0						0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
VH-167B	Monthly	0.0		0.0		0.0						0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
VH-168B	Monthly	0.0		0.0		0.0						0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
VH-169B	Monthly	0.0		0.0		0.0						0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
VH-170B	Monthly	0.0		0.0		0.0						0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
VH-171B	Monthly	0.0		0.0		0.0						0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
VH-172B	Monthly	0.0		0.0		0.0						0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
VH-129C	Monthly	0.0		0.0		0.0						0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
VH-160C	Monthly	0.0		0.0		0.0						0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
VH-161C	Monthly	0.0		0.0		0.0						0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
VH-162C	Monthly	0.0		0.0		0.0						0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
VH-168C	Monthly	0.0		0.0		0.0						0.0				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
204C	Monthly	0.0		trace		trace						trace				0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
VH-131A	Semi-annually	na		na		na						0.0				na		na		na		na		na		0.0		na		na	
VH-139A	Semi-annually	na		na		na						0.0				na		na		na		na		na		0.0		na		na	
VH-139C	Semi-annually	na		na		na						0.0				na		na		na		na		na		0.0		na		na	
CECOS52SR	Semi-annually	na		na		na						0.0				na		na		na		na		na		0.0		na		na	
CECOS18SR	Semi-annually	na		na		na						0.0				na		na		na		na		na		0.0		na		na	
CECOS-53	Semi-annually	na		na		na						0.0				na		na		na		na		na		0.0		na		na	

na - not applicable/not taken
GALS - gallons purged

FIGURES

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PARSONS

40 La Riviere Dr, Suite 350
Buffalo, NY 14202
(716) 541-0730

Created by: JWS	Date: 03-29-11
Checked by: RBP	Date: 03-29-11
Approved by: DDT	Date: 03-29-11
Project Manager: DDT	Date: 03-29-11
Job number: 445356.02020	

FIGURE 1-1
SITE LOCATION MAP
NECCO PARK
NIAGARA FALLS, NY

U:/Necco/HydroGeo/Mapping/gis/Necco_Site_location_map.srf

PARSONS

40 LA RIVIERE DR., SUITE 350
BUFFALO, NY 14202
(716) 541-0752

Created by: JWS	Date: 02-27-12
Checked by: JWS	Date: 02-27-2012
Project Manager: Eric Felter	Date: 02-12-2012
Project Number: 445357.02023	

LEGEND

✦ 2010 REVISED CHEMICAL MONITORING	┅ RAIL ROADS
⬠ RECOVERY WELLS	▨ GROUT CURTAIN
◆ MONITORING WELL	

FIGURE 3-1
WELL AND PIEZOMETER LOCATIONS
DUPONT NECCO PARK SITE
NIAGARA FALLS, NY

U:\Necco\hydrogeo\Maps\gis\basemap.mxd

Figure 3-2
Select A-Zone Monitoring Wells
Groundwater Elevations 2005 Through 2013
DuPont Necco Park

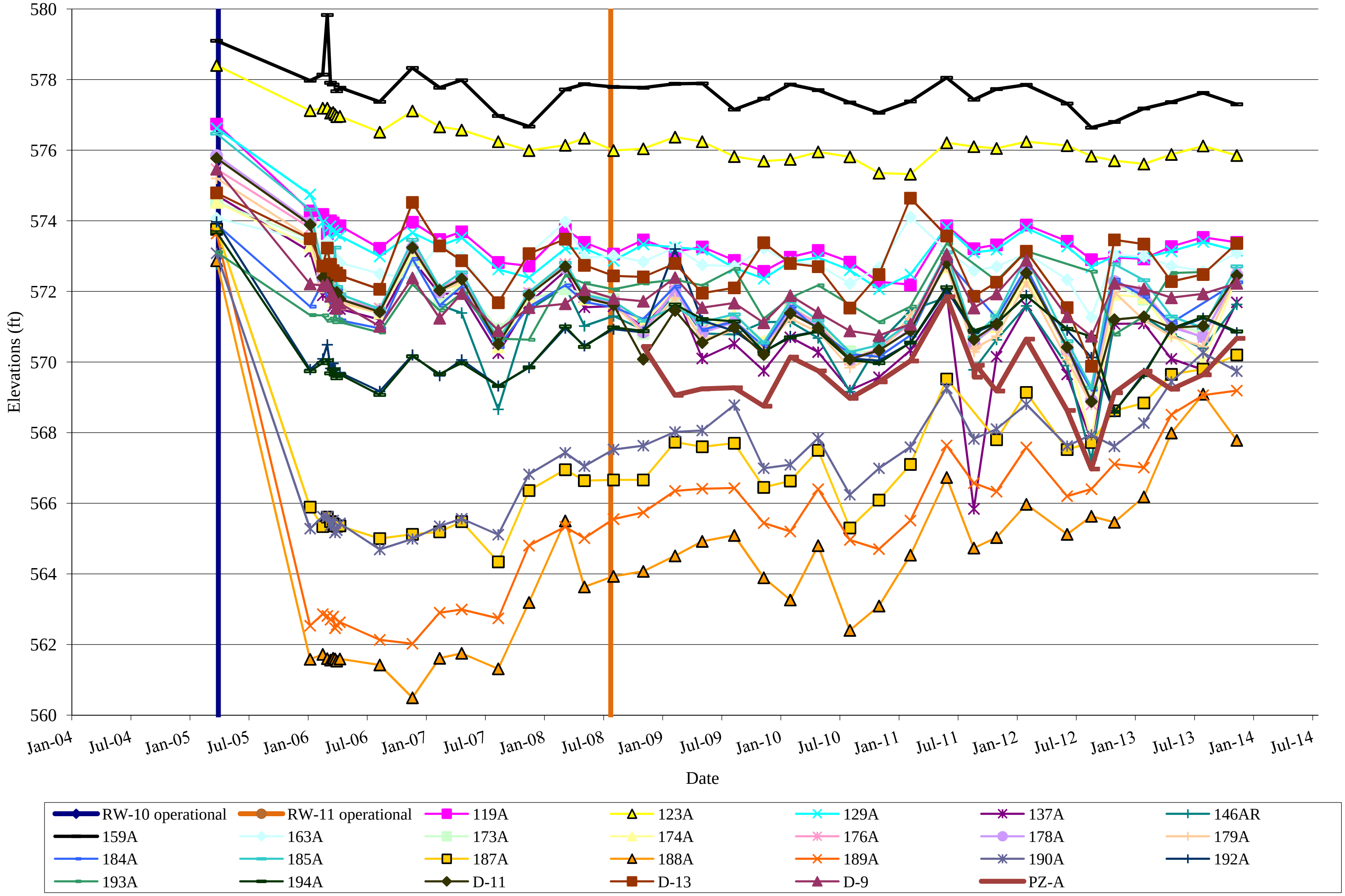
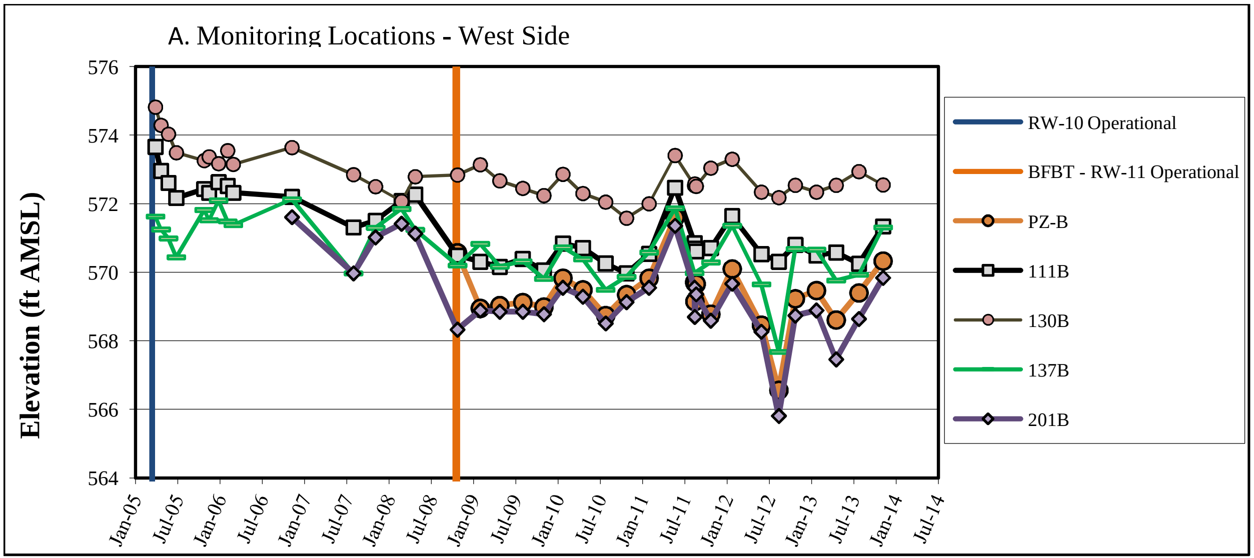
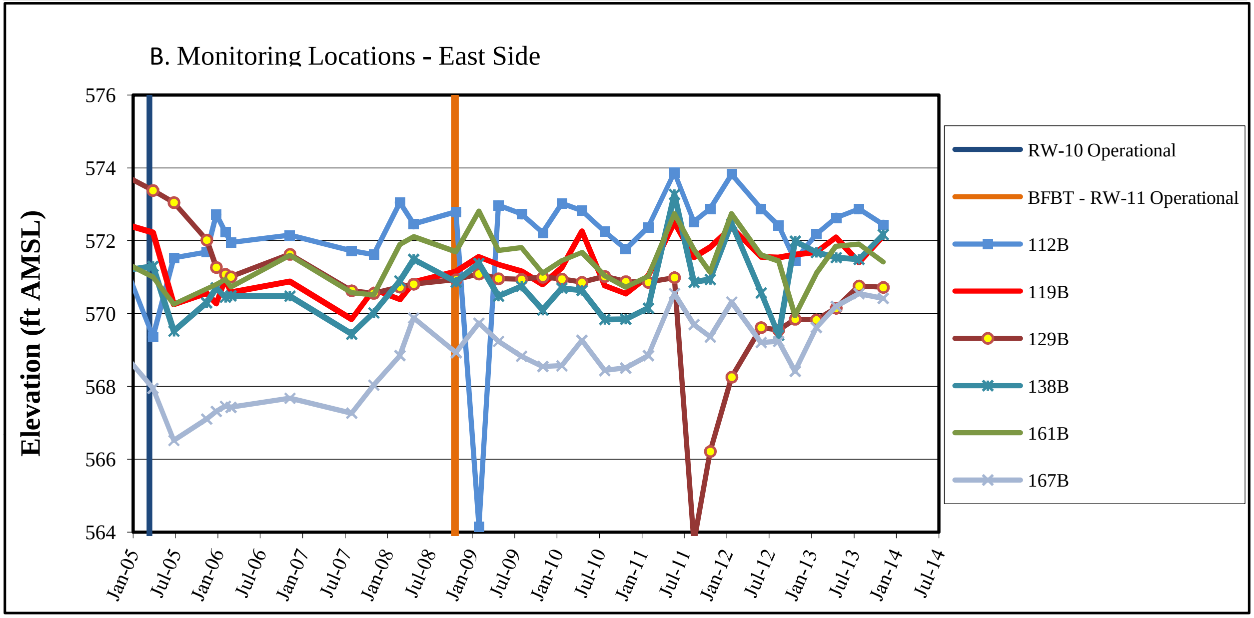


Figure 3-3
Select B-Zone Monitoring Wells
Groundwater Elevations 2005 through 2013

A. Monitoring Locations - West Side



B. Monitoring Locations - East Side



C. Pumping wells

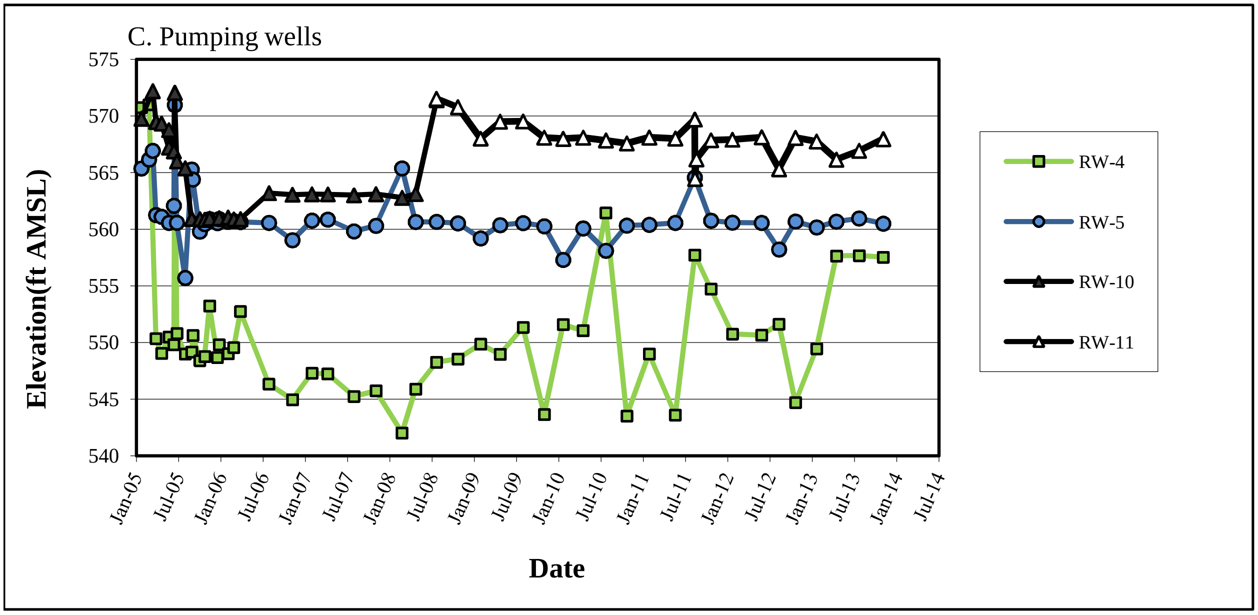
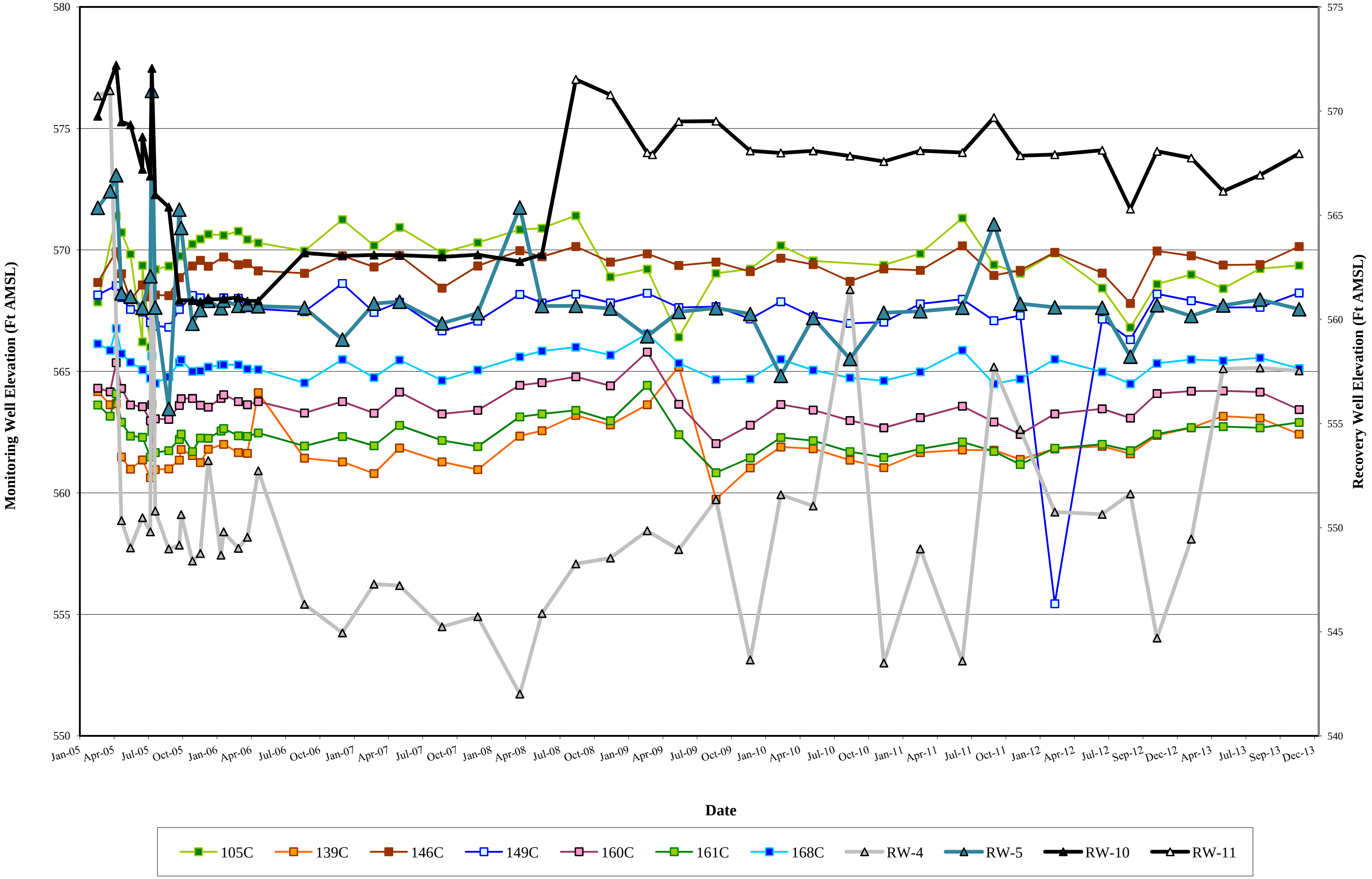
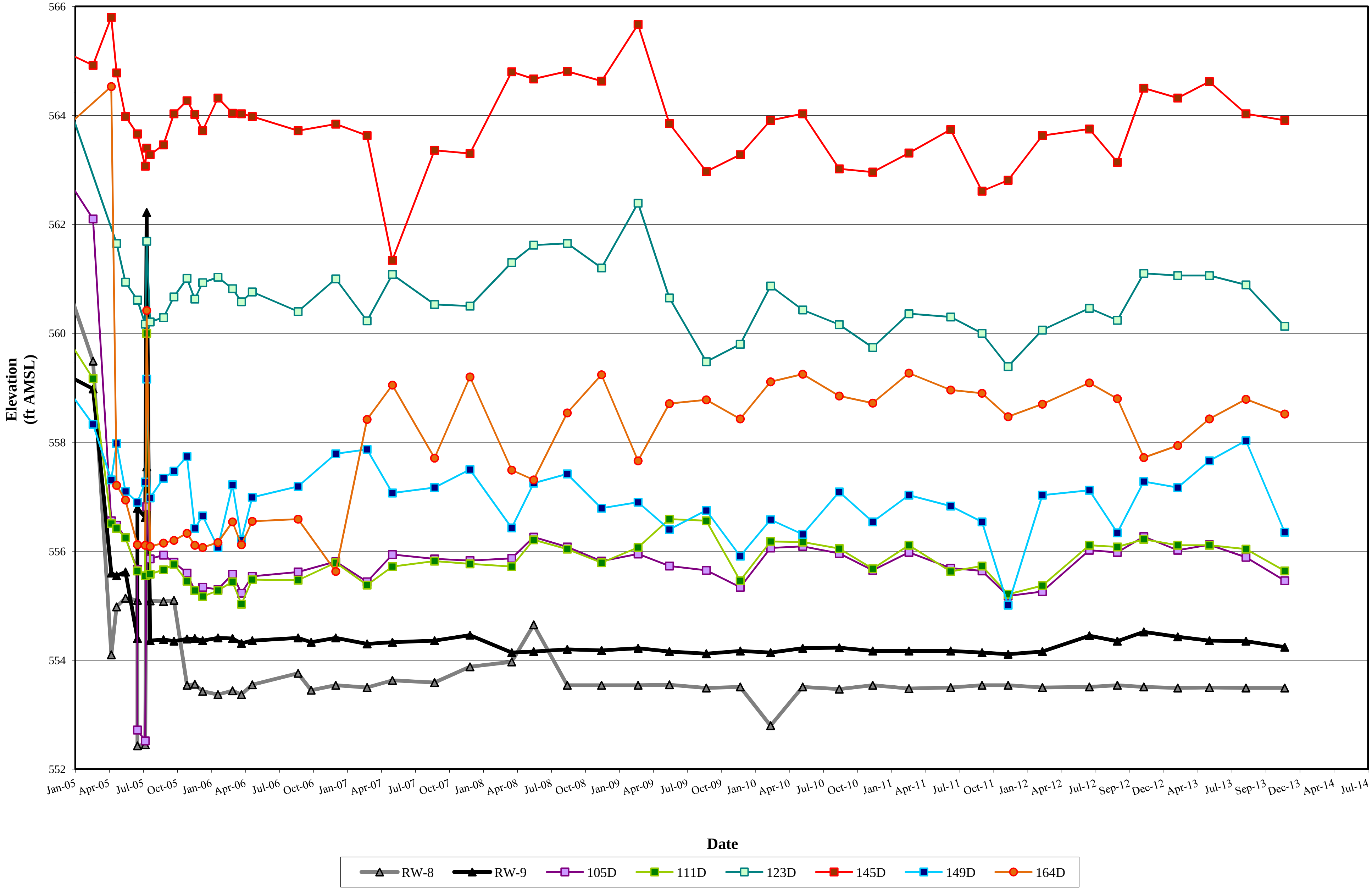


Figure 3-4
Select C-Zone Monitoring Wells
Groundwater Elevations 2005 Through 2013
DuPont Necco Park



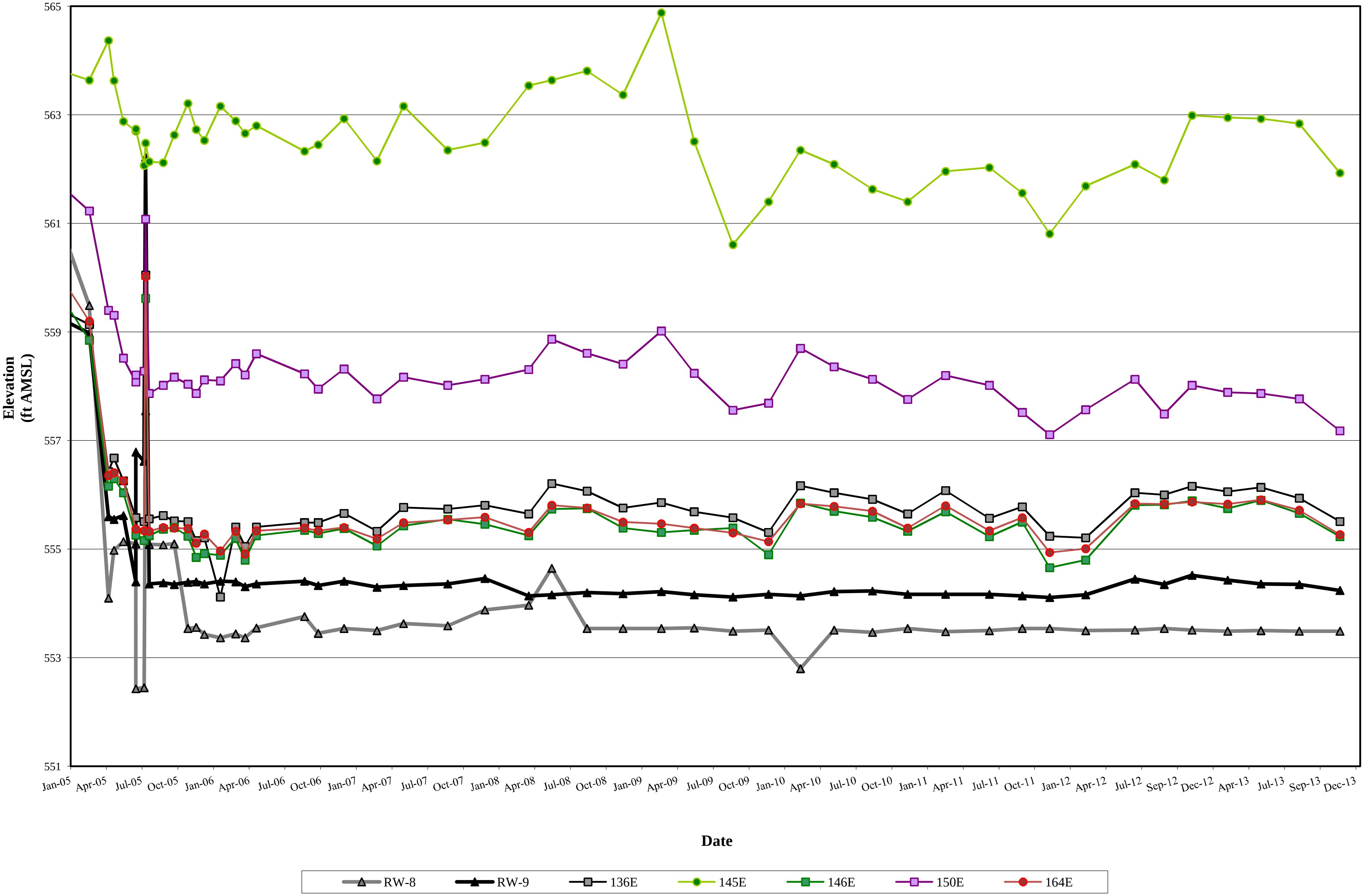
Necco 2013 C Zone Water Elev Trends.xlsx

Figure 3-5
Select D-Zone Monitoring Wells
Groundwater Elevations 2005 through 2013
DuPont Necco Park



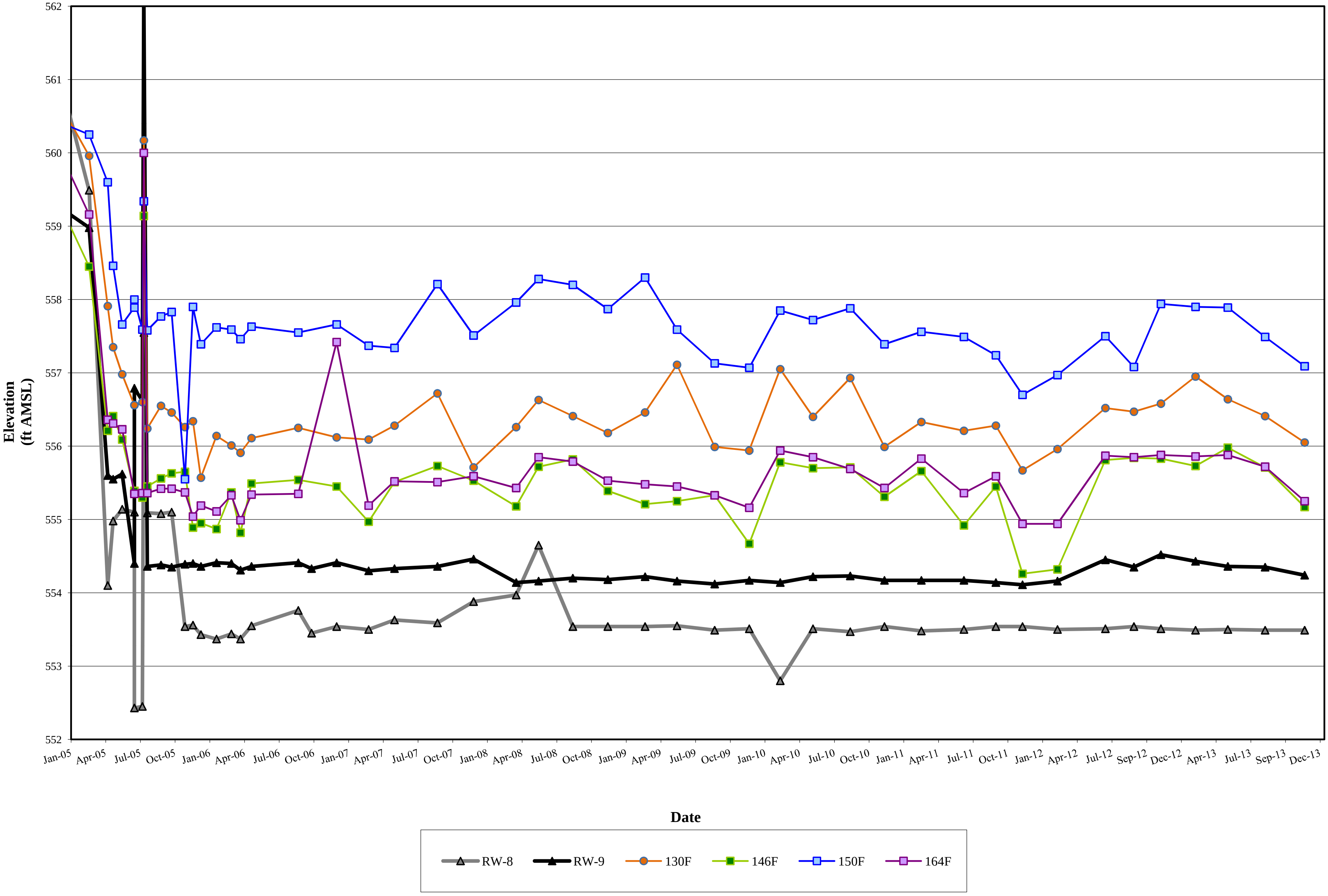
Necco 2013 D Zone Water Elev Trends.xlsx

Figure 3-6
Select E-Zone Monitoring Wells
Groundwater Elevations 2005 Through 2013
DuPont Necco Park

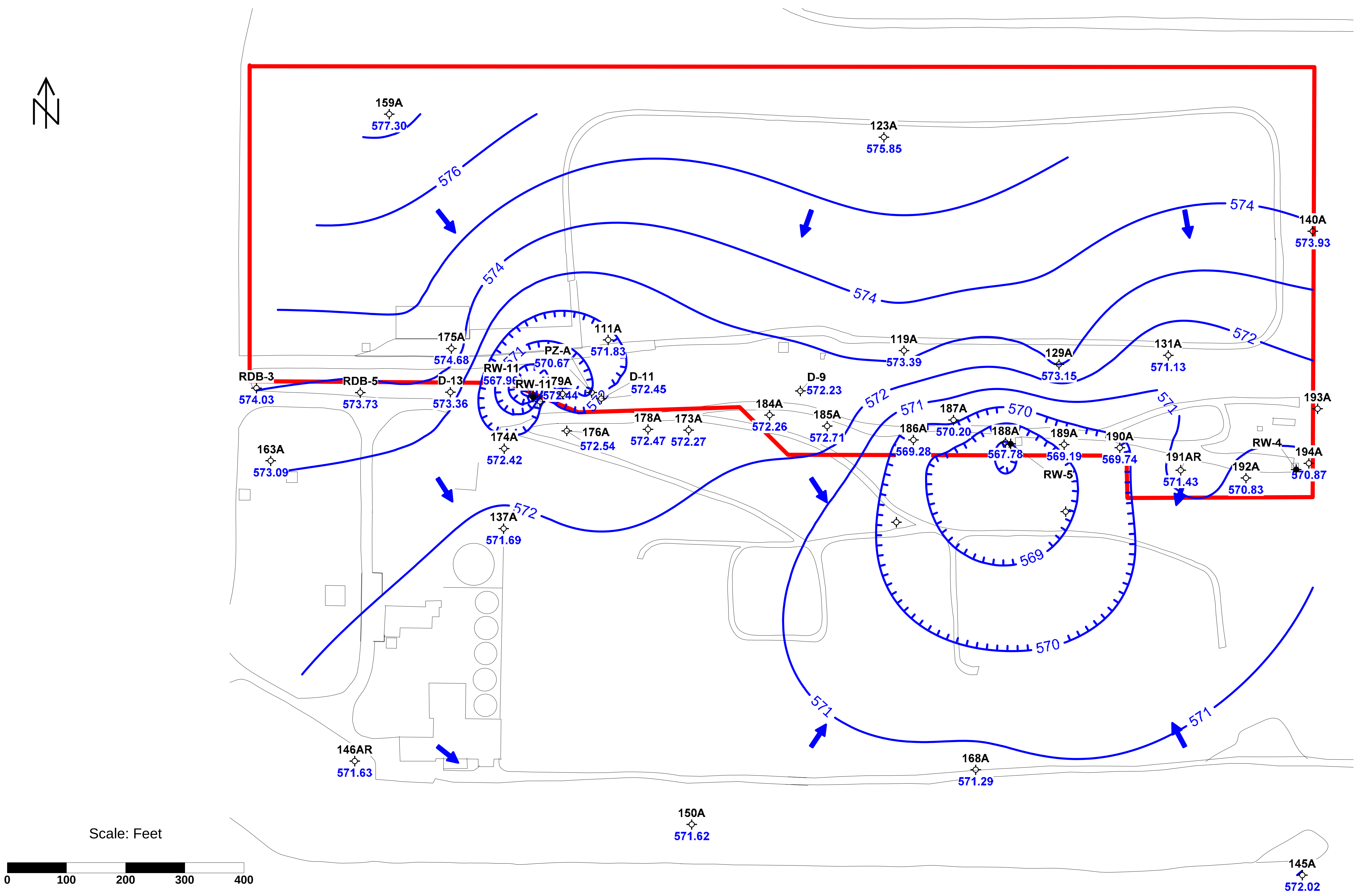


Necco 2013 E Zone Water Elev Trends.xlsx

Figure 3-7
Select F-Zone Monitoring Wells
Groundwater Elevations 2005 Through 2013
DuPont Necco Park



Necco 2013 F Zone Water Elev Trends.xlsx



Contour Interval = 1 foot **Elevation datum feet AMSL** **191A was decommissioned in October 2013 and replaced with 191AR.**

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Buffalo, NY 14202
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Created by: RBP	Date: 01-07-14
Checked by: JWS	Date: 01-10-14
Project Manager: EAF	Date: 01-10-14

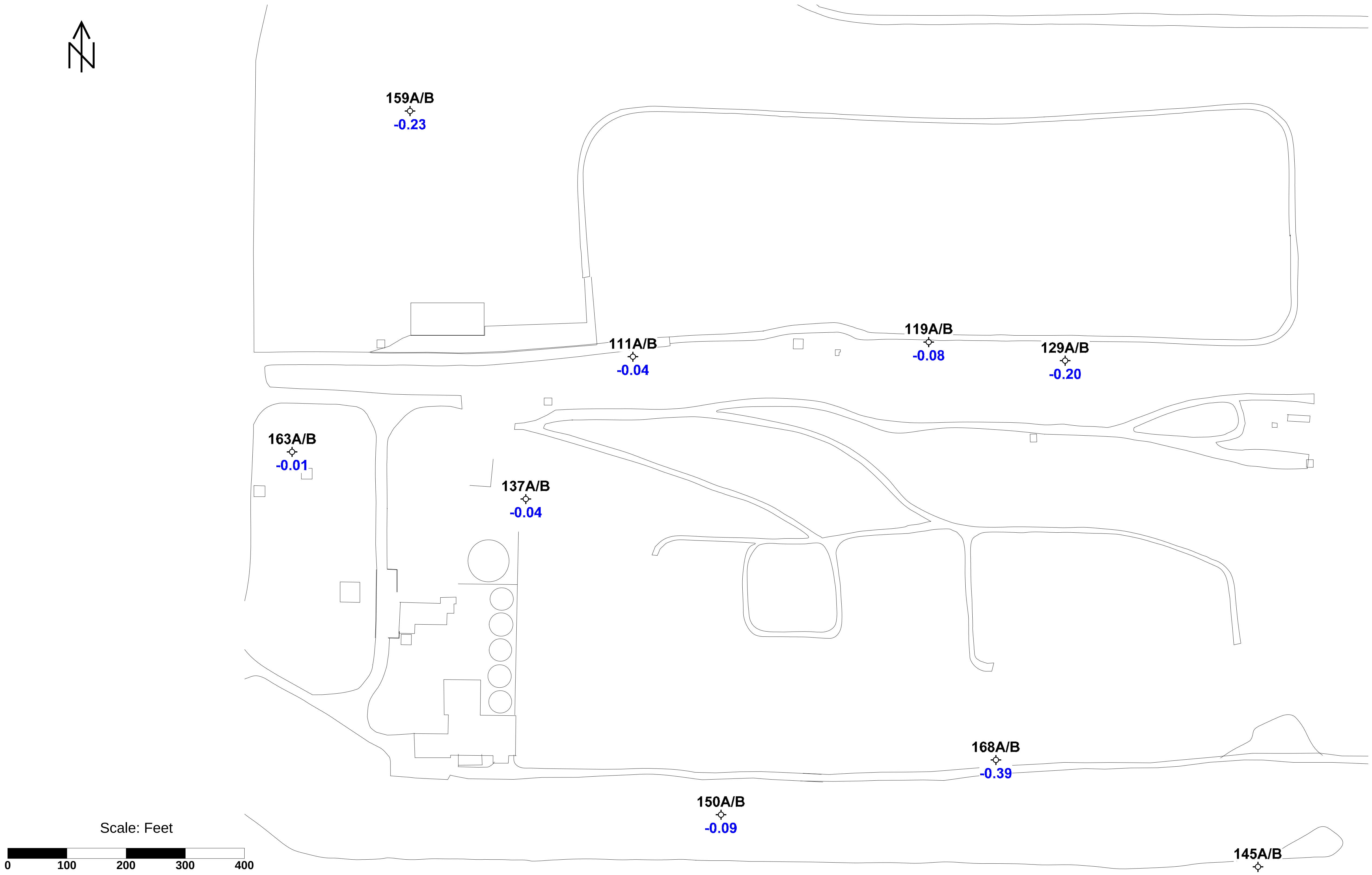
Job number: 447777.02000

LEGEND

3B	**Well ID**		**Potentiometric Contour**		**Source Area Extent**
⌖	**Monitoring Well**		**Structure**		
●	**Pumping Well**		**Road**		

Figure 3-8
Potentiometric Surface Map
DuPont Necco Park: A-Zone
November 20, 2013

//nybuf03fs01/Dupont$/Necco/HydroGeo/Hydro/GW_contours/2013-11-20 NEC Contour Tool/2013-11-20 - A PZ - F2.srf



Negative value indicates downward gradient

Elevation datum feet AMSL

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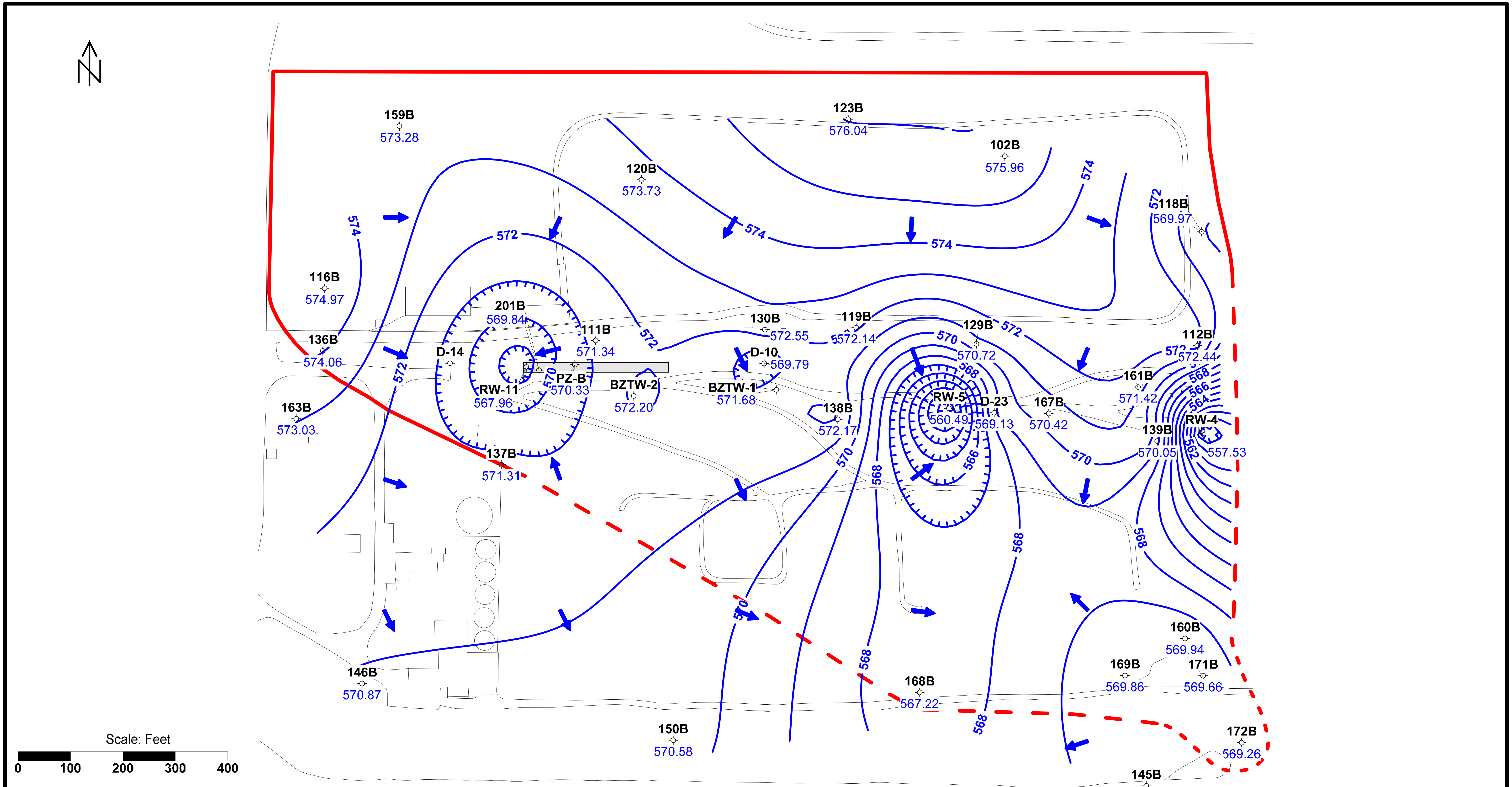
Job number: 447777.02000	

LEGEND

3B	**Well ID**		**Potentiometric Contour**
⌖	**Monitoring Well**	▭	**Structure**
✦	**Pumping Well**		**Road**

Figure 3-9
Vertical Gradient: A-Zone to B-Zone
DuPont Necco Park
November 20, 2013

//nybuf03fs01/Dupont$/Necco/HydroGeo/Hydro/GW_contours/2013-11-20 NEC Contour Tool/2013-11-20 - ABvgrad - F3.srf



Contour interval = 1.0 foot
Elevation datum feet AMSL
Wells 149B and 151B are outside the area shown, but were used in the contouring.
Wells 170B, TRW-6, and TRW-7 were not used in the contouring.

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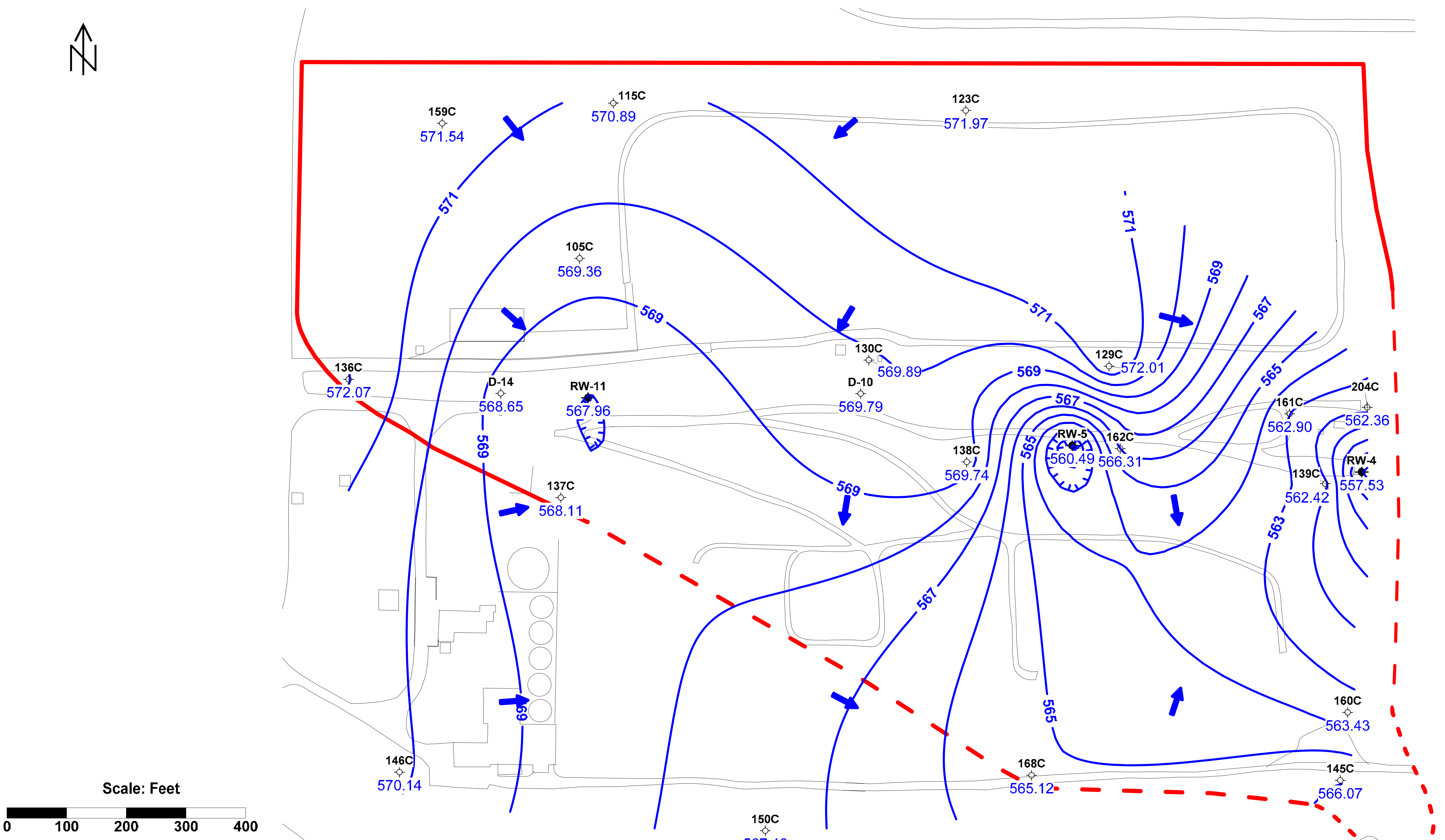
Project Manager: EAF	Date: 01-10-14
Job number: 447777.02000	

LEGEND

3B	**Well ID**	∕	**Potentiometric Contour**	– – —	**Source Area Extent**
⌖	**Monitoring Well**	▭	**Structure**	▬	**Bedrock Fractured Blast Trench**
✦	**Pumping Well**	═	**Road**		

Figure 3-10
Potentiometric Surface Map
DuPont Necco Park: B-Zone
November 20, 2013

//nybuf03fs01/Dupont$/Necco/HydroGeo/Hydro/GW_contours/2013-11-20 NEC Contour Tool/2013-11-20 - PZ B - F5.srf



Contour interval = 1.0 foot

Elevation datum feet AMSL

Well 112C was not used in the contouring due to suspect casing.

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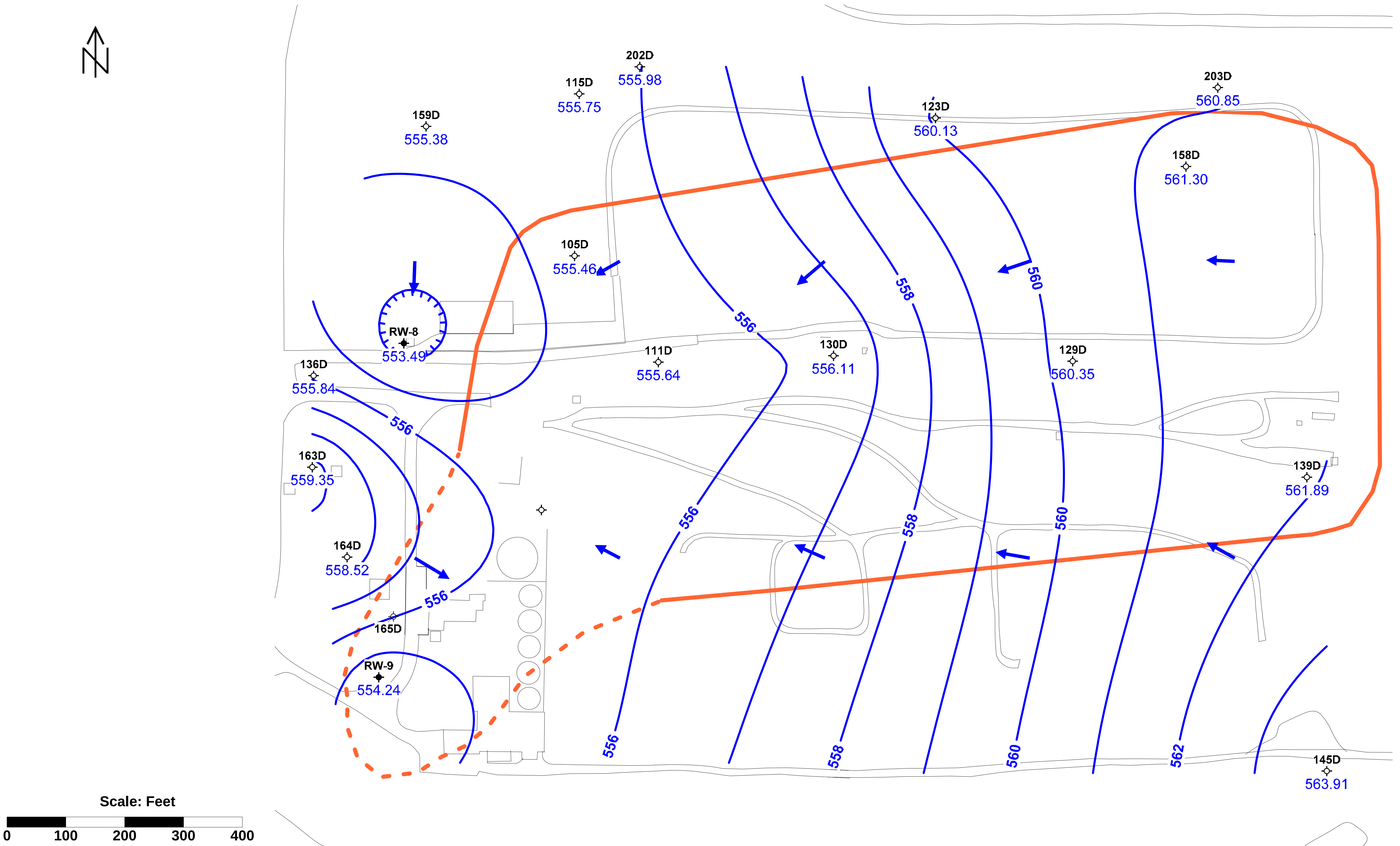
Job number: 447777.02000	

LEGEND

3B	Well ID	╱	Potentiometric Contour
✧	Monitoring Well	▭	Structure
◆	Pumping Well	═	Road
- - - ━━	Source Area Extent		

Figure 3-11
Potentiometric Surface Map
DuPont Necco Park: C-Zone
November 20, 2013

//nybuf03fs01/Dupont$/Necco/HydroGeo/Hydro/GW_contours/2013-11-20 NEC Contour Tool/2013-11-20 - PZ C - F7.srf



Contour interval = 1.0 feet
Elevation datum feet AMSL
Well 149D, located outside the map area, was used in the contour interpolation.
Well 148D located downgradient was not used in the interpolation.

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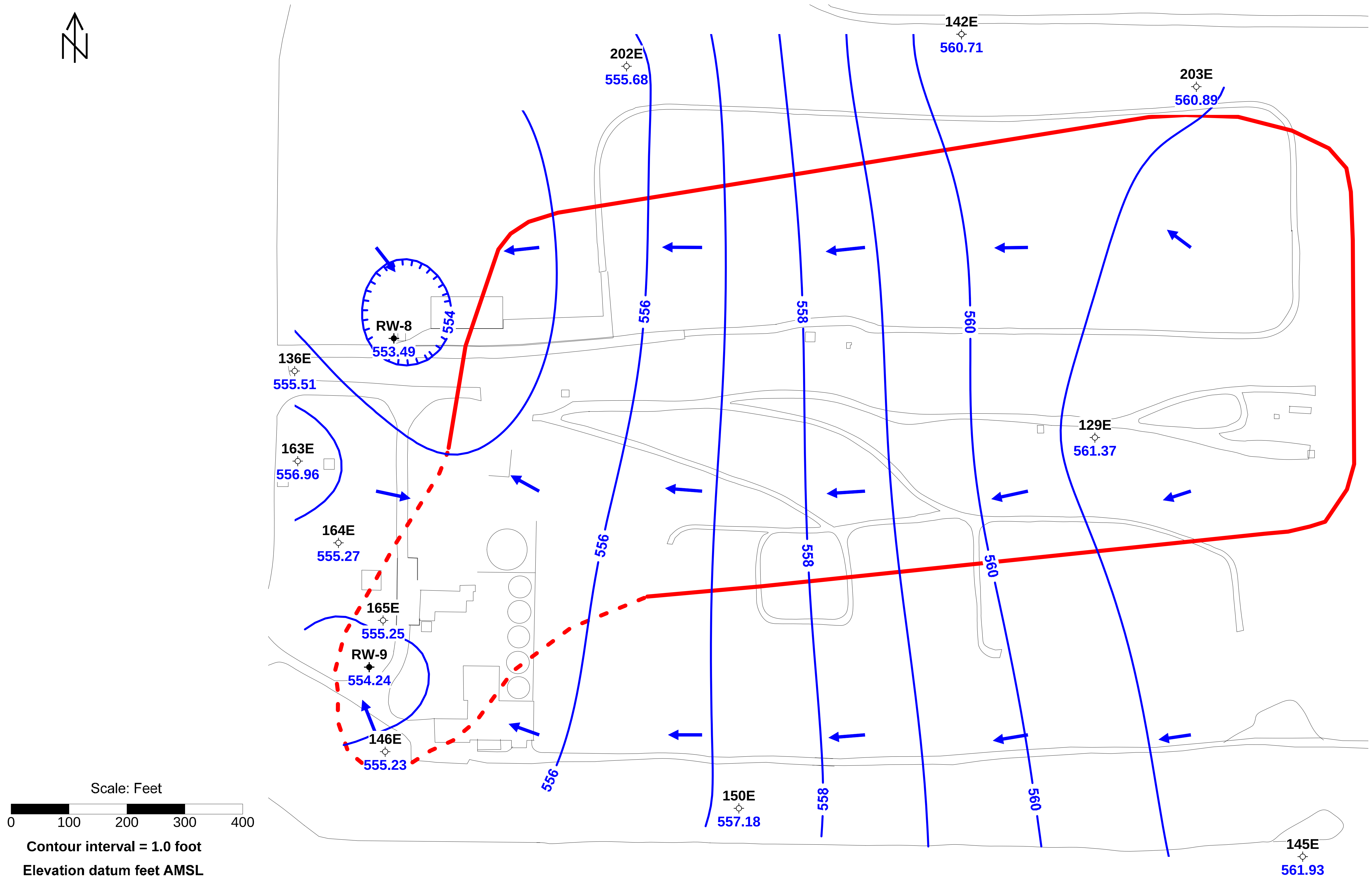
Project Manager: EAF	Date: 01-10-14
Job number: 447777.02000	

LEGEND

3B	Well ID		Potentiometric Contour	- - —	Source Area Extent
⌖	Monitoring Well	▭	Structure		
✦	Pumping Well		Road		

Figure 3-12
Potentiometric Surface Map
DuPont Necco Park: D-Zone
November 20, 2013

//nybuf03fs01/Dupont$/Necco/HydroGeo/Hydro/GW_contours/2013-11-20 NEC Contour Tool/2013-11-20 - PZ D - F9.srf



Contour interval = 1.0 foot

Elevation datum feet AMSL

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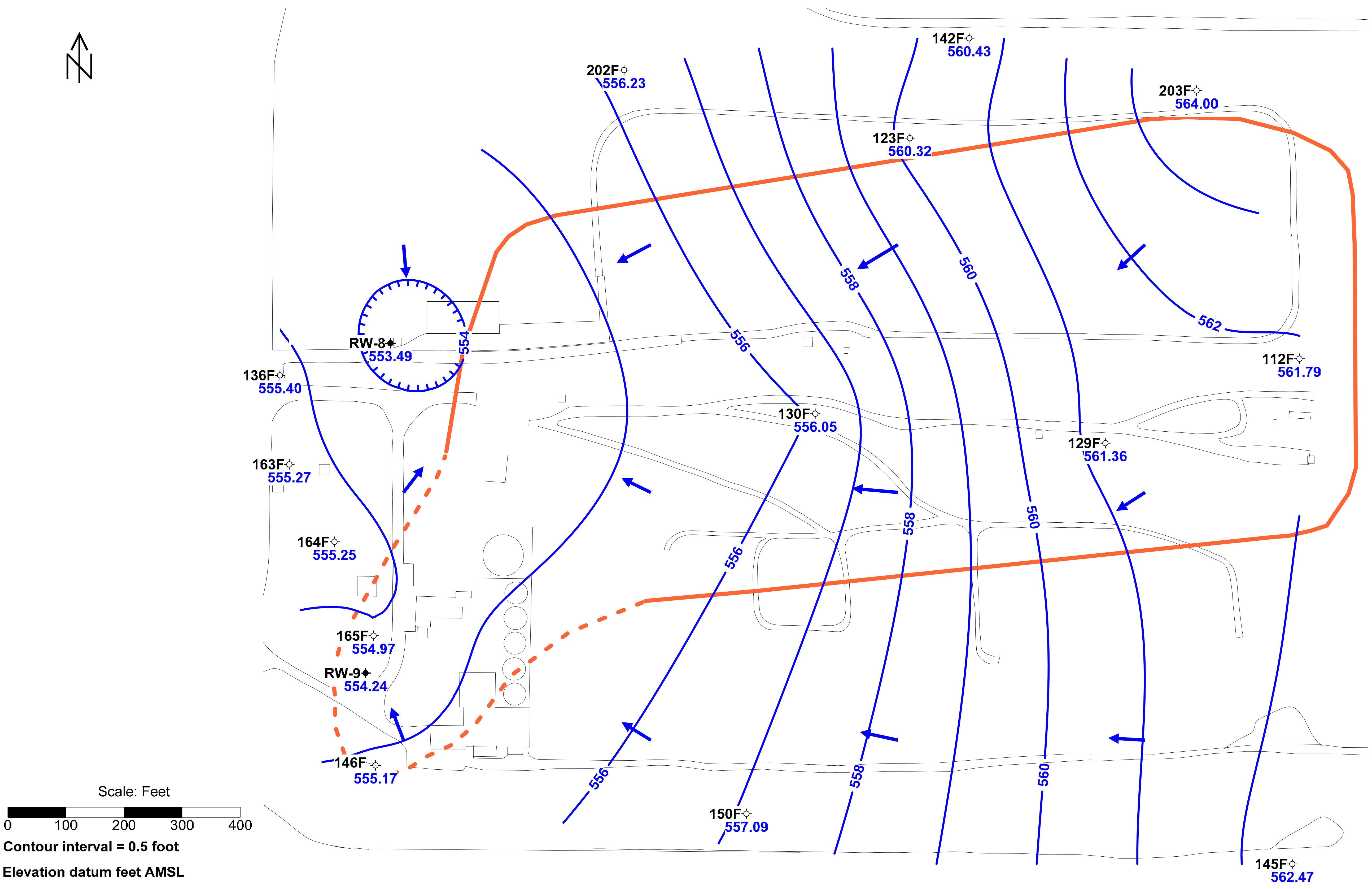
Checked by: JWS	Date: 01-10-14
Project Manager: EAF	Date: 01-10-14
Job number: 447777.02000	

LEGEND

3B	**Well ID**		**Potentiometric Contour**
⌖	**Monitoring Well**	▭	**Structure**
◆	**Pumping Well**		**Road**
			Source Area Extent

Figure 3-13
Potentiometric Surface Map
DuPont Necco Park: E-Zone
November 20, 2013

//nybuf03fs01/Dupont$/Necco/HydroGeo/Hydro/GW_contours/2013-11-20 NEC Contour Tool/2013-11-20 - PZ E - F11.srf



Contour interval = 0.5 foot

Elevation datum feet AMSL

148F located downgradient was not used in the interpolation.

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(716) 541-0730

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Checked by: JWS	Date: 01-10-14
Project Manager: EAF	Date: 01-10-14
Job number: 447777.02000	

LEGEND

3B	Well ID	Potentiometric Contour	Source Area Extent
✧	Monitoring Well	Structure	
✦	Pumping Well	Road	

Figure 3-14
Potentiometric Surface Map
DuPont Necco Park: F-Zone
November 20, 2013

//nybuf03fs01/Dupont$/Necco/HydroGeo/Hydro/GW_contours/2013-11-20 NEC Contour Tool/2013-11-20 - PZ F - F13.srf

APPENDIX A
WELL ABANDONMENT AND WELL REPLACEMENT LOGS

PARSONS

LOG OF BORING 191AR

(Page 1 of 1)

NECCO Park
Niagara Falls Blvd and 56th Ave
Niagara Falls, NY 14302
448576.02050

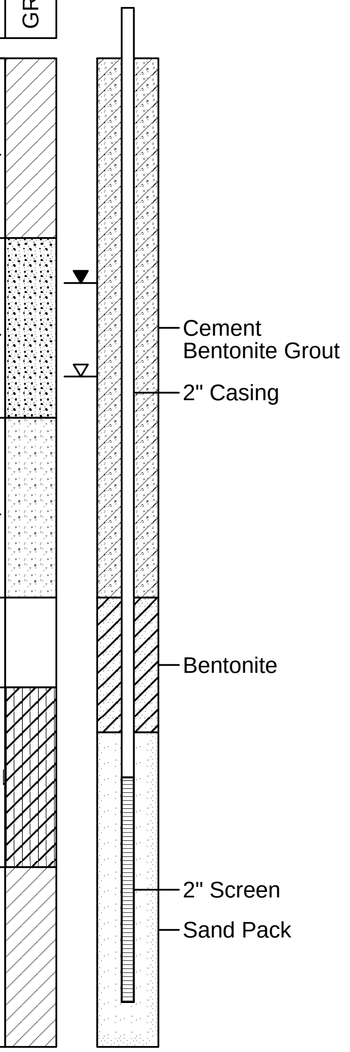
Drilling Start Date	: 8 October 2013	Weather	: Sunny, 60F
Drilling Finish Date	: 8 October 2013	Geologist	: R. Piurek
Drilling Company	: Nothnagle	Screen type/diam.	: Sch. 40 / 2"
Method	: CME 85, 4.25" HSA	Scr. Length/slot	: 5' / 0.010
Hole Diameter	: 8"	Depth to Water	: 8'

Water Levels
▼ During Drilling
▽ After Completion: 11/20/13

Well: 191AR
Elev.:

Depth in feet	Samples	Recovery %	Blows	PID (ppm)	DESCRIPTION	USCS
1	1	45	1-1-2-4	0.0	Brown TILL, silt and clay with some organic matter (roots), trace sand and gravel, slightly moist-dry.	FILL
3	2	45	6-7-7-8	0.0	Light brown/red TILL, silt, trace sand and clay, dry.	
5	3	75	33-17-29-15	0.1	Black-gray FILL, fine to coarse gravel and sand, some to little ash, brick/slag, dry.	FILL
7	4	45	10-23-14-8	0.0	Black-gray FILL, fine to coarse gravel and sand, slag, ash, trace brick fragments, dry.	
9	5	10	6-4-3-3	0.0	Black-dark gray, coarse to fine SLAG and GRAVEL, trace coarse sand, wet. Fill.	FILL
11	6	35	3-7-9-20	0.0	Light gray-black, coarse to fine GRAVEL and SLAG fill, trace coarse sand, wet.	
13	7	0	7-8-7-9	0.0	No recovery. Water in spoon. Wet.	
15	8	70	3-10-12-13	3.3	Light brown-red CLAY and SILT, moist.	CL/ ML
17	9	100	1-1-1-1	0.3	Light brown-red CLAY and SILT, moist.	
19	10	65	WOH	0.0	Light brown CLAY, soft, moist.	CL
21	11	100	WOH	30.6	Light brown CLAY, soft, moist. PID hit at 21.5' BGS. Potential free phase at 21.5'. Moderate odor.	

End of boring @ 22'



WELL DECOMISSIONING RECORD

Site Name: NECCO Park
Site Location: Niagara Falls, NY
Drilling Company: Nothnagle

Well ID: 119AT
Driller: Steve Lorenty
Inspector: Dan Chamberland
Date: 10/10/2013

DECOMMISSIONING DATA
(FILL IN ALL THAT APPLY)

WELL SCHEMATIC

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Diameter (in.)	
Temporary Casing Installed	
Casking type/diameter (in.)	
Method of Installing	

CASING PULLING

Method employed	Rig Pull
Casing Retrieved (ft.)	0.5
Casing type/diameter (in)	2" PVC

CASING PERFORATING

Equipment Used	
Number of Perforations/foot	
Size of perforations	
Interval Perforated	

GROUTING

Interval grouted (FBLS)	0-17
# of batches prepared	2
For each batch record:	
Amount of water used (gal)	16
Amount of cement used (lbs)	188
Cement Type	Portland
Quantity of bentonite used (lbs)	7.8
Volume of grout prepared (gal)	22
Volume of grout used (gal)	22

COMMENTS:

WELL DECOMISSIONING RECORD

Site Name: NECCO Park
Site Location: Niagara Falls, NY
Drilling Company: Nothnagle

Well ID: 129AT
Driller: Steve Lorenty
Inspector: Dan Chamberland
Date: 10/10/2013

DECOMMISSIONING DATA
(FILL IN ALL THAT APPLY)

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Diameter (in.)	
Temporary Casing Installed	
Casking type/diameter (in.)	
Method of Installing	

CASING PULLING

Method employed	Rig Pull
Casing Retrieved (ft.)	1
Casing type/diameter (in)	2" PVC

CASING PERFORATING

Equipment Used	
Number of Perforations/foot	
Size of perforations	
Interval Perforated	

GROUTING

Interval grouted (FBLS)	0-18
# of batches prepared	1
For each batch record:	
Amount of water used (gal)	7.8
Amount of cement used (lbs)	94
Cement Type	Portland
Quantity of bentonite used (lbs)	3.9
Volume of grout prepared (gal)	11
Volume of grout used (gal)	11

COMMENTS:

WELL SCHEMATIC

WELL DECOMISSIONING RECORD

Site Name: NECCO Park
Site Location: Niagara Falls, NY
Drilling Company: Nothnagle
Well ID: 180AT
Driller: Steve Lorenty
Inspector: Rob Piurek
Date: 10/9/2013

DECOMMISSIONING DATA
(FILL IN ALL THAT APPLY)

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Diameter (in.)	
Temporary Casing Installed	
Casking type/diameter (in.)	
Method of Installing	

CASING PULLING

Method employed	Rig Pull
Casing Retrieved (ft.)	10
Casing type/diameter (in)	2" PVC

CASING PERFORATING

Equipment Used	
Number of Perforations/foot	
Size of perforations	
Interval Perforated	

GROUTING

Interval grouted (FBLS)	0-10
# of batches prepared	1
For each batch record:	
Amount of water used (gal)	7.8
Amount of cement used (lbs)	94
Cement Type	Portland
Quantity of bentonite used (lbs)	3.9
Volume of grout prepared (gal)	11
Volume of grout used (gal)	11

COMMENTS:

WELL SCHEMATIC

WELL DECOMISSIONING RECORD

Site Name: NECCO Park
Site Location: Niagara Falls, NY
Drilling Company: Nothnagle

Well ID: 184AT
Driller: Steve Lorenty
Inspector: Dan Chamberland
Date: 10/9/2013

DECOMMISSIONING DATA
(FILL IN ALL THAT APPLY)

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Diameter (in.)	
Temporary Casing Installed	
Casking type/diameter (in.)	
Method of Installing	

CASING PULLING

Method employed	Rig Pull
Casing Retrieved (ft.)	10
Casing type/diameter (in)	2" PVC

CASING PERFORATING

Equipment Used	
Number of Perforations/foot	
Size of perforations	
Interval Perforated	

GROUTING

Interval grouted (FBLS)	0-10.4
# of batches prepared	1
For each batch record:	
Amount of water used (gal)	7.8
Amount of cement used (lbs)	94
Cement Type	Portland
Quantity of bentonite used (lbs)	3.9
Volume of grout prepared (gal)	11
Volume of grout used (gal)	11

COMMENTS:

WELL SCHEMATIC

WELL DECOMISSIONING RECORD

Site Name: NECCO Park
Site Location: Niagara Falls, NY
Drilling Company: Nothnagle

Well ID: 185AT
Driller: Steve Lorenty
Inspector: Dan Chamberland
Date: 10/9/2013

DECOMMISSIONING DATA (FILL IN ALL THAT APPLY)

WELL SCHEMATIC

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Diameter (in.)	
Temporary Casing Installed	
Casking type/diameter (in.)	
Method of Installing	

CASING PULLING

Method employed	Rig Pull
Casing Retrieved (ft.)	15
Casing type/diameter (in)	2" PVC

CASING PERFORATING

Equipment Used	
Number of Perforations/foot	
Size of perforations	
Interval Perforated	

GROUTING

Interval grouted (FBLS)	0-11
# of batches prepared	1
For each batch record:	
Amount of water used (gal)	7.8
Amount of cement used (lbs)	94
Cement Type	Portland
Quantity of bentonite used (lbs)	3.9
Volume of grout prepared (gal)	11
Volume of grout used (gal)	11

COMMENTS:

WELL DECOMISSIONING RECORD

Site Name: NECCO Park
Site Location: Niagara Falls, NY
Drilling Company: Nothnagle

Well ID: 186AT
Driller: Steve Lorenty
Inspector: Dan Chamberland
Date: 10/9/2013

DECOMMISSIONING DATA
(FILL IN ALL THAT APPLY)

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Diameter (in.)	
Temporary Casing Installed	
Casking type/diameter (in.)	
Method of Installing	

CASING PULLING

Method employed	Rig Pull
Casing Retrieved (ft.)	12
Casing type/diameter (in)	2" PVC

CASING PERFORATING

Equipment Used	
Number of Perforations/foot	
Size of perforations	
Interval Perforated	

GROUTING

Interval grouted (FBLS)	0-10.8
# of batches prepared	1
For each batch record:	
Amount of water used (gal)	7.8
Amount of cement used (lbs)	94
Cement Type	Portland
Quantity of bentonite used (lbs)	3.9
Volume of grout prepared (gal)	11
Volume of grout used (gal)	11

COMMENTS:

WELL SCHEMATIC

WELL DECOMISSIONING RECORD

Site Name: NECCO Park
Site Location: Niagara Falls, NY
Drilling Company: Nothnagle

Well ID: 187AT
Driller: Steve Lorenty
Inspector: Rob Piurek
Date: 10/8/2013

DECOMMISSIONING DATA
(FILL IN ALL THAT APPLY)

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Diameter (in.)	
Temporary Casing Installed	
Casking type/diameter (in.)	
Method of Installing	

CASING PULLING

Method employed	Rig Pull
Casing Retrieved (ft.)	10
Casing type/diameter (in)	2" PVC

CASING PERFORATING

Equipment Used	
Number of Perforations/foot	
Size of perforations	
Interval Perforated	

GROUTING

Interval grouted (FBLS)	0-10
# of batches prepared	1
For each batch record:	
Amount of water used (gal)	7.8
Amount of cement used (lbs)	94
Cement Type	Portland
Quantity of bentonite used (lbs)	3.9
Volume of grout prepared (gal)	11
Volume of grout used (gal)	11

COMMENTS:

WELL SCHEMATIC

WELL DECOMISSIONING RECORD

Site Name: NECCO Park
Site Location: Niagara Falls, NY
Drilling Company: Nothnagle

Well ID: 188AT
Driller: Steve Lorenty
Inspector: Dan Chamberland
Date: 10/9/2013

DECOMMISSIONING DATA
(FILL IN ALL THAT APPLY)

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Diameter (in.)	
Temporary Casing Installed	
Casking type/diameter (in.)	
Method of Installing	

CASING PULLING

Method employed	Rig Pull
Casing Retrieved (ft.)	10
Casing type/diameter (in)	2" PVC

CASING PERFORATING

Equipment Used	
Number of Perforations/foot	
Size of perforations	
Interval Perforated	

GROUTING

Interval grouted (FBLS)	0-10.4
# of batches prepared	1
For each batch record:	
Amount of water used (gal)	7.8
Amount of cement used (lbs)	94
Cement Type	Portland
Quantity of bentonite used (lbs)	3.9
Volume of grout prepared (gal)	11
Volume of grout used (gal)	11

COMMENTS:

WELL SCHEMATIC

WELL DECOMISSIONING RECORD

Site Name: NECCO Park
Site Location: Niagara Falls, NY
Drilling Company: Nothnagle

Well ID: 189AT
Driller: Steve Lorenty
Inspector: Rob Piurek
Date: 10/9/2013

DECOMMISSIONING DATA
(FILL IN ALL THAT APPLY)

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Diameter (in.)	
Temporary Casing Installed	
Casking type/diameter (in.)	
Method of Installing	

CASING PULLING

Method employed	Rig Pull
Casing Retrieved (ft.)	10
Casing type/diameter (in)	2" PVC

CASING PERFORATING

Equipment Used	
Number of Perforations/foot	
Size of perforations	
Interval Perforated	

GROUTING

Interval grouted (FBLS)	0-10.5
# of batches prepared	1
For each batch record:	
Amount of water used (gal)	7.8
Amount of cement used (lbs)	94
Cement Type	Portland
Quantity of bentonite used (lbs)	3.9
Volume of grout prepared (gal)	11
Volume of grout used (gal)	11

COMMENTS:

WELL SCHEMATIC

WELL DECOMISSIONING RECORD

Site Name: NECCO Park
Site Location: Niagara Falls, NY
Drilling Company: Nothnagle

Well ID: 190AT
Driller: Steve Lorenty
Inspector: Rob Piurek
Date: 10/9/2013

DECOMMISSIONING DATA
(FILL IN ALL THAT APPLY)

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Diameter (in.)	
Temporary Casing Installed	
Casking type/diameter (in.)	
Method of Installing	

CASING PULLING

Method employed	Rig Pull
Casing Retrieved (ft.)	10
Casing type/diameter (in)	2" PVC

CASING PERFORATING

Equipment Used	
Number of Perforations/foot	
Size of perforations	
Interval Perforated	

GROUTING

Interval grouted (FBLS)	0-11.5
# of batches prepared	1
For each batch record:	
Amount of water used (gal)	7.8
Amount of cement used (lbs)	94
Cement Type	Portland
Quantity of bentonite used (lbs)	3.9
Volume of grout prepared (gal)	11
Volume of grout used (gal)	11

COMMENTS:

WELL SCHEMATIC

WELL DECOMISSIONING RECORD

Site Name: NECCO Park
Site Location: Niagara Falls, NY
Drilling Company: Nothnagle
Well ID: 191A
Driller: Steve Lorenty
Inspector: Rob Piurek
Date: 10/7/2013

DECOMMISSIONING DATA
(FILL IN ALL THAT APPLY)

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Diameter (in.)	
Temporary Casing Installed	
Casking type/diameter (in.)	
Method of Installing	

CASING PULLING

Method employed	Rig Pull
Casing Retrieved (ft.)	4
Casing type/diameter (in)	2" PVC

CASING PERFORATING

Equipment Used	
Number of Perforations/foot	
Size of perforations	
Interval Perforated	

GROUTING

Interval grouted (FBLS)	0-22
# of batches prepared	2
For each batch record:	
Amount of water used (gal)	16
Amount of cement used (lbs)	188
Cement Type	Portland
Quantity of bentonite used (lbs)	7.8
Volume of grout prepared (gal)	22
Volume of grout used (gal)	22

COMMENTS:

Measured depth of 12.2'BGS. Tremie rod down to about 22' BGS.

WELL SCHEMATIC

WELL DECOMISSIONING RECORD

Site Name: NECCO Park
Site Location: Niagara Falls, NY
Drilling Company: Nothnagle

Well ID: 191AT
Driller: Steve Lorenty
Inspector: Rob Piurek
Date: 10/7/2013

DECOMMISSIONING DATA
(FILL IN ALL THAT APPLY)

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Diameter (in.)	
Temporary Casing Installed	
Casking type/diameter (in.)	
Method of Installing	

CASING PULLING

Method employed	Rig Pull
Casing Retrieved (ft.)	4
Casing type/diameter (in)	2" PVC

CASING PERFORATING

Equipment Used	
Number of Perforations/foot	
Size of perforations	
Interval Perforated	

GROUTING

Interval grouted (FBLS)	0-23.4
# of batches prepared	1
For each batch record:	
Amount of water used (gal)	7.8
Amount of cement used (lbs)	94
Cement Type	Portland
Quantity of bentonite used (lbs)	3.9
Volume of grout prepared (gal)	11
Volume of grout used (gal)	8

COMMENTS:

WELL SCHEMATIC

WELL DECOMISSIONING RECORD

Site Name: NECCO Park
Site Location: Niagara Falls, NY
Drilling Company: Nothnagle

Well ID: 192AT
Driller: Steve Lorenty
Inspector: Rob Piurek
Date: 10/7/2013

DECOMMISSIONING DATA
(FILL IN ALL THAT APPLY)

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Diameter (in.)	
Temporary Casing Installed	
Casking type/diameter (in.)	
Method of Installing	

CASING PULLING

Method employed	Rig Pull
Casing Retrieved (ft.)	4
Casing type/diameter (in)	2" PVC

CASING PERFORATING

Equipment Used	
Number of Perforations/foot	
Size of perforations	
Interval Perforated	

GROUTING

Interval grouted (FBLS)	0-13.5
# of batches prepared	2
For each batch record:	
Amount of water used (gal)	16
Amount of cement used (lbs)	188
Cement Type	Portland
Quantity of bentonite used (lbs)	7.8
Volume of grout prepared (gal)	17
Volume of grout used (gal)	17

COMMENTS:

WELL SCHEMATIC

WELL DECOMISSIONING RECORD

Site Name: NECCO Park
Site Location: Niagara Falls, NY
Drilling Company: Nothnagle

Well ID: 193AT
Driller: Steve Lorenty
Inspector: Dan Chamberland
Date: 10/9/2013

DECOMMISSIONING DATA
(FILL IN ALL THAT APPLY)

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Diameter (in.)	
Temporary Casing Installed	
Casking type/diameter (in.)	
Method of Installing	

CASING PULLING

Method employed	Truck Pull
Casing Retrieved (ft.)	4
Casing type/diameter (in)	2" PVC

CASING PERFORATING

Equipment Used	
Number of Perforations/foot	
Size of perforations	
Interval Perforated	

GROUTING

Interval grouted (FBLS)	0-10.0
# of batches prepared	1
For each batch record:	
Amount of water used (gal)	7.8
Amount of cement used (lbs)	94
Cement Type	Portland
Quantity of bentonite used (lbs)	3.9
Volume of grout prepared (gal)	11
Volume of grout used (gal)	11

COMMENTS:

WELL SCHEMATIC

WELL DECOMISSIONING RECORD

Site Name: NECCO Park
Site Location: Niagara Falls, NY
Drilling Company: Nothnagle

Well ID: 194AT
Driller: Steve Lorenty
Inspector: Rob Piurek
Date: 10/7/2013

DECOMMISSIONING DATA
(FILL IN ALL THAT APPLY)

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Diameter (in.)	
Temporary Casing Installed	
Casking type/diameter (in.)	
Method of Installing	

CASING PULLING

Method employed	Rig Pull
Casing Retrieved (ft.)	13.5
Casing type/diameter (in)	2" PVC

CASING PERFORATING

Equipment Used	
Number of Perforations/foot	
Size of perforations	
Interval Perforated	

GROUTING

Interval grouted (FBLS)	0-13.5
# of batches prepared	1
For each batch record:	
Amount of water used (gal)	7.8
Amount of cement used (lbs)	94
Cement Type	Portland
Quantity of bentonite used (lbs)	3.9
Volume of grout prepared (gal)	11
Volume of grout used (gal)	6

COMMENTS:

WELL SCHEMATIC

WELL DECOMISSIONING RECORD

Site Name: NECCO Park
Site Location: Niagara Falls, NY
Drilling Company: Nothnagle

Well ID: 195AT
Driller: Steve Lorenty
Inspector: Dan Chamberland
Date: 10/9/2013

DECOMMISSIONING DATA
(FILL IN ALL THAT APPLY)

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Diameter (in.)	
Temporary Casing Installed	
Casking type/diameter (in.)	
Method of Installing	

CASING PULLING

Method employed	Truck Pull
Casing Retrieved (ft.)	10
Casing type/diameter (in)	2" PVC

CASING PERFORATING

Equipment Used	
Number of Perforations/foot	
Size of perforations	
Interval Perforated	

GROUTING

Interval grouted (FBLS)	0-11
# of batches prepared	1
For each batch record:	
Amount of water used (gal)	7.8
Amount of cement used (lbs)	94
Cement Type	Portland
Quantity of bentonite used (lbs)	3.9
Volume of grout prepared (gal)	11
Volume of grout used (gal)	11

COMMENTS:

WELL SCHEMATIC

WELL DECOMISSIONING RECORD

Site Name: NECCO Park
Site Location: Niagara Falls, NY
Drilling Company: Nothnagle

Well ID: 196AT
Driller: Steve Lorenty
Inspector: Dan Chamberland
Date: 10/9/2013

DECOMMISSIONING DATA
(FILL IN ALL THAT APPLY)

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Diameter (in.)	
Temporary Casing Installed	
Casking type/diameter (in.)	
Method of Installing	

CASING PULLING

Method employed	Truck Pull
Casing Retrieved (ft.)	10
Casing type/diameter (in)	2" PVC

CASING PERFORATING

Equipment Used	
Number of Perforations/foot	
Size of perforations	
Interval Perforated	

GROUTING

Interval grouted (FBLS)	0-12
# of batches prepared	1
For each batch record:	
Amount of water used (gal)	7.8
Amount of cement used (lbs)	94
Cement Type	Portland
Quantity of bentonite used (lbs)	3.9
Volume of grout prepared (gal)	11
Volume of grout used (gal)	11

COMMENTS:

WELL SCHEMATIC

WELL DECOMISSIONING RECORD

Site Name: NECCO Park
Site Location: Niagara Falls, NY
Drilling Company: Nothnagle

Well ID: 197AT
Driller: Steve Lorenty
Inspector: Dan Chamberland
Date: 10/9/2013

DECOMMISSIONING DATA
(FILL IN ALL THAT APPLY)

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Diameter (in.)	
Temporary Casing Installed	
Casking type/diameter (in.)	
Method of Installing	

CASING PULLING

Method employed	Truck Pull
Casing Retrieved (ft.)	10
Casing type/diameter (in)	2" PVC

CASING PERFORATING

Equipment Used	
Number of Perforations/foot	
Size of perforations	
Interval Perforated	

GROUTING

Interval grouted (FBLS)	0-13
# of batches prepared	1
For each batch record:	
Amount of water used (gal)	7.8
Amount of cement used (lbs)	94
Cement Type	Portland
Quantity of bentonite used (lbs)	3.9
Volume of grout prepared (gal)	11
Volume of grout used (gal)	11

COMMENTS:

WELL SCHEMATIC

WELL DECOMISSIONING RECORD

Site Name: NECCO Park
Site Location: Niagara Falls, NY
Drilling Company: Nothnagle

Well ID: 198AT
Driller: Steve Lorenty
Inspector: Dan Chamberland
Date: 10/9/2013

DECOMMISSIONING DATA
(FILL IN ALL THAT APPLY)

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Diameter (in.)	
Temporary Casing Installed	
Casking type/diameter (in.)	
Method of Installing	

CASING PULLING

Method employed	Truck Pull
Casing Retrieved (ft.)	10
Casing type/diameter (in)	2" Stainless

CASING PERFORATING

Equipment Used	
Number of Perforations/foot	
Size of perforations	
Interval Perforated	

GROUTING

Interval grouted (FBLS)	0-13.3
# of batches prepared	1
For each batch record:	
Amount of water used (gal)	7.8
Amount of cement used (lbs)	94
Cement Type	Portland
Quantity of bentonite used (lbs)	3.9
Volume of grout prepared (gal)	11
Volume of grout used (gal)	11

COMMENTS:

WELL SCHEMATIC

WELL DECOMISSIONING RECORD

Site Name: NECCO Park
Site Location: Niagara Falls, NY
Drilling Company: Nothnagle

Well ID: 199AT
Driller: Steve Lorenty
Inspector: Dan Chamberland
Date: 10/9/2013

DECOMMISSIONING DATA
(FILL IN ALL THAT APPLY)

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Diameter (in.)	
Temporary Casing Installed	
Casking type/diameter (in.)	
Method of Installing	

CASING PULLING

Method employed	Truck Pull
Casing Retrieved (ft.)	1
Casing type/diameter (in)	2" PVC

CASING PERFORATING

Equipment Used	
Number of Perforations/foot	
Size of perforations	
Interval Perforated	

GROUTING

Interval grouted (FBLS)	0-13.7
# of batches prepared	1
For each batch record:	
Amount of water used (gal)	7.8
Amount of cement used (lbs)	94
Cement Type	Portland
Quantity of bentonite used (lbs)	3.9
Volume of grout prepared (gal)	11
Volume of grout used (gal)	22

COMMENTS:

WELL SCHEMATIC

WELL DECOMISSIONING RECORD

Site Name: NECCO Park
Site Location: Niagara Falls, NY
Drilling Company: Nothnagle

Well ID: 200AT
Driller: Steve Lorenty
Inspector: Dan Chamberland
Date: 10/9/2013

DECOMMISSIONING DATA
(FILL IN ALL THAT APPLY)

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Diameter (in.)	
Temporary Casing Installed	
Casking type/diameter (in.)	
Method of Installing	

CASING PULLING

Method employed	Truck Pull
Casing Retrieved (ft.)	0.5
Casing type/diameter (in)	2" PVC

CASING PERFORATING

Equipment Used	
Number of Perforations/foot	
Size of perforations	
Interval Perforated	

GROUTING

Interval grouted (FBLS)	0-13
# of batches prepared	1
For each batch record:	
Amount of water used (gal)	7.8
Amount of cement used (lbs)	94
Cement Type	Portland
Quantity of bentonite used (lbs)	3.9
Volume of grout prepared (gal)	11
Volume of grout used (gal)	11

COMMENTS:

WELL SCHEMATIC

APPENDIX B
2013 ANNUAL GROUNDWATER SAMPLING RESULTS

Appendix B
2013 Annual Groundwater Sampling Results - Necco Park

	Location	VH-137A	VH-145A	VH-146AR	VH-150A	VH-D-11	VH-D-13	VH-D-9	VH-111B	VH-136B	VH-137B	VH-137B	VH-139B	VH-141B
	Date	08/16/2013	08/15/2013	08/14/2013	08/20/2013	08/12/2013	08/16/2013	08/16/2013	08/19/2013	08/15/2013	08/16/2013	08/16/2013	08/21/2013	08/13/2013
LabAnalyte	**Units**	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS	DUP	FS	FS
Field Parameters														
DEPTH TO WATER FROM TOC	Feet													
COLOR	NS	N/A	N/A	SL.TURBID	NS	N/A	N/A	N/A	N/A	N/A	N/A	NS	N/A	N/A
DISSOLVED OXYGEN	UG/L	0.09	0.23	0.11	NS	0.21	0.14	0.1	0.24	0.09	0.14	NS	0.25	0.7
ODOR	NS	SLIGHT	NONE	SLIGHT	NS	NS	NONE	NONE	STRONG	SLIGHT	NONE	NS	STRONG	NONE
OXIDATION REDUCTION POTENTIAL	MV	-523	-257	-567	NS	-496	-342	-361	-355	-555	-545	NS	-471	-292
PH	STD UNITS	12.69	7.12	9.45	7.46	11.87	8.3	6.65	6.83	9.11	12.85	NS	7.17	9.61
SPECIFIC CONDUCTANCE	UMHOS/CM	6670	19000	1414	NS	3300	1315	5770	3300	2110	6080	NS	30700	4120
TEMPERATURE	DEGREES C	16.73	12.84	16.25	NS	15.52	17.94	18	14.53	17.16	13.84	NS	13.25	15.01
TURBIDITY QUALITATIVE	NTU	12.39	8.11	13.15	NS	3.29	20.1	19.07	13.97	1835	11.49	NS	7.11	8.97
Volatile Organics														
1,1,2,2-TETRACHLOROETHANE	UG/L	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<10	<0.72	<0.18	<0.18	3800	<0.18
1,1,2-TRICHLOROETHANE	UG/L	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	100	<1.1	<0.27	<0.27	950	<0.27
1,1-DICHLOROETHENE	UG/L	11	<0.19	<0.19	<0.19	13	0.35 J	<0.19	250	4.4	12	12	110	<0.19
1,2-DICHLOROETHANE	UG/L	3.9	<0.22	<0.22	<0.22	2.6	0.41 J	0.66 J	990	<0.88	4	4	200	<0.22
CARBON TETRACHLORIDE	UG/L	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<7.2	<0.52	<0.13	<0.13	<6.5	<0.13
CHLOROFORM	UG/L	0.63 J	<0.16	<0.16	<0.16	1.3	<0.16	<0.16	2000	<0.64	1.2	1.2	1400	<0.16
CIS-1,2 DICHLOROETHENE	UG/L	61	0.41 J	<0.17	0.70 J	65	8.4	<0.17	3600	620	130 J	110	18000	<0.17
METHYLENE CHLORIDE	UG/L	42	<0.33	<0.33	<0.33	5.9	<0.33	<0.33	3400	<1.3	33	32	11000	<0.33
TETRACHLOROETHENE	UG/L	47	<0.29	<0.29	<0.29	30	0.38 J	<0.29	120	1500	85 J	76	2900	<0.29
TRANS-1,2-DICHLOROETHENE	UG/L	5.6	<0.19	<0.19	<0.19	5	1.2	<0.19	150	16	8.2	7.8	4500	<0.19
TRICHLOROETHENE	UG/L	78	<0.17	<0.17	<0.17	78	2.4	<0.17	390	250	140 J	120	4600	<0.17
VINYL CHLORIDE	UG/L	46	<0.22	0.52 J	<0.22	40	4.8	<0.22	7700	18	84	72	5700	<0.22
Gases														
ETHANE	UG/L	NS	NS	NS	NS	NS	NS	NS	28	NS	52	54	160	14
ETHENE	UG/L	NS	NS	NS	NS	NS	NS	NS	4900	NS	110	110	2000	1.6
METHANE	UG/L	NS	NS	NS	NS	NS	NS	NS	6600	NS	1100	1200	6100	690
PROPANE	UG/L	NS	NS	NS	NS	NS	NS	NS	1.4	NS	1.9	1.9	11	0.56 J
Semivolatile Organics														
2,4,5-TRICHLOROPHENOL	UG/L	3.9 J	<0.29	4.5 J	<0.29	1.8 J	<0.29	<0.29	NS	2100	80 J	120 J	NS	NS
2,4,6-TRICHLOROPHENOL	UG/L	<2.3	<0.23	0.65 J	<0.23	0.89 J	0.38 J	<0.24	NS	390 J	17 J	24 J	NS	NS
3- AND 4- METHYLPHENOL	UG/L	33 J	<0.76	<0.76	<0.76	11 J	<0.76	<0.78	NS	<76	21 J	23 J	NS	NS
HEXACHLOROBENZENE	UG/L	<0.81	<0.081	<0.081	<0.081	<0.081	<0.081	<0.084	NS	<8.1	<0.32	<0.32	NS	NS
HEXACHLOROBUTADIENE	UG/L	<2.6	<0.26	<0.26	<0.26	2.3 J	<0.26	<0.26	NS	<26	1.2 J	1.2 J	NS	NS
HEXACHLOROETHANE	UG/L	<1.8	<0.18	<0.18	<0.18	<0.18	<0.18	<0.19	NS	<18	<0.72	<0.72	NS	NS
PENTACHLOROPHENOL	UG/L	25 J	<0.26	6.2 J	<0.26	4.5 J	2.5 J	2.7 J	NS	5300	89 J	120 J	NS	NS
PHENOL	UG/L	230	<0.57	<0.57	<0.57	28	<0.57	<0.59	NS	<57	95	100	NS	NS
Tentativley Identified Compound	UG/L	70 J	NS	1.1 J	NS	17 J	1.8 J	NS	NS	NS	37 J	44 J	NS	NS
Inorganics														
ALKALINITY, TOTAL	MG/L	NS	NS	NS	NS	NS	NS	NS	1200	NS	870 J	820	26	82
BARIUM	UG/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
BARIUM, DISSOLVED	UG/L	4100	32 J	16 J	53 J	290	81 J	150 J	NS	59 J	2000	2200	NS	NS
TOTAL ORGANIC CARBON	MG/L	NS	NS	NS	NS	NS	NS	NS	2300	NS	22	23	170	7.3
CHLORIDE	UG/L	480000	100000	290000	140000	490000	160000	1600000	10000000	170000	450000	460000	13000000	880000
IRON, DISSOLVED	UG/L	NS	NS	NS	NS	NS	NS	NS	340000	NS	<81	<81	460000	<81
MANGANESE, DISSOLVED	UG/L	NS	NS	NS	NS	NS	NS	NS	3600 B	NS	2.5 B	1.3 B	6600	5 B
NITRATE/NITRITE NITROGEN	UG/L	NS	NS	NS	NS	NS	NS	NS	<12	NS	<12	<12	<12	<12
SULFATE	UG/L	NS	NS	NS	NS	NS	NS	NS	1400	NS	23000	26000	330000	1200000
SULFIDE	UG/L	NS	NS	NS	NS	NS	NS	NS	43000	NS	3000 J	2400 J	2400	950 J
Total Volatiles	UG/L	295.1	0.41	0.52	0.70	240.8	17.9	0.66	18700.0	2408.4	497.4	435.0	53160.0	0.0

< and ND = Non detect at stated reporting limit

Appendix B
2013 Annual Groundwater Sampling Results - Necco Park

	Location	VH-145B	VH-146B	VH-149B	VH-151B	VH-171B	VH-172B	VH-153B	VH-150B	VH-168B	VH-105C	VH-136C	VH-137C	VH-141C
	Date	08/15/2013	08/14/2013	08/22/2013	08/19/2013	08/20/2013	08/12/2013	08/22/2013	08/20/2013	08/14/2013	08/21/2013	08/15/2013	08/16/2013	08/13/2013
LabAnalyte	**Units**	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS
Field Parameters														
DEPTH TO WATER FROM TOC	Feet													
COLOR	NS	N/A	SL.TURBID	N/A	N/A	BLACK TNT	N/A	N/A	NA	N/A	YELLOW TINT	N/A	CLEAR	N/A
DISSOLVED OXYGEN	UG/L	0.19	0.14	0.1	0.09	0.48	0.2	0.35	0.33	0.34	0.27	0.1	0.18	0.13
ODOR	NS	STRONG	SLIGHT	SLIGHT	SLIGHT	NONE	NONE	NONE	NONE	SLIGHT	SLIGHT	SLIGHT	SLIGHT	YES(OIL)
OXIDATION REDUCTION POTENTIAL	MV	-370	-566	-462	-309	-501	-322	-241	-634	-359	-405	-504	-466	-507
PH	STD UNITS	10.05	11.64	10.85	7.39	7.61	7.26	7.17	9.97	7.04	7.61	12.1	7.42	12.32
SPECIFIC CONDUCTANCE	UMHOS/CM	14550	1175	1810	2180	15300	9940	6340	1720	36010	24700	2001	7710	9600
TEMPERATURE	DEGREES C	15.61	13.23	16.39	21.31	16.57	14.93	17.46	12.34	15.03	15.1	15.33	15.97	15.63
TURBIDITY QUALITATIVE	NTU	8.3	6.13	6.62	7.03	6.45	12.08	12.38	2.35	1.38	36.1	7.68	17.78	22
Volatile Organics														
1,1,2,2-TETRACHLOROETHANE	UG/L	<0.90	<0.18	<0.18	<0.18	<0.18	170	<0.18	<0.18	64	1100	<3.0	<2.3	<0.18
1,1,2-TRICHLOROETHANE	UG/L	7.3	<0.27	<0.27	<0.27	<0.27	15	<0.27	<0.27	990	47000	<4.5	41	<0.27
1,1-DICHLOROETHENE	UG/L	16	3.6	2.6	<0.19	<0.19	4.9	<0.19	2.1	310	3800	5.4 J	370	0.36 J
1,2-DICHLOROETHANE	UG/L	<1.1	<0.22	<0.22	<0.22	<0.22	<0.73	<0.22	1.5	670	2800	<3.7	50	<0.22
CARBON TETRACHLORIDE	UG/L	<0.65	<0.13	<0.13	<0.13	<0.13	<0.43	0.28 J	<0.13	<4.3	460 J	<2.2	<1.6	<0.13
CHLOROFORM	UG/L	28	<0.16	<0.16	<0.16	<0.16	71	<0.16	<0.16	85	100000	<2.7	13	<0.16
CIS-1,2 DICHLOROETHENE	UG/L	1400	21	24	1.3	91	820	<0.17	86	20000	31000	88	3000	1.2
METHYLENE CHLORIDE	UG/L	4.5 J	<0.33	<0.33	<0.33	<0.33	3.7	<0.33	<0.33	21000	51000	<5.5	2900	81
TETRACHLOROETHENE	UG/L	7.5	<0.29	<0.29	<0.29	<0.29	100	<0.29	6.2	18 J	24000	5300	11 J	18
TRANS-1,2-DICHLOROETHENE	UG/L	160	1.6	2.6	1.1	3.2	97	0.85 J	13	300	7400	15 J	310	<0.19
TRICHLOROETHENE	UG/L	130	1.7	2.6	<0.17	<0.17	150	0.50 J	2.3	570	190000	1200	67	6.7
VINYL CHLORIDE	UG/L	260	15	16	2.1	100	150	<0.22	23	13000	2200	7.7 J	1400	8.9
Gases														
ETHANE	UG/L	5.6	NS	NS	6.6	NS	NS	76	NS	NS	46	NS	41	11
ETHENE	UG/L	71	NS	NS	1.2	NS	NS	<0.18	NS	NS	1100	NS	80	21
METHANE	UG/L	390	NS	NS	630	NS	NS	880	NS	NS	2600	NS	270	4100
PROPANE	UG/L	0.55 J	NS	NS	0.51 J	NS	NS	1.2	NS	NS	5.7	NS	6.1	0.98 J
Semivolatile Organics														
2,4,5-TRICHLOROPHENOL	UG/L	<1.1	9.8	6.8 J	<0.29	<1.1	<0.29	NS	29 J	<5.7	NS	1400 J	NS	NS
2,4,6-TRICHLOROPHENOL	UG/L	<0.91	4.1 J	2.4 J	<0.23	<0.91	<0.23	NS	6.1 J	<4.6	NS	2300 J	NS	NS
3- AND 4- METHYLPHENOL	UG/L	<3.0	2.2 J	1.2 J	<0.76	<3.0	1.1 J	NS	9.9 J	230 J	NS	<760	NS	NS
HEXACHLOROBENZENE	UG/L	<0.32	<0.081	<0.081	<0.081	<0.32	<0.081	NS	<0.41	<1.6	NS	<81	NS	NS
HEXACHLOROBUTADIENE	UG/L	<1.0	<0.26	<0.26	<0.26	2.2 J	45	NS	<1.3	<5.1	NS	<260	NS	NS
HEXACHLOROETHANE	UG/L	<0.72	<0.18	<0.18	<0.18	<0.72	<0.18	NS	<0.90	<3.6	NS	<180	NS	NS
PENTACHLOROPHENOL	UG/L	<1.0	14 J	<0.26	<0.26	<1.0	<0.26	NS	<1.3	<5.1	NS	34000 J	NS	NS
PHENOL	UG/L	<2.3	<0.57	<0.57	<0.57	<2.3	<0.57	NS	40 J	260	NS	<570	NS	NS
Tentativley Identified Compound	UG/L	91 J	1.2 J		7.0 J	67 J	15 J	NS	11 J	2700 J	NS	NS	NS	NS
Inorganics														
ALKALINITY, TOTAL	MG/L	47 J	NS	NS	16	NS	NS	270	NS	NS	990	NS	120	1300
BARIUM	UG/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	46 J	NS	NS
BARIUM, DISSOLVED	UG/L	34 J	32 J	44 J	53 J	37 J	18 J	NS	270	370	NS	NS	NS	NS
TOTAL ORGANIC CARBON	MG/L	15	NS	NS	2.9	NS	NS	9.1	NS	NS	2100	NS	370	98
CHLORIDE	UG/L	5000000	150000	220000	490000	5500000	2900000	1300000	470000	14000000	8600000	120000	2500000	2000000
IRON, DISSOLVED	UG/L	<81	NS	NS	9700	NS	NS	12000	NS	NS	59000	NS	550000	88 J
MANGANESE, DISSOLVED	UG/L	46	NS	NS	270	NS	NS	200 B	NS	NS	1300	NS	24000 B	4.6 B
NITRATE/NITRITE NITROGEN	UG/L	<12	NS	NS	<12	NS	NS	<12	NS	NS	<12	NS	<12	26 J
SULFATE	UG/L	870000	NS	NS	390000	NS	NS	1500000	NS	NS	420000	NS	1100	92000
SULFIDE	UG/L	540 J	NS	NS	1900	NS	NS	19000	NS	NS	810 J	NS	43000 J	3600
Total Volatiles	UG/L	2013.3	42.9	47.8	4.5	194.2	1581.6	1.6	134.1	56989.2	460760	6616.1	8162.0	116.2

< and ND = Non detect at stated reporting limit

Appendix B
2013 Annual Groundwater Sampling Results - Necco Park

	Location	VH-145C	VH-146C	VH-149C	VH-150C	VH-151C	VH-168C	VH-105D	VH-123D	VH-136D	VH-136D	VH-137D	VH-139D
	Date	08/12/2013	08/14/2013	08/22/2013	08/20/2013	08/19/2013	08/14/2013	08/21/2013	08/22/2013	08/12/2013	08/12/2013	08/16/2013	08/21/2013
LabAnalyte	**Units**	FS	FS	FS	FS	FS	FS	FS	FS	FS	DUP	FS	FS
Field Parameters													
DEPTH TO WATER FROM TOC	Feet												
COLOR	NS	N/A	N/A	N/A	BLACK TINT	CLEAR	BLACK	N/A	BLACK TINT	SL. BLACK TINT	NS	BLACK	N/A
DISSOLVED OXYGEN	UG/L	0.12	0.18	0.12	0.44	0.18	0.37	0.25	0.19	0.22	NS	0.15	0.24
ODOR	NS	NONE	NONE	NONE	SLIGHT	N/A	SLIGHT	SLIGHT	NONE	NONE	NS	SLIGHT	STRONG
OXIDATION REDUCTION POTENTIAL	MV	-346	-393	-397	-534	-214	-501	-114	-517	-367	NS	-489	-203
PH	STD UNITS	7.6	9.1	9.64	7.21	7.69	6.31	6.09	8.29	8.12	NS	8.16	7.04
SPECIFIC CONDUCTANCE	UMHOS/CM	1950	1490	1432	6370	564	62200	19400	2600	1308	NS	928	4420
TEMPERATURE	DEGREES C	18.48	15.82	16.64	19.63	25.87	15.18	13.22	16.62	14.29	NS	15.41	15.32
TURBIDITY QUALITATIVE	NTU	5.49	4.75	5.79	3.49	25.2	1.42	8.24	13.83	7.19	NS	20.8	20.5
Volatile Organics													
1,1,2,2-TETRACHLOROETHANE	UG/L	<0.72	<0.18	<0.18	<0.18	<0.18	1300	100000	<0.18	0.73 J	1.1	8.7 J	79
1,1,2-TRICHLOROETHANE	UG/L	<1.1	<0.27	<0.27	<0.27	0.35 J	1500	290000	<0.27	9.4 J	14 J	360	21
1,1-DICHLOROETHENE	UG/L	6.1	0.47 J	1.3	11	0.23 J	210	2600	1.1	10	12	140	13
1,2-DICHLOROETHANE	UG/L	<0.88	<0.22	<0.22	0.38 J	0.48 J	140	16000	<0.22	9.4 J	12 J	<2.4	<1.5
CARBON TETRACHLORIDE	UG/L	<0.52	<0.13	0.30 J	<0.13	<0.13	430	360000	<0.13	<0.26	<0.13	4.9 J	<0.87
CHLOROFORM	UG/L	<0.64	<0.16	<0.16	2.2	0.92 J	510	160000	<0.16	14 J	24 J	2300	100
CIS-1,2 DICHLOROETHENE	UG/L	1100	3.3	13	230	6.4	990	13000	5.4	630	730	640	160
METHYLENE CHLORIDE	UG/L	4.3	<0.33	<0.33	31	<0.33	3500	6300 B	<0.33	1.4 J	<0.33	130	25 B
TETRACHLOROETHENE	UG/L	1.8 J	<0.29	<0.29	0.60 J	0.60 J	440	22000	1.1	0.79 J	1.1	250	580
TRANS-1,2-DICHLOROETHENE	UG/L	10	0.62 J	1.9	21	0.23 J	250	4400	<0.19	9.7 J	12 J	120	32
TRICHLOROETHENE	UG/L	9.5	0.91 J	0.99 J	7.1	1.5	2600	250000	1.6	28	44	3400	1900
VINYL CHLORIDE	UG/L	200	2.2	8.4	160	2.1	350	560 J	1.1	380	440	120	44
Gases													
ETHANE	UG/L	12	NS	5.4	NS	NS	NS	7.4	NS	6.1	7.2	14	13
ETHENE	UG/L	45	NS	27	NS	NS	NS	62	NS	310	360	68	40
METHANE	UG/L	280	NS	810	NS	NS	NS	590	NS	340	410	380	410
PROPANE	UG/L	3.2	NS	0.38 J	NS	NS	NS	0.52 J	NS	1.5	1.7	1.4	1.3
Semivolatile Organics													
2,4,5-TRICHLOROPHENOL	UG/L	<0.29	0.40 J	1.2 J	<0.29	<0.29	<5.7	NS	<2.9	19	19	NS	NS
2,4,6-TRICHLOROPHENOL	UG/L	<0.23	0.50 J	1.1 J	<0.23	<0.23	<4.6	NS	<2.3	3.4 J	3.8 J	NS	NS
3- AND 4- METHYLPHENOL	UG/L	21	<0.76	3.1 J	<0.76	<0.76	15 J	NS	38 J	<0.76	<0.76	NS	NS
HEXACHLOROBENZENE	UG/L	<0.081	<0.081	<0.081	<0.081	<0.081	<1.6	NS	<0.81	<0.081	<0.081	NS	NS
HEXACHLOROBUTADIENE	UG/L	<0.26	0.49 J	<0.26	<0.26	<0.26	17 J	NS	<2.6	<0.26	<0.26	NS	NS
HEXACHLOROETHANE	UG/L	<0.18	<0.18	<0.18	<0.18	<0.18	<3.6	NS	<1.8	<0.18	<0.18	NS	NS
PENTACHLOROPHENOL	UG/L	<0.26	<0.26	<0.26	<0.26	<0.26	<5.1	NS	<2.6	4.6 J	4.5 J	NS	NS
PHENOL	UG/L	26	<0.57	0.92 J	4.2 J	<0.57	100 J	NS	280	<0.57	<0.57	NS	NS
Tentativley Identified Compound	UG/L	34 J			430 J	NS	3700 J	NS	NS	NS	4.5 J	NS	NS
Inorganics													
ALKALINITY, TOTAL	MG/L	87	NS	13	NS	NS	NS	820	NS	170	160	110	110
BARIUM	UG/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
BARIUM, DISSOLVED	UG/L	43 J	28 J	31 J	42 J	71 J	310	NS	20 J	52 J	53 J	NS	NS
TOTAL ORGANIC CARBON	MG/L	7.9	NS	5.5	NS	NS	NS	1500	NS	4.7	5	13	4.1
CHLORIDE	UG/L	320000	150000	200000	1400000	5900	29000000	6600000	190000	180000	190000	110000	890000
IRON, DISSOLVED	UG/L	28000	NS	<81	NS	NS	NS	14000	NS	350	330	5800	15000
MANGANESE, DISSOLVED	UG/L	1100 J	NS	28	NS	NS	NS	710	NS	170 J	170 J	570 B	930
NITRATE/NITRITE NITROGEN	UG/L	<12	NS	<12	NS	NS	NS	13 J	NS	<12	<12	<12	<12
SULFATE	UG/L	440000	NS	350000	NS	NS	NS	1100000	NS	280000	290000	60000	1100000
SULFIDE	UG/L	<410	NS	4900	NS	NS	NS	5900	NS	8900 J	1200 J	5400 J	2200
Total Volatiles	UG/L	1331.7	7.5	25.9	463.3	12.8	12220	1218560	10.3	1093.4	1290.2	7473.6	2929.0

< and ND = Non detect at stated reporting limit

2013 Annual Groundwater Sampling Results - Necco Park

	Location	VH-145D	VH-147D	VH-148D	VH-149D	VH-156D	VH-165D	VH-136E	VH-136E	VH-145E	VH-146E	VH-150E	VH-156E	VH-165E
	Date	08/15/2013	08/13/2013	08/13/2013	08/22/2013	08/19/2013	08/19/2013	08/15/2013	08/15/2013	08/15/2013	08/12/2013	08/20/2013	08/19/2013	08/19/2013
LabAnalyte	**Units**	FS	FS	FS	FS	FS	FS	FS	DUP	FS	FS	FS	FS	FS
Field Parameters														
DEPTH TO WATER FROM TOC	Feet													
COLOR	NS	N/A	N/A	N/A	BLACK	N/A	N/A	N/A	NS	YELLOW TINT	L. BLACK TIN	BLACK TINT	N/A	GRAY TINT
DISSOLVED OXYGEN	UG/L	0.16	0.24	0.16	0.2	0.26	0.21	0.25	NS	0.26	0.28	1.14	0.34	0.3
ODOR	NS	STRONG	NONE	YES	STRONG	STRONG	SLIGHT	SLIGHT	NS	STRONG	SLIGHT	SLIGHT	SLIGHT	STRONG
OXIDATION REDUCTION POTENTIAL	MV	-641	-247	-587	-386	-460	-483	-498	NS	-348	-555	-548	-312	-457
PH	STD UNITS	8.03	7.99	10.29	9.66	7.91	9.33	8.05	NS	7.02	7.22	6.52	9.34	8.01
SPECIFIC CONDUCTANCE	UMHOS/CM	25900	2360	988	1311	2340	1299	1560	NS	13160	4020	18100	12.5	2720
TEMPERATURE	DEGREES C	16.97	13.49	16.57	15.68	13.71	14.47	13.3	NS	12.9	15.1	13.86	16.34	13.43
TURBIDITY QUALITATIVE	NTU	11.43	3.66	8.84	23.17	5.33	12.08	9.14	NS	13.32	1.76	4.18	15.31	3.24
Volatile Organics														
1,1,2,2-TETRACHLOROETHANE	UG/L	<0.36	<0.18	<0.18	0.21 J	<0.18	<0.18	<0.18	<0.18	<3.0	<1.2	<0.45	<0.18	660
1,1,2-TRICHLOROETHANE	UG/L	0.74 J	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<4.5	4.4 J	<0.68	<0.27	880
1,1-DICHLOROETHENE	UG/L	<0.38	<0.19	<0.19	0.20 J	<0.19	0.31 J	<0.19	<0.19	<3.2	230	<0.48	<0.19	290
1,2-DICHLOROETHANE	UG/L	5.8	<0.22	<0.22	<0.22	<0.22	2	12	12	<3.7	<1.5	<0.55	<0.22	280
CARBON TETRACHLORIDE	UG/L	<0.26	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<2.2	<0.87	<0.33	<0.13	200
CHLOROFORM	UG/L	<0.32	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<2.7	110	7.2	<0.16	500
CIS-1,2 DICHLOROETHENE	UG/L	230	64	2.8	1	0.35 J	1.5	<0.17	<0.17	110	2100	660	<0.17	19000
METHYLENE CHLORIDE	UG/L	270	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33	<5.5	12	13	<0.33	5200
TETRACHLOROETHENE	UG/L	<0.58	<0.29	0.54 J	<0.29	<0.29	<0.29	<0.29	<0.29	<4.8	<1.9	<0.73	<0.29	250
TRANS-1,2-DICHLOROETHENE	UG/L	2.7	2.6	<0.19	0.59 J	<0.19	0.48 J	8.7	9.1	630	160	18	<0.19	400
TRICHLOROETHENE	UG/L	<0.34	0.31 J	0.95 J	0.31 J	<0.17	<0.17	2.8	2.7	<2.8	420	14	<0.17	1500
VINYL CHLORIDE	UG/L	320	45	<0.22	1.5	0.75 J	3.3	4.2	3.6	2100	2600	550	<0.22	6500
Gases														
ETHANE	UG/L	NS	0.66	33	2.8	1.1	2	5.4	5.8	74	9.4	NS	0.89	NS
ETHENE	UG/L	NS	1.1	4.2	11	<0.18	85	350	370	980	940	NS	<0.18	NS
METHANE	UG/L	NS	65	390	340	210	100	240	260	1900	1800	NS	94	NS
PROPANE	UG/L	NS	<0.24	13	<0.24	<0.24	<0.24	1.3	1.4	2.5	0.85 J	NS	<0.24	NS
Semivolatile Organics														
2,4,5-TRICHLOROPHENOL	UG/L	<5.7	<0.29	<1.1	<0.29	<0.29	59	<0.29	<0.29	<1.1	8.5 J	<5.7	<0.29	1600
2,4,6-TRICHLOROPHENOL	UG/L	<4.6	<0.23	<0.91	<0.23	<0.23	4.1 J	<0.23	<0.23	<0.91	5.5 J	<4.6	<0.23	180 J
3- AND 4- METHYLPHENOL	UG/L	<15	<0.76	40 J	0.84 J	<0.77	13 J	<0.76	<0.76	<3.0	9.0 J	<15	<0.76	45 J
HEXACHLOROBENZENE	UG/L	<1.6	<0.081	<0.32	<0.081	<0.082	<0.16	<0.081	<0.081	<0.32	<0.081	<1.6	<0.081	<4.1
HEXACHLOROBUTADIENE	UG/L	<5.1	<0.26	<1.0	<0.26	<0.26	<0.51	<0.26	<0.26	<1.0	<0.26	<5.1	<0.26	65 J
HEXACHLOROETHANE	UG/L	<3.6	<0.18	<0.72	<0.18	<0.18	<0.36	<0.18	<0.18	<0.72	<0.18	<3.6	<0.18	<9.0
PENTACHLOROPHENOL	UG/L	<5.1	<0.26	<1.0	<0.26	0.42 J	2.2 J	<0.26	<0.26	<1.0	<0.26	<5.1	<0.26	50 J
PHENOL	UG/L	39 J	<0.57	70	<0.57	<0.58	4.3 J	<0.57	<0.57	<2.3	<0.57	540	<0.57	59 J
Tentativley Identified Compound	UG/L	1200 J	NS	NS	NS	0.55 J	39 J	4.7 J	3.1 J	62 J	23 J	5700 J	0.45 J	360 J
Inorganics														
ALKALINITY, TOTAL	MG/L	NS	210	24 B	26	300	44	210 J	210 J	310 J	290	NS	38	NS
BARIUM	UG/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
BARIUM, DISSOLVED	UG/L	2000	18 J	29 J	18 J	120 J	27 J	57 J	60 J	1200	36 J	74 J	11 J	150 J
TOTAL ORGANIC CARBON	MG/L	NS	1.8	8.2	3.6	3.7	9.7	5.6	6	18	18	NS	1.4	NS
CHLORIDE	UG/L	8700000	65000	140000	250000	200000	350000	190000	170000	4200000	500000	5800000	210000	680000
IRON, DISSOLVED	UG/L	NS	620	<81	<81	370	<81	200	230	43000	<81	NS	<81	NS
MANGANESE, DISSOLVED	UG/L	NS	39	5.6 B	15	69	41	160	170	2300	91 J	NS	45	NS
NITRATE/NITRITE NITROGEN	UG/L	NS	<12	17 J	<12	<12	<12	<12	13 B	<12	<12	NS	<12	NS
SULFATE	UG/L	NS	1300000	210000	230000	670000	12000	330000	320000	870000	1400000	NS	310000	NS
SULFIDE	UG/L	NS	<410	8100	2800	22000	3200	5000 J	12000 J	750 J	73000	NS	3600	NS
Total Volatiles	UG/L	829.2	111.9	4.3	3.8	1.1	7.6	27.7	27.4	2840.0	5636.4	1262.2	0.0	35660.0

< and ND = Non detect at stated reporting limit

Appendix B
2013 Annual Groundwater Sampling Results - Necco Park

	Location	VH-136F	VH-146F	VH-147F	VH-150F	VH-156F	VH-147G1	VH-147G1	VH-147G2	VH-147G3
	Date	08/15/2013	08/14/2013	08/13/2013	08/20/2013	08/19/2013	08/13/2013	08/13/2013	08/13/2013	08/13/2013
LabAnalyte	**Units**	FS	FS	FS	FS	FS	FS	DUP	FS	FS
Field Parameters										
DEPTH TO WATER FROM TOC	Feet									
COLOR	NS	N/A	BLACK	N/A	N/A	N/A	BLACK TINT	NS	N/A	BLACK TINT
DISSOLVED OXYGEN	UG/L	0.15	0.25	0.31	0.22	0.19	0.23	NS	0.21	0.18
ODOR	NS	SLIGHT	SLIGHT	YES	SLIGHT	SLIGHT	YES	NS	YES	YES
OXIDATION REDUCTION POTENTIAL	MV	-556	-421	-298	-34	-334	-253	NS	-363	-473
PH	STD UNITS	9.21	7.43	8.58	6.7	9.61	4.48	NS	9.66	7.49
SPECIFIC CONDUCTANCE	UMHOS/CM	1033	11250	2800	25500	1051	4470	NS	5590	9930
TEMPERATURE	DEGREES C	13.75	12.66	14.39	15.94	14.97	13.97	NS	14.41	15.62
TURBIDITY QUALITATIVE	NTU	8.89	1.79	10.73	8.76	15.93	5.94	NS	23.1	5.37
Volatile Organics										
1,1,2,2-TETRACHLOROETHANE	UG/L	<0.18	<9.0	<0.18	<0.60	<0.18	<0.18	<0.18	<1.8	17
1,1,2-TRICHLOROETHANE	UG/L	<0.27	97	<0.27	<0.90	<0.27	0.39 J	0.43 J	<2.7	17
1,1-DICHLOROETHENE	UG/L	0.25 J	230	<0.19	0.68 J	0.25 J	<0.19	<0.19	2.2 J	<2.7
1,2-DICHLOROETHANE	UG/L	2.1	13 J	<0.22	<0.73	1	11	12	190	48
CARBON TETRACHLORIDE	UG/L	<0.13	<6.5	<0.13	<0.43	<0.13	<0.13	<0.13	<1.3	<1.9
CHLOROFORM	UG/L	<0.16	65	<0.16	<0.53	0.96 J	0.36 J	0.34 J	<1.6	37
CIS-1,2 DICHLOROETHENE	UG/L	7.3	4500	0.77 J	49	5.2	6.9	6.6	85	16
METHYLENE CHLORIDE	UG/L	<0.33	590	4.2	6.7	0.37 J	<0.33	<0.33	<3.3	<4.7
TETRACHLOROETHENE	UG/L	0.36 J	<15	0.85 J	<0.97	0.54 J	<0.29	<0.29	<2.9	<4.1
TRANS-1,2-DICHLOROETHENE	UG/L	2.7	380	<0.19	1.1 J	0.19 J	11	10	54	240
TRICHLOROETHENE	UG/L	0.40 J	280	0.61 J	<0.57	0.91 J	0.88 J	0.89 J	<1.7	8.3 J
VINYL CHLORIDE	UG/L	58	4100	1	490	6.5	37 J	35	1300	2200
Gases										
ETHANE	UG/L	NS	47	NS	100	NS	NS	NS	NS	NS
ETHENE	UG/L	NS	170	NS	62	NS	NS	NS	NS	NS
METHANE	UG/L	NS	1900	NS	2200	NS	NS	NS	NS	NS
PROPANE	UG/L	NS	2.8	NS	1.2	NS	NS	NS	NS	NS
Semivolatile Organics										
2,4,5-TRICHLOROPHENOL	UG/L	1.7 J	270	<0.29	<2.9	26	<0.29	<0.29	13	<0.29
2,4,6-TRICHLOROPHENOL	UG/L	0.70 J	19 J	<0.23	<2.3	0.92 J	<0.23	<0.23	<0.23	<0.23
3- AND 4- METHYLPHENOL	UG/L	1.6 J	59 J	<0.76	8.4 J	2.6 J	<0.76	<0.76	<0.76	<0.76
HEXACHLOROBENZENE	UG/L	<0.081	<0.81	<0.081	<0.81	<0.081	<0.081	<0.081	<0.081	<0.081
HEXACHLOROBUTADIENE	UG/L	<0.26	<2.6	<0.26	<2.6	<0.26	<0.26	<0.26	<0.26	<0.26
HEXACHLOROETHANE	UG/L	<0.18	<1.8	<0.18	<1.8	<0.18	<0.18	<0.18	<0.18	<0.18
PENTACHLOROPHENOL	UG/L	<0.26	<2.6	<0.26	<2.6	1.0 J	<0.26	<0.26	<0.26	<0.26
PHENOL	UG/L	2.5 J	340	<0.57	410	1.0 J	<0.57	<0.57	1.0 J	<0.57
Tentativley Identified Compound	UG/L	NS	2700 J	NS	1500 J	NS	1.4 J	NS	35 J	31 J
Inorganics										
ALKALINITY, TOTAL	MG/L	NS	540	NS	50	NS	NS	NS	NS	NS
BARIUM	UG/L	NS	NS	NS	NS	NS	NS	NS	NS	NS
BARIUM, DISSOLVED	UG/L	16 J	30 J	22 J	66 J	4.6 J	12 J	13 J	14 J	18 J
TOTAL ORGANIC CARBON	MG/L	NS	67	NS	190	NS	NS	NS	NS	NS
CHLORIDE	UG/L	280000	4100000	150000	9800000	240000	260000	260000	1700000	3000000
IRON, DISSOLVED	UG/L	NS	220	NS	340000	NS	NS	NS	NS	NS
MANGANESE, DISSOLVED	UG/L	NS	850	NS	3800	NS	NS	NS	NS	NS
NITRATE/NITRITE NITROGEN	UG/L	NS	<12	NS	<12	NS	NS	NS	NS	NS
SULFATE	UG/L	NS	1100000	NS	1300000	NS	NS	NS	NS	NS
SULFIDE	UG/L	NS	220000	NS	1800	NS	NS	NS	NS	NS
Total Volatiles	UG/L	71.1	10255.0	7.4	547.5	15.9	67.5	65.3	1631.2	2583.3

< and ND = Non detect at stated reporting limit

APPENDIX B
LABORATORY ANALYTICAL DATA
DUPLICATE SAMPLE RESULTS FROM NIAGARA RIVER STUDY

	Location	VH-149B	VH-149C	VH-150B	VH-150C	VH-151B	VH-151C
	Date	30-May-13	30-May-13	29-May-13	29-May-13	29-May-13	30-May-13
LabAnalyte	**Units**	FS	FS	FS	FS	FS	FS
Volatile Organics							
1,1,2,2-TETRACHLOROETHANE	UG/L	0.18 U	0.18 U	1.4 U	0.18 U	0.18 U	0.18 U
1,1,2-TRICHLOROETHANE	UG/L	0.27 U	0.27 U	2.2 U	0.27 U	0.27 U	0.27 U
1,1-DICHLOROETHENE	UG/L	1.1	3	4.2 J	1.2	0.21 J	0.19 U
1,2-DICHLOROETHANE	UG/L	0.22 U	0.22 U	1.8 U	0.22 U	0.22 U	0.22 U
CARBON TETRACHLORIDE	UG/L	0.13 U	0.13 U	1 U	0.13 U	0.13 U	0.13 U
CHLOROFORM	UG/L	0.16 U	0.16 U	1.3 U	0.16 U	0.16 U	0.16 U
CIS-1,2 DICHLOROETHENE	UG/L	10	20	260	4.2	4	0.17 U
METHYLENE CHLORIDE	UG/L	0.33 U	0.33 U	2.6 U	0.33 U	0.33 U	0.33 U
TETRACHLOROETHENE	UG/L	0.29 U	0.29 U	16	0.3 J	0.29 U	0.29 U
TRANS-1,2-DICHLOROETHENE	UG/L	1.2	3.6	32	2.9	4	0.19 U
TRICHLOROETHENE	UG/L	1.2	1.5	10	3.4	4.6	0.17 U
VINYL CHLORIDE	UG/L	8	21	67	6.5	9.1	0.22 U
1,2-DICHLOROPROPANE	UG/L	0.18 U	0.18 U	1.4 U	0.18 U	0.18 U	0.18 U
1,1,1-TRICHLOROETHANE	UG/L	0.22 U	0.22 U	1.8 U	0.22 U	0.22 U	0.22 U
ACROLEIN	UG/L	2.2 U	2.2 U	18 U	2.2 U	2.2 U	2.2 U
ACRYLONITRILE	UG/L	2 U	2 U	16 U	2 U	2 U	2 U
BENZENE	UG/L	0.58 J	1.5	11	0.16 J	9	0.13 U
BROMOFORM	UG/L	0.64 U	0.64 U	5.1 U	0.64 U	0.64 U	0.64 U
1,2,4-TRICHLOROBENZENE	UG/L	0.15 U	0.15 U	6 J	0.2 J,B	0.15 U	0.15 U
1,2-DIBROMO-3-CHLOROPROPANE	UG/L	0.67 U	0.67 U	5.4 U	0.67 U	0.67 U	0.67 U
CHLOROBENZENE	UG/L	0.15 U	0.15 U	5.5 J	0.15 U	0.15 U	0.15 U
CHLORODIBROMOMETHANE	UG/L	0.18 U	0.18 U	1.4 U	0.18 U	0.18 U	0.18 U
CHLOROFORM	UG/L	0.16 U	0.16 U	1.3 U	0.16 U	0.16 U	0.16 U
CIS-1,3-DICHLOROPROPENE	UG/L	0.14 U	0.14 U	1.1 U	0.14 U	0.14 U	0.14 U
ETHYLBENZENE	UG/L	0.17 U	0.17 U	10	0.17 U	0.22 J	0.17 U
TOLUENE	UG/L	0.2 J	0.37 J	15	0.15 J	0.13 U	0.13 U
TRANS-1,3-DICHLOROPROPENE	UG/L	0.19 U	0.19 U	1.5 U	0.19 U	0.19 U	0.19 U
1,2-DICHLOROBENZENE	UG/L	0.13 U	0.13 U	15	0.13 U	0.13 U	0.13 U
1,3-DICHLOROBENZENE	UG/L	0.14 U	0.14 U	5 J	0.14 U	0.14 U	0.14 U
1,4-DICHLOROBENZENE	UG/L	0.13 U	0.13 U	1.7 J	0.13 U	0.13 U	0.13 U
2-CHLOROETHYL VINYL ETHER	UG/L	0.99 U	0.99 U	7.9 U	0.99 U	0.99 U	0.99 U
2-HEXANONE	UG/L	0.41 U	0.41 U	3.3 U	0.41 U	0.41 U	0.41 U
ACETONE	UG/L	1.1 U	1.1 U	25 J	4.9 J	1.1 U	1.1 U
CYCLOHEXANE	UG/L	0.12 U	0.12 U	2 J	0.2 J	0.12 U	0.12 U
DICHLORODIFLUOROMETHANE	UG/L	0.31 U	0.31 U	2.5 U	0.31 U	0.31 U	0.31 U
METHYL ACETATE	UG/L	0.46 J	0.38 U	3 U	0.38 U	0.77 J	0.38 U
METHYL TERTIARY BUTYL ETHER	UG/L	0.17 U	0.17 U	1.4 U	0.17 U	0.17 U	0.17 U
STYRENE	UG/L	0.11 U	0.11 U	0.88 U	0.11 U	0.11 U	0.11 U
TRICHLOROFLUOROMETHANE	UG/L	0.21 U	0.21 U	1.7 U	0.21 U	0.21 U	0.21 U
BROMOFORM	UG/L	0.64 U	0.64 U	5.1 U	0.64 U	0.64 U	0.64 U
XYLENES	UG/L	0.28 U	0.28 U	33	0.28 U	0.28 U	0.28 U
CARBON DISULFIDE	UG/L	5.1	7.3	9	2.2	4.6	0.85 J
CHLOROMETHANE	UG/L	0.3 U	0.3 U	2.4 U	0.3 U	0.3 U	0.3 U
BROMOMETHANE	UG/L	0.41 U	0.41 U	3.3 U	0.41 U	0.41 U	0.41 U
DICHLOROBROMOMETHANE	UG/L	0.15 U	0.15 U	1.2 U	0.15 U	0.15 U	0.15 U
ETHYLENE DIBROMIDE	UG/L	0.24 U	0.24 U	1.9 U	0.24 U	0.24 U	0.24 U
ISOPROPYLBENZENE	UG/L	0.25 J	0.13 U	1 U	0.13 U	0.13 U	0.13 U
2-BUTANONE (MEK)	UG/L	0.57 U	0.57 U	4.6 U	4.4 J	0.57 U	0.57 U
4-METHYL-2-PENTANONE (MIBK)	UG/L	0.32 U	0.32 U	2.6 U	0.32 U	0.32 U	0.32 U
1,1-DICHLOROETHANE	UG/L	0.41 J	1	12	0.15 U	5.2	0.15 U

APPENDIX B
LABORATORY ANALYTICAL DATA
DUPLICATE SAMPLE RESULTS FROM NIAGARA RIVER STUDY

	Location	VH-149B	VH-149C	VH-150B	VH-150C	VH-151B	VH-151C
	Date	30-May-13	30-May-13	29-May-13	29-May-13	29-May-13	30-May-13
LabAnalyte	**Units**	FS	FS	FS	FS	FS	FS
Semivolatile Organics							
2,4,5-TRICHLOROPHENOL	UG/L	5.4 J	1.6 U	21	1.6 U	1.6 U	1.6 U
2,4,6-TRICHLOROPHENOL	UG/L	1.8 U	1.8 U	2.5 J	1.8 U	1.8 U	1.8 U
2,4-DINITROPHENOL	UG/L	6.3 U	6.3 U	6.3 U	6.5 U	6.4 U	6.5 U
2-METHYLPHENOL (O-CRESOL)	UG/L	1.3 J	1.2 J	3.1 J	0.91 U	0.9 U	0.91 U
3- AND 4- METHYLPHENOL	UG/L	0.92 U	1.5 J	7.9 J	0.95 U	0.94 U	0.95 U
HEXACHLOROBENZENE	UG/L	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
BIS(2-ETHYLHEXYL)PHTHALATE	UG/L	13 U	13 U	13 U	13 U	13 U	13 U
1,2-DIPHENYLHYDRAZINE	UG/L	0.67 U	0.68 U	0.68 U	0.69 U	0.69 U	0.69 U
BENZALDEHYDE	UG/L	1.5 U	1.5 U	1.5 U	1.6 U	1.6 U	1.6 U
BIPHENYL	UG/L	0.42 U	0.43 U	0.43 U	0.44 U	0.43 U	0.44 U
CAPROLACTAM	UG/L	14 J	12 U	12 U	13 U	12 U	13 U
INDENO (1,2,3-CD) PYRENE	UG/L	0.2 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U
HEXACHLOROBUTADIENE	UG/L	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U
HEXACHLOROETHANE	UG/L	0.64 U	0.65 U	0.65 U	0.66 U	0.65 U	0.66 U
PENTACHLOROPHENOL	UG/L	0.68 U	0.68 U	0.68 U	0.7 U	0.69 U	0.7 U
PHENOL	UG/L	0.59 U	0.6 U	18	0.61 U	0.61 U	0.61 U
BIS(2-CHLOROETHYL)ETHER	UG/L	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U
2-CHLOROPHENOL	UG/L	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U
1,3-DICHLOROBENZENE	UG/L	0.14 U	0.14 U	5 J	0.14 U	0.14 U	0.14 U
1,4-DICHLOROBENZENE	UG/L	0.13 U	0.13 U	1.7 J	0.13 U	0.13 U	0.13 U
1,2-DICHLOROBENZENE	UG/L	0.13 U	0.13 U	15	0.13 U	0.13 U	0.13 U
HEXACHLOROETHANE	UG/L	0.64 U	0.65 U	0.65 U	0.66 U	0.65 U	0.66 U
NITROBENZENE	UG/L	0.86 U	0.87 U	0.87 U	0.89 U	0.88 U	0.89 U
ISOPHORONE	UG/L	0.66 U	0.66 U	0.66 U	0.68 U	0.67 U	0.68 U
2-NITROPHENOL	UG/L	1.7 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U
BIS(2-CHLOROETHOXY)METHANE	UG/L	0.59 U	0.6 U	0.6 U	0.61 U	0.61 U	0.61 U
2,4-DICHLOROPHENOL	UG/L	17	12	51	0.35 U	0.35 U	0.35 U
1,2,4-TRICHLOROBENZENE	UG/L	0.15 U	0.15 U	6 J	0.2 J,B	0.15 U	0.15 U
NAPHTHALENE	UG/L	0.14 U	0.14 U	1.1 J	0.15 U	0.15 U	0.15 U
4-CHLOROANILINE	UG/L	2.9 J	8.2 J	530 E	0.93 U	27	0.93 U
HEXACHLOROBUTADIENE	UG/L	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U
4-CHLORO-3-METHYLPHENOL	UG/L	0.77 U	0.78 U	0.78 U	0.79 U	0.79 U	0.79 U
HEXACHLOROCYCLOPENTADIENE	UG/L	0.53 U,*	0.53 U,*	0.53 U,*	0.55 U,*	0.54 U,*	0.55 U,*
2,4,6-TRICHLOROPHENOL	UG/L	1.8 U	1.8 U	2.5 J	1.8 U	1.8 U	1.8 U
2,4,5-TRICHLOROPHENOL	UG/L	5.4 J	1.6 U	21	1.6 U	1.6 U	1.6 U
2-CHLORONAPHTHALENE	UG/L	0.15 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U
2-NITROANILINE	UG/L	3.6 U	3.6 U	3.6 U	3.7 U	3.7 U	3.7 U
ACENAPHTHYLENE	UG/L	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U
2,6-DINITROTOLUENE	UG/L	0.81 U	0.82 U	0.82 U	0.84 U	0.83 U	0.84 U
3-NITROANILINE	UG/L	3.3 U	3.3 U	3.3 U	3.4 U	3.3 U	3.4 U
ACENAPHTHENE	UG/L	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U
2,4-DINITROPHENOL	UG/L	6.3 U	6.3 U	6.3 U	6.5 U	6.4 U	6.5 U
4-NITROPHENOL	UG/L	6.6 U	6.7 U	13 U	6.8 U	6.7 U	6.8 U
HEXACHLOROBENZENE	UG/L	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
PENTACHLOROPHENOL	UG/L	0.68 U	0.68 U	0.68 U	0.7 U	0.69 U	0.7 U
PHENANTHRENE	UG/L	0.44 U	0.44 U	0.44 U	0.45 U	0.44 U	0.45 U
ANTHRACENE	UG/L	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U
CARBAZOLE	UG/L	0.16 U	0.16 U	0.16 U	0.17 U	0.16 U	0.17 U
FLUORANTHENE	UG/L	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U
PYRENE	UG/L	0.16 U	0.16 U	0.16 U	0.17 U	0.16 U	0.17 U
3,3'-DICHLOROBENZIDINE	UG/L	1.1 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
BENZO(A)ANTHRACENE	UG/L	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U
CHRYSENE	UG/L	0.14 U	0.14 U	0.14 U	0.15 U	0.15 U	0.15 U
BIS(2-ETHYLHEXYL)PHTHALATE	UG/L	13 U	13 U	13 U	13 U	13 U	13 U
BENZO(B)FLUORANTHENE	UG/L	0.16 U	0.16 U	0.16 U	0.17 U	0.16 U	0.17 U
BENZO(K)FLUORANTHENE	UG/L	0.56 U	0.56 U	0.56 U	0.58 U	0.57 U	0.58 U
DIMETHYL PHTHALATE	UG/L	0.78 U	0.79 U	0.79 U	0.81 U	0.8 U	0.81 U
DIETHYL PHTHALATE	UG/L	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U

APPENDIX B
LABORATORY ANALYTICAL DATA
DUPLICATE SAMPLE RESULTS FROM NIAGARA RIVER STUDY

	Location	VH-149B	VH-149C	VH-150B	VH-150C	VH-151B	VH-151C
	Date	30-May-13	30-May-13	29-May-13	29-May-13	29-May-13	30-May-13
LabAnalyte	**Units**	FS	FS	FS	FS	FS	FS
DI-N-OCTYL PHTHALATE	UG/L	2.1 U	2.1 U	2.1 U	2.2 U	2.2 U	2.2 U
DIBENZOFURAN	UG/L	0.63 U	0.64 U	0.64 U	0.65 U	0.64 U	0.65 U
4-NITROANILINE	UG/L	1.8 U	1.8 U	3.6 U	1.8 U	1.8 U	1.8 U
4-BROMOPHENYL PHENYL ETHER	UG/L	0.65 U	0.65 U	0.65 U	0.67 U	0.66 U	0.67 U
2,4-DIMETHYLPHENOL	UG/L	0.92 J	0.88 U	3.2 J	0.9 U	0.89 U	0.9 U
2,4-DINITROTOLUENE	UG/L	0.55 U	0.55 U	0.55 U	0.56 U	0.56 U	0.56 U
1,2-DIPHENYLHYDRAZINE	UG/L	0.67 U	0.68 U	0.68 U	0.69 U	0.69 U	0.69 U
BENZO[A]PYRENE	UG/L	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U
DIBENZ(A,H)ANTHRACENE	UG/L	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U
N-NITROSODIMETHYLAMINE	UG/L	0.75 U	0.76 U	0.76 U	0.77 U	0.77 U	0.77 U
N-NITROSODI-N-PROPYLAMINE	UG/L	0.31 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U
4-CHLOROPHENYL PHENYL ETHER	UG/L	0.51 U	0.52 U	0.52 U	0.53 U	0.52 U	0.53 U
DI-N-BUTYL PHTHALATE	UG/L	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
AZOBENZENE	UG/L	0.67 U	0.68 U	0.68 U	0.69 U	0.69 U	0.69 U
BUTYL BENZYL PHTHALATE	UG/L	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
N-NITROSODIPHENYLAMINE	UG/L	0.87 U	0.88 U	0.88 U	0.9 U	0.89 U	0.9 U
FLUORENE	UG/L	0.22 U	0.22 U	0.22 U	0.23 U	0.23 U	0.23 U
2-METHYLNAPHTHALENE	UG/L	0.12 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U
BENZIDINE	UG/L	35 U	36 U	36 U	37 U	36 U	37 U
ACETOPHENONE	UG/L	0.82 U	0.82 U	0.82 U	0.84 U	0.83 U	0.84 U
ATRAZINE	UG/L	0.91 U	0.92 U	0.92 U	0.94 U	0.93 U	0.94 U
BENZO(B)FLUORANTHENE	UG/L	0.16 U	0.16 U	0.16 U	0.17 U	0.16 U	0.17 U
4,6-DINITRO-2-METHYLPHENOL	UG/L	2.2 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U
BENZO(G,H,I)PERYLENE	UG/L	0.15 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U
BENZO(K)FLUORANTHENE	UG/L	0.56 U	0.56 U	0.56 U	0.58 U	0.57 U	0.58 U
PCBs/Pesticides							
PCB 1016	UG/L	0.18 U	0.18 U	1.7 U	0.18 U	0.18 U	0.17 U
PCB 1221	UG/L	0.14 U	0.14 U	1.3 U	0.13 U	0.14 U	0.13 U
PCB 1232	UG/L	0.17 U	0.17 U	1.6 U	0.16 U	0.17 U	0.16 U
PCB 1242	UG/L	0.23 U	0.23 U	2.2 U	0.23 U	0.23 U	0.22 U
PCB 1248	UG/L	0.1 U	0.1 U	1 U	0.1 U	0.1 U	0.1 U
PCB 1254	UG/L	0.17 U	0.17 U	1.6 U	0.16 U	0.17 U	0.16 U
PCB 1260	UG/L	0.18 U	0.18 U	1.7 U	0.18 U	0.18 U	0.17 U
PCB 1268	UG/L	0.25 U	0.25 U	2.4 U	0.25 U	0.25 U	0.24 U
PCB 1262	UG/L	0.16 U	0.16 U	1.5 U	0.15 U	0.16 U	0.15 U
ALPHA-BHC	UG/L	0.027 U	0.027 U	0.027 U	0.027 U	0.027 U	0.027 U
BETA-BHC	UG/L	0.041 U	0.041 U	0.041 U	0.041 U	0.041 U	0.041 U
DELTA-BHC	UG/L	0.018 U	0.018 U	0.018 U	0.018 U	0.018 U	0.018 U
HEPTACHLOR EPOXIDE	UG/L	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
ENDOSULFAN SULFATE	UG/L	0.023 U	0.023 U	0.023 U	0.023 U	0.023 U	0.023 U
MIREX	UG/L	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
ALDRIN	UG/L	0.034 U	0.034 U	0.034 U	0.034 U	0.034 U	0.034 U
ENDOSULFAN II	UG/L	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2,4'-DDT	UG/L	0.009 U	0.009 U	0.009 U	0.009 U	0.009 U	0.009 U
4,4'-DDT	UG/L	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
ALPHA CHLORDANE	UG/L	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
ENDRIN KETONE	UG/L	0.038 U	0.038 U	0.038 U	0.038 U	0.038 U	0.038 U
DIELDRIN	UG/L	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
ENDRIN	UG/L	0.039 U	0.039 U	0.039 U	0.039 U	0.039 U	0.039 U
4,4'-DDD	UG/L	0.027 U	0.027 U	0.027 U	0.027 U	0.027 U	0.027 U
4,4'-DDE	UG/L	0.032 U	0.032 U	0.032 U	0.032 U	0.032 U	0.032 U
ENDRIN ALDEHYDE	UG/L	0.037 U	0.037 U	0.037 U	0.037 U	0.037 U	0.037 U
HEPTACHLOR	UG/L	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TOXAPHENE	UG/L	0.76 U	0.76 U	0.76 U	0.76 U	0.76 U	0.76 U
ENDOSULFAN I	UG/L	0.038 U	0.038 U	0.038 U	0.038 U	0.038 U	0.038 U

APPENDIX B
LABORATORY ANALYTICAL DATA
DUPLICATE SAMPLE RESULTS FROM NIAGARA RIVER STUDY

	Location	VH-149B	VH-149C	VH-150B	VH-150C	VH-151B	VH-151C
	Date	30-May-13	30-May-13	29-May-13	29-May-13	29-May-13	30-May-13
LabAnalyte	**Units**	FS	FS	FS	FS	FS	FS
Inorganics							
LEAD	MG/L	0.0035	0.0019 U	0.0019 U	0.0019 U	0.0019 U	0.0019 U
MERCURY	MG/L	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U
ARSENIC	MG/L	0.0057 J	0.0032 U	0.0047 J	0.0041 J	0.0054 J	0.0032 U
COPPER	MG/L	0.0045 U	0.0045 U	0.0045 U	0.023 U	0.023 U	0.0045 U
SELENIUM	MG/L	0.00034 U	0.00034 U	0.00079 J	0.001 J	0.00041 J	0.00092 J
MERCURY	MG/L	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U
NICKEL	MG/L	0.0042 J	0.0032 U	0.0089 J	0.006 J	0.0072 J	0.0032 U
SILVER	MG/L	0.000011 J,B	0.0000083 U	0.000042 J,B	0.000019 J,B	0.00001 J,B	0.0000083 U
ANTIMONY	MG/L	0.00055 J	0.00021 J	0.00025 J	0.00031 J	0.00065 J	0.00014 J
BERYLLIUM	MG/L	0.00046 U	0.00046 U	0.00046 U	0.00046 U	0.00046 U	0.00046 U
CADMIUM	MG/L	0.00066 U	0.00066 U	0.00066 U	0.00066 U	0.00066 U	0.00066 U
CHROMIUM	MG/L	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0022 U
ZINC	MG/L	0.26 B	0.005 U	0.005 U	0.011 J,B	0.015 J,B	0.019 J,B
CALCIUM	MG/L	240 B	180 B	140 B	790 B	770 B	76 B
MAGNESIUM	MG/L	5.4 B	9.5 B	1.6 J,B	89 B	94 B	21 B
THALLIUM	MG/L	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U

*Field parameters were not measured.

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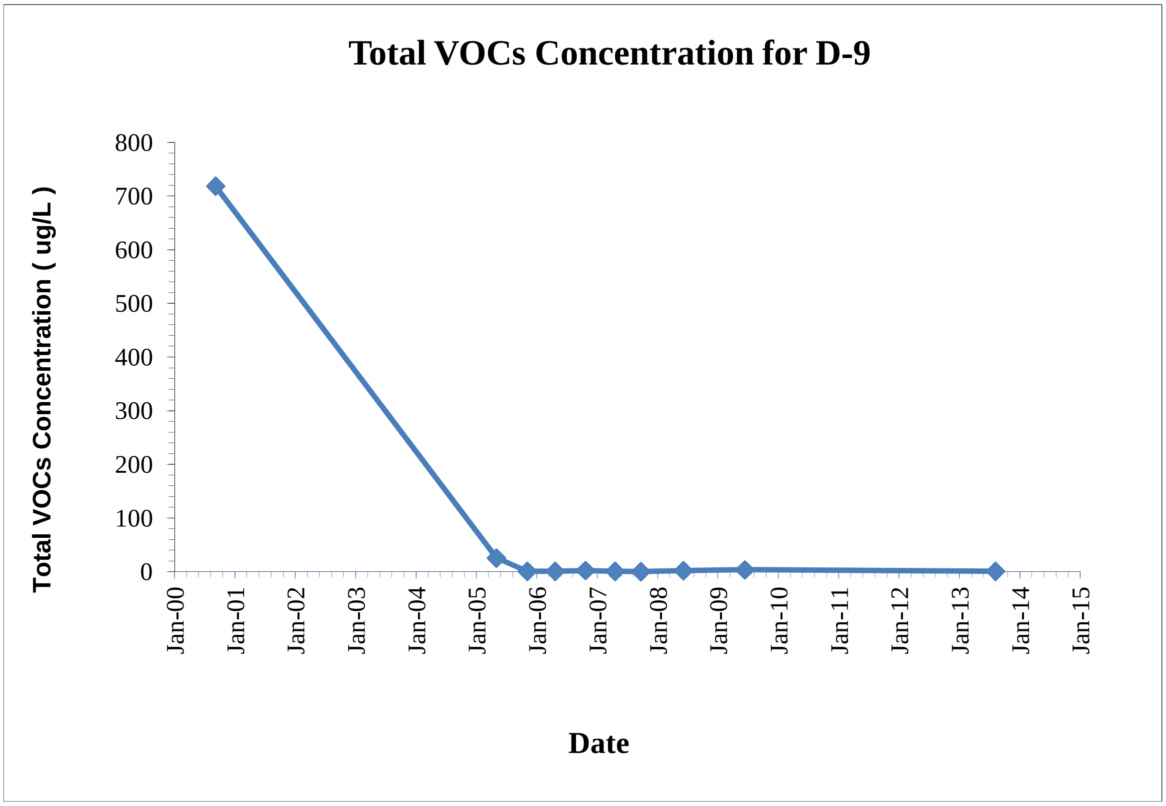
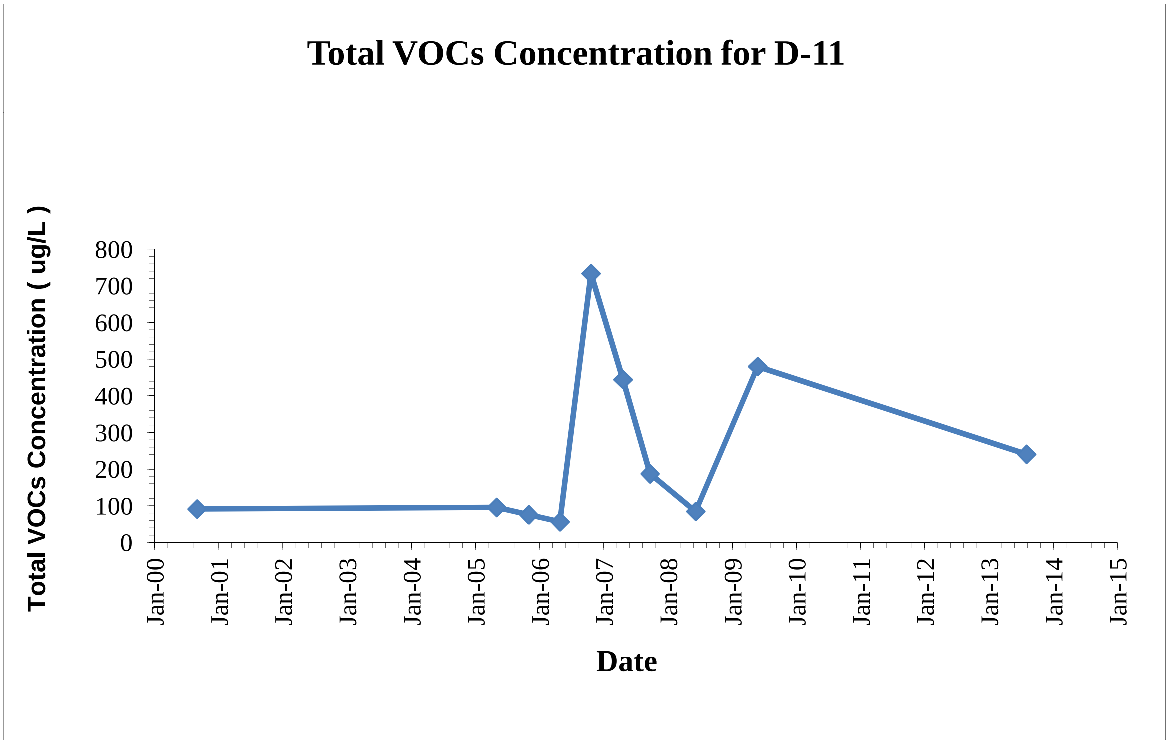
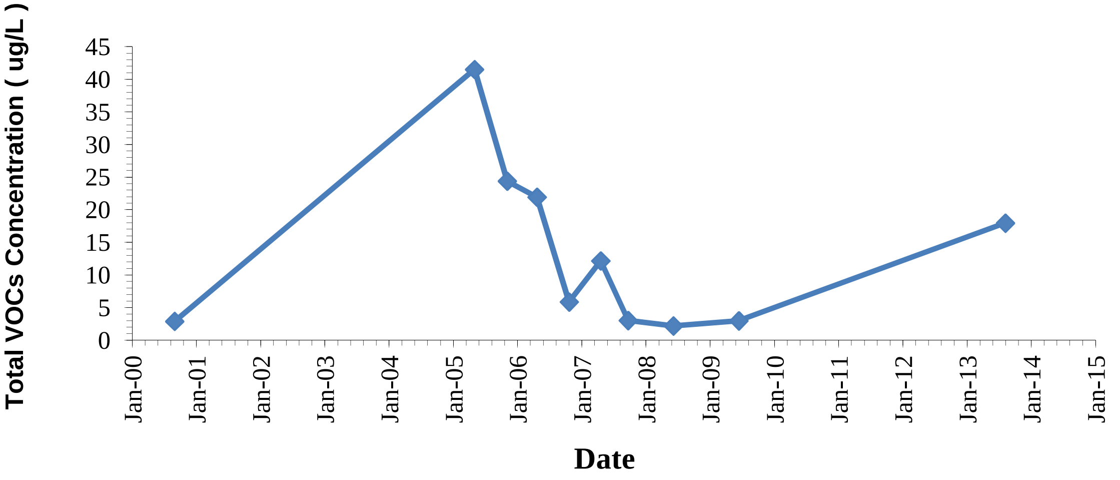
APPENDIX C
TVOC TREND PLOTS

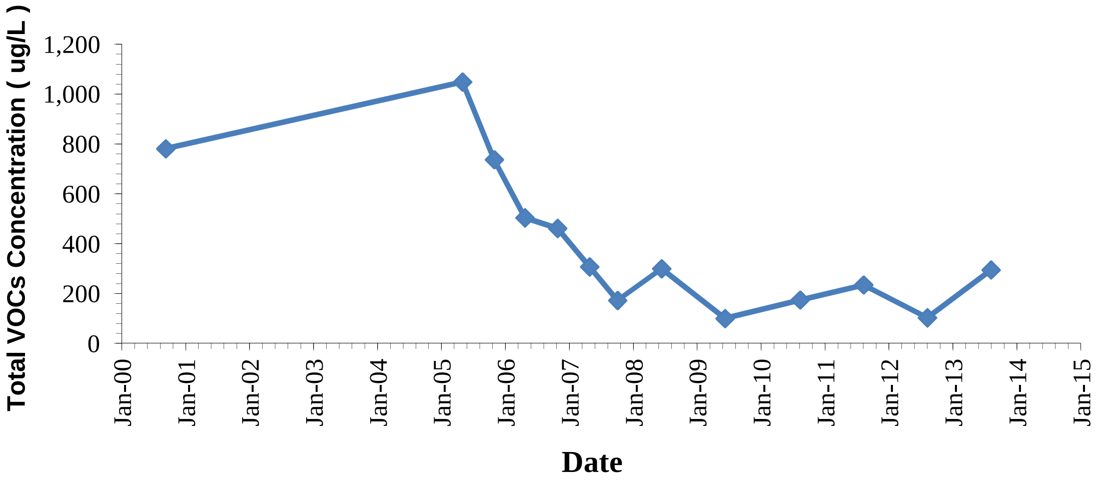

Total VOCs Concentration for D-9
Total VOCs Concentration (ug/L)
800
700
600
500
400
300
200
100
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date

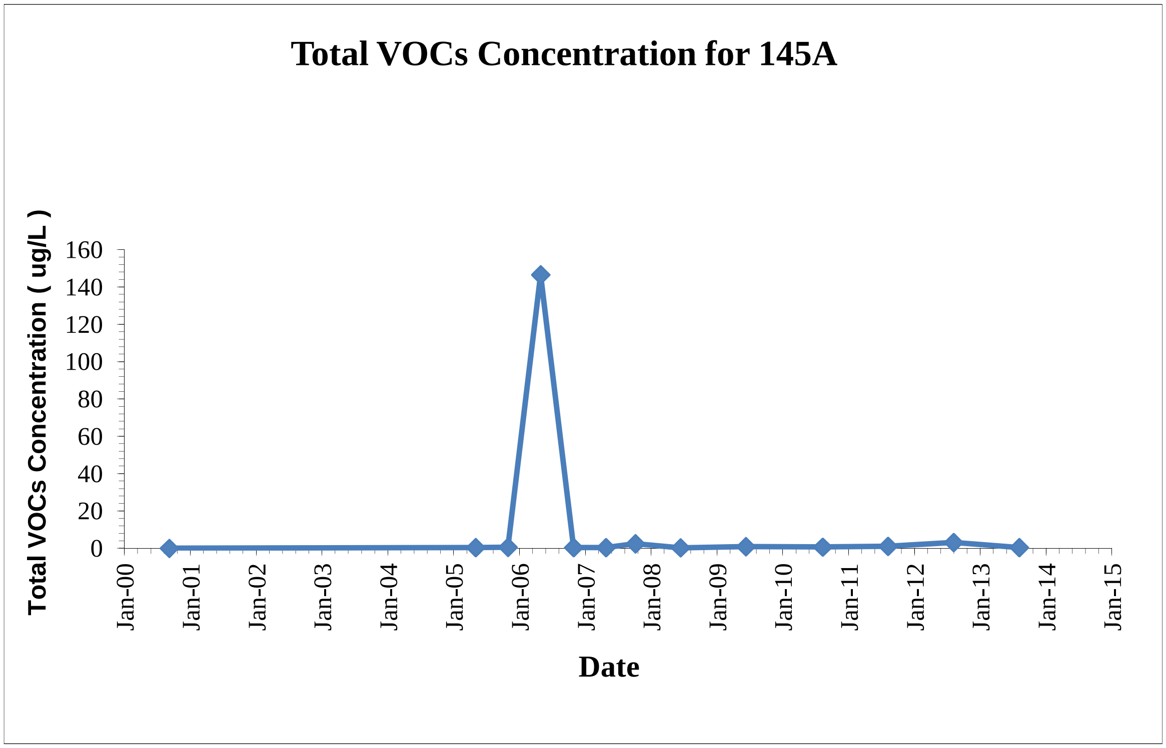

Total VOCs Concentration for D-11
Total VOCs Concentration (ug/L)
800
700
600
500
400
300
200
100
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date

Total VOCs Concentration for D-13



Total VOCs Concentration for 137A




Total VOCs Concentration for 145A
Total VOCs Concentration (ug/L)
0
20
40
60
80
100
120
140
160
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
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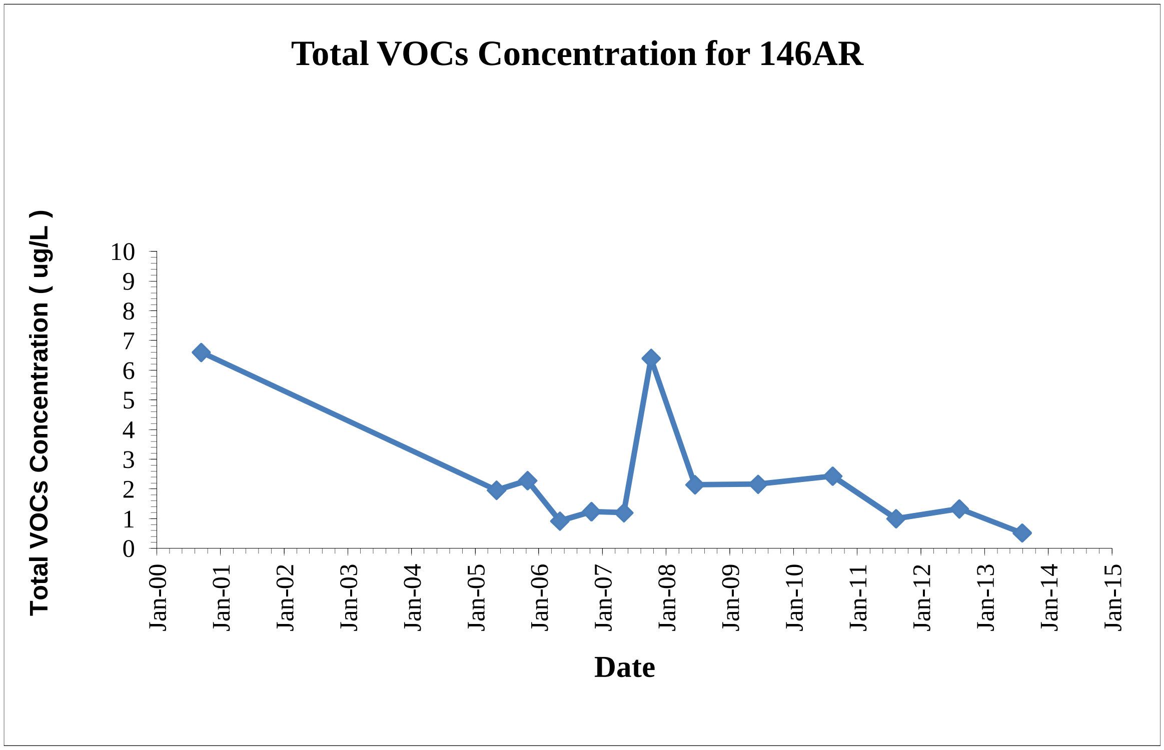
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date


Total VOCs Concentration for 146AR
Total VOCs Concentration (ug/L)
0
1
2
3
4
5
6
7
8
9
10
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
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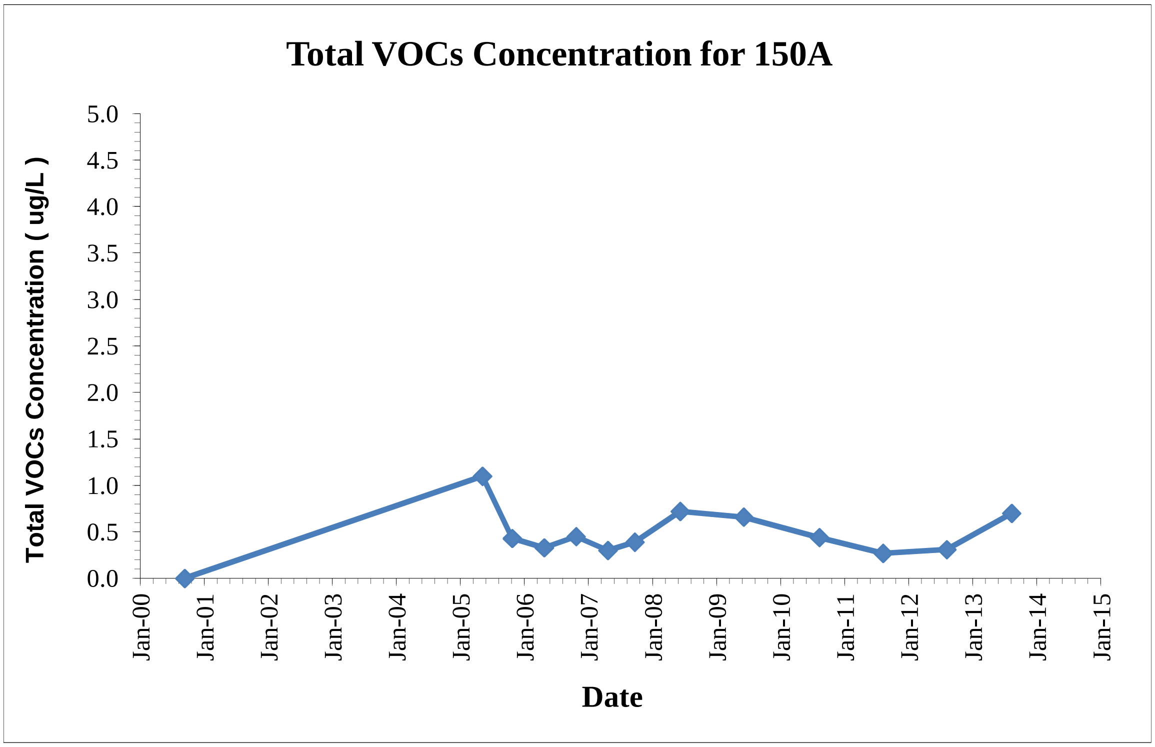
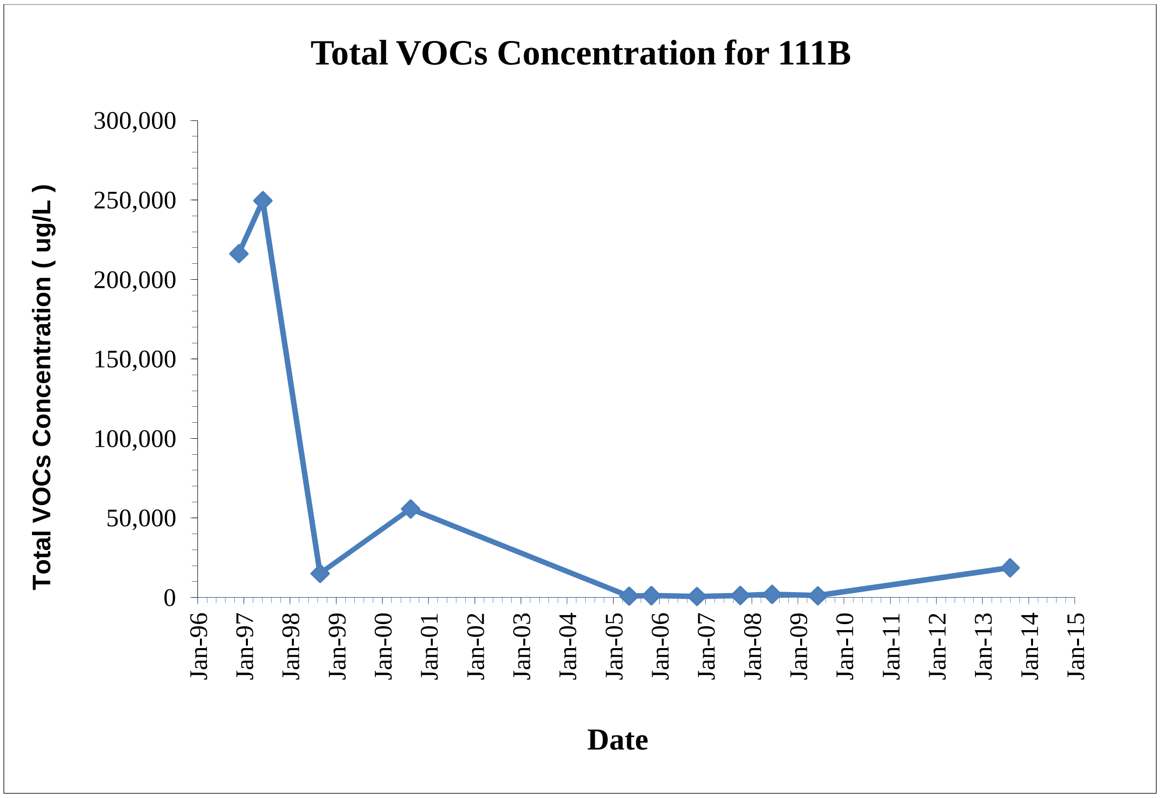
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date


Total VOCs Concentration for 150A
Total VOCs Concentration (ug/L)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date


Total VOCs Concentration for 111B
Total VOCs Concentration (ug/L)
300,000
250,000
200,000
150,000
100,000
50,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
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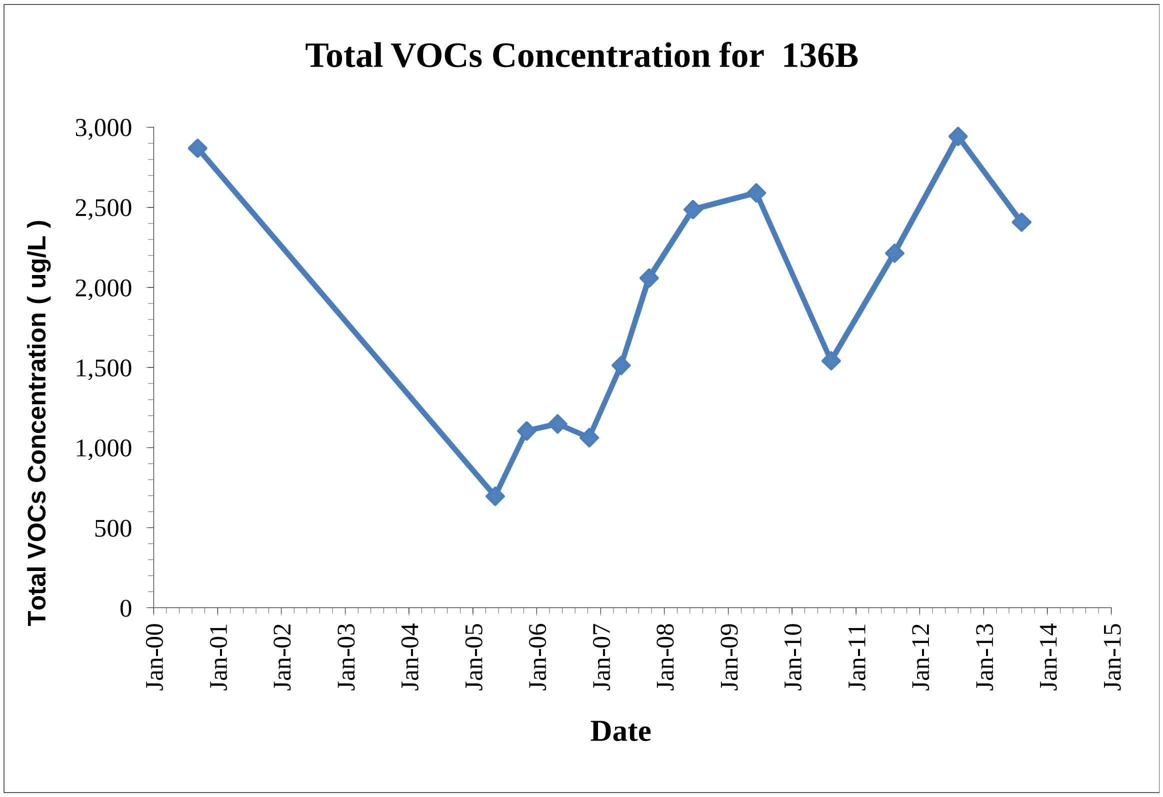
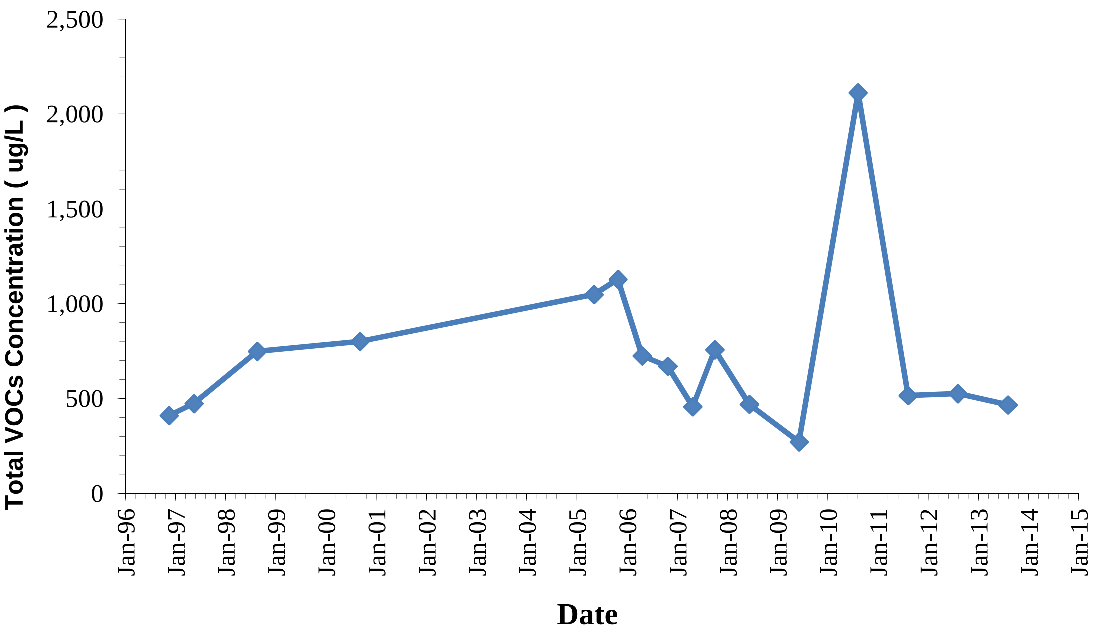
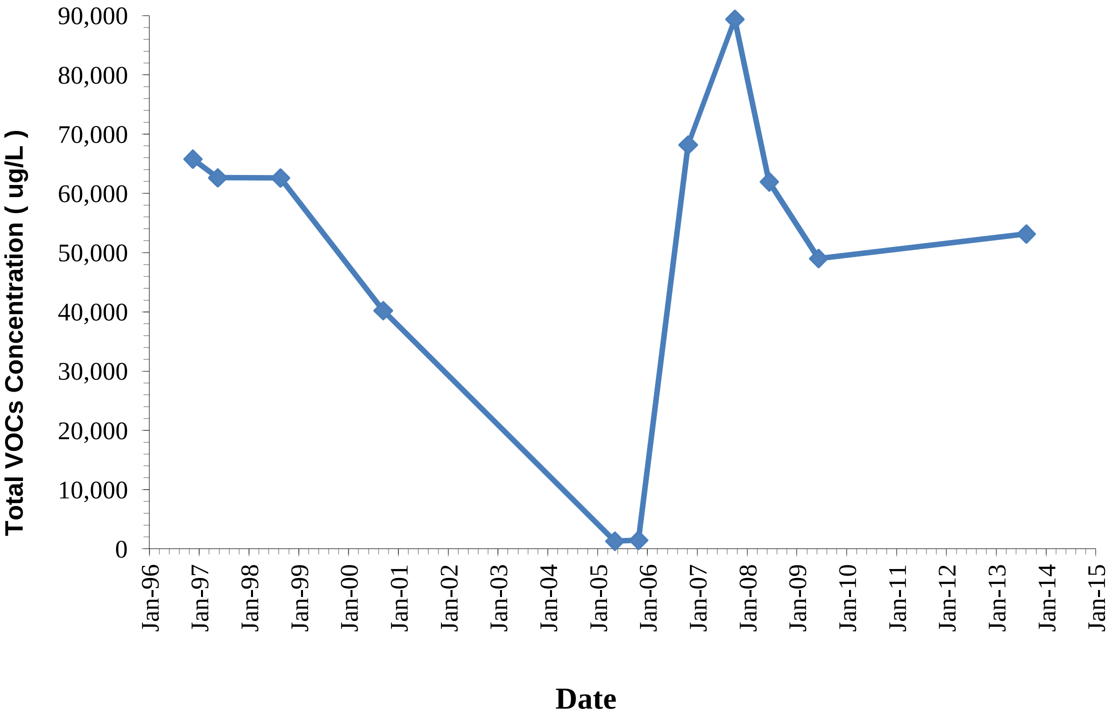
Jan-12
Jan-13
Jan-14
Jan-15
Date

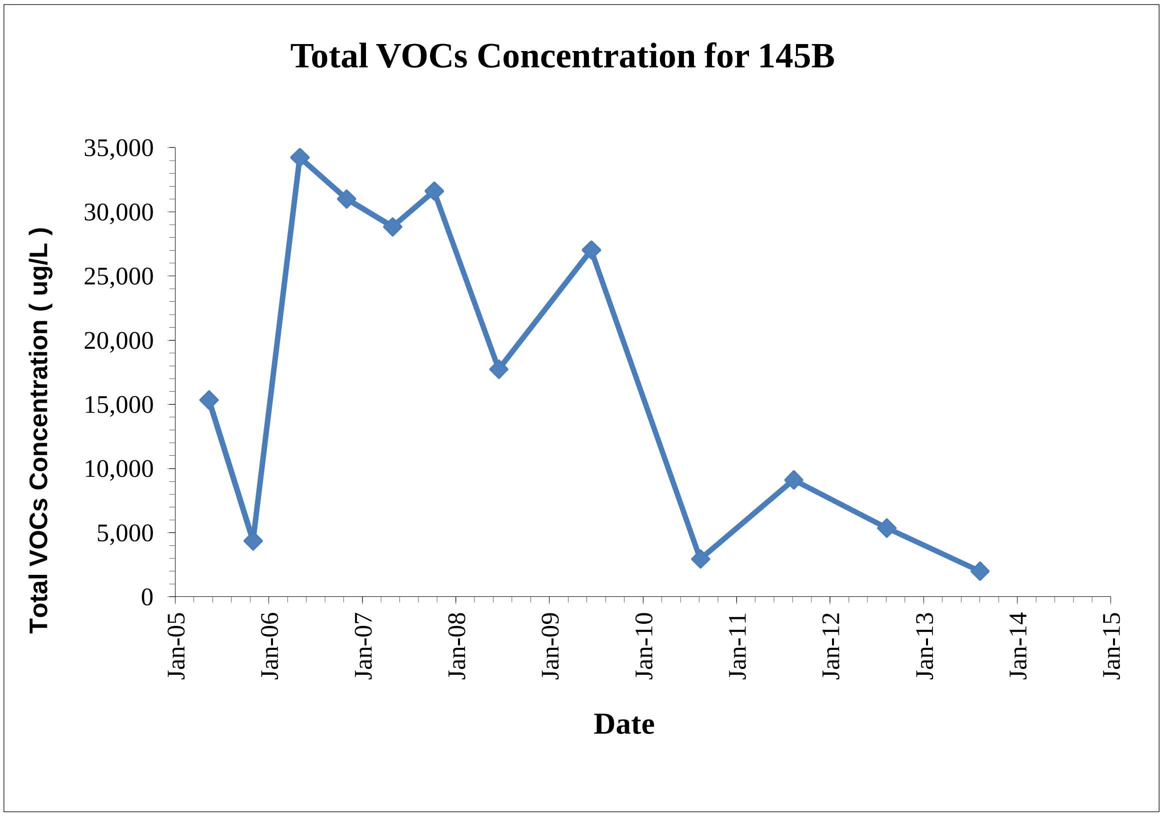

Total VOCs Concentration for 136B
Total VOCs Concentration (ug/L)
3,000
2,500
2,000
1,500
1,000
500
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date

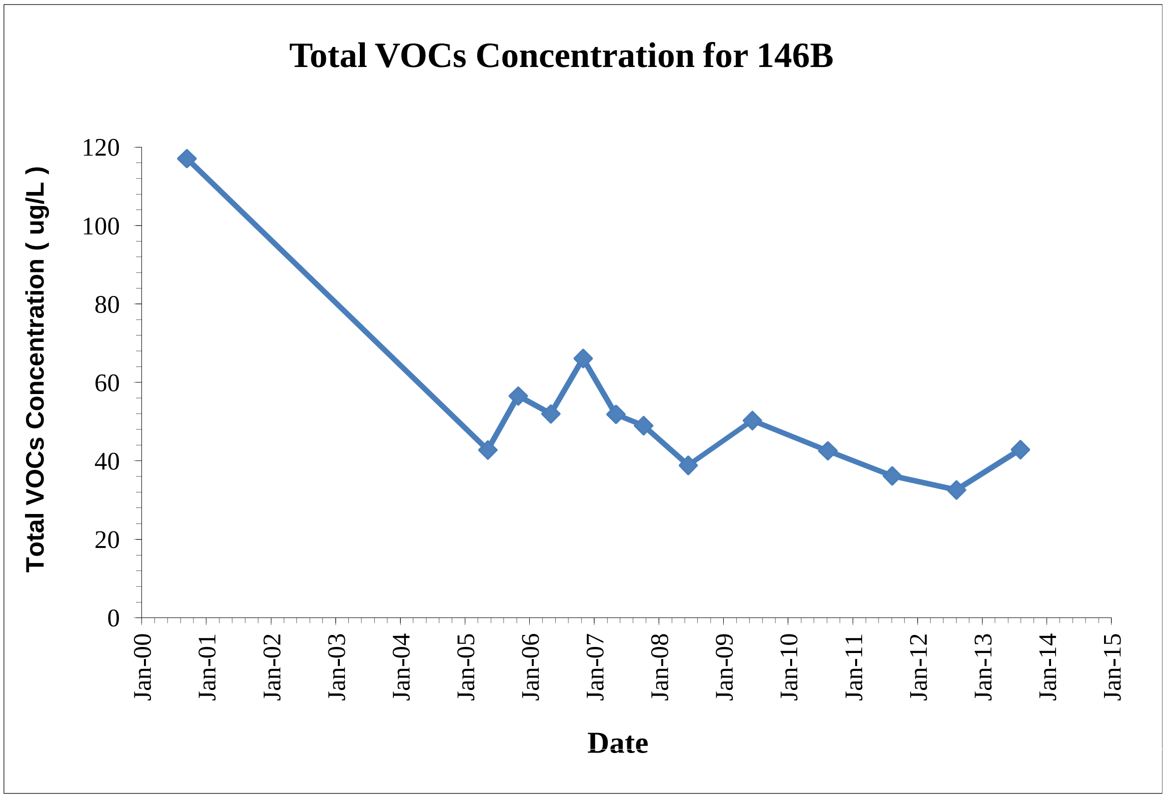
Total VOCs Concentration for 137B

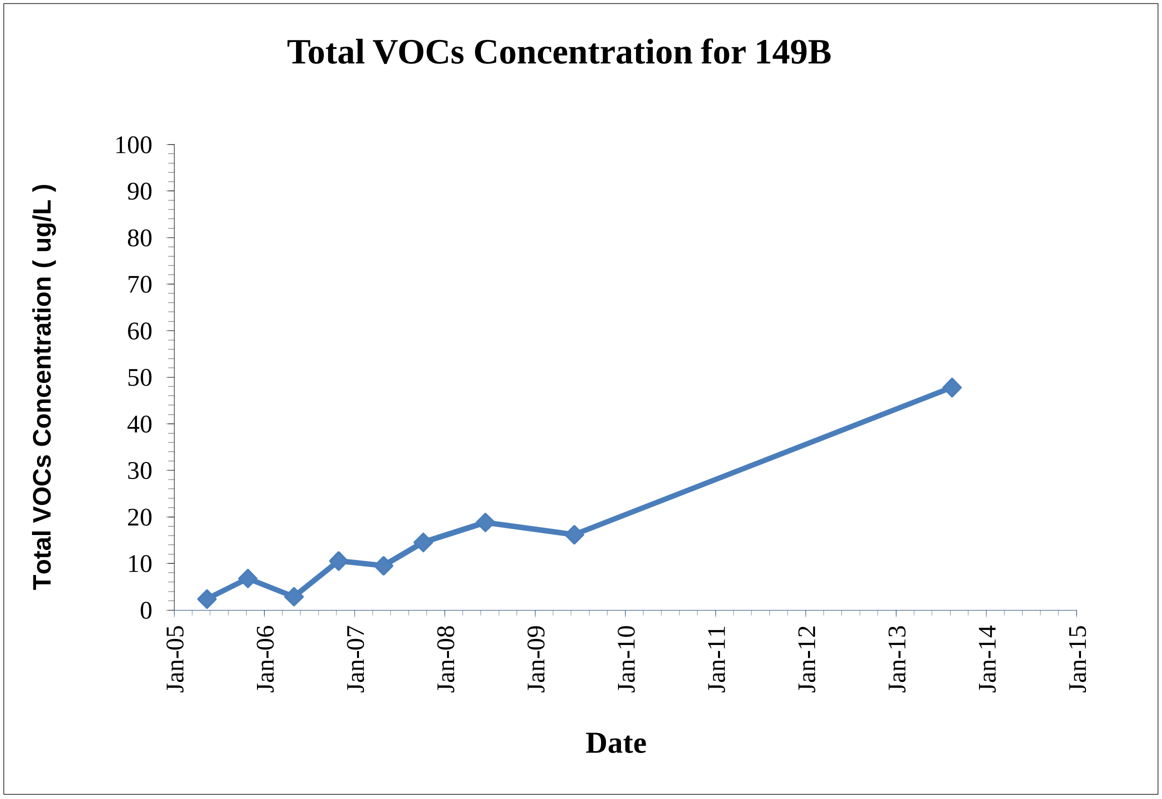


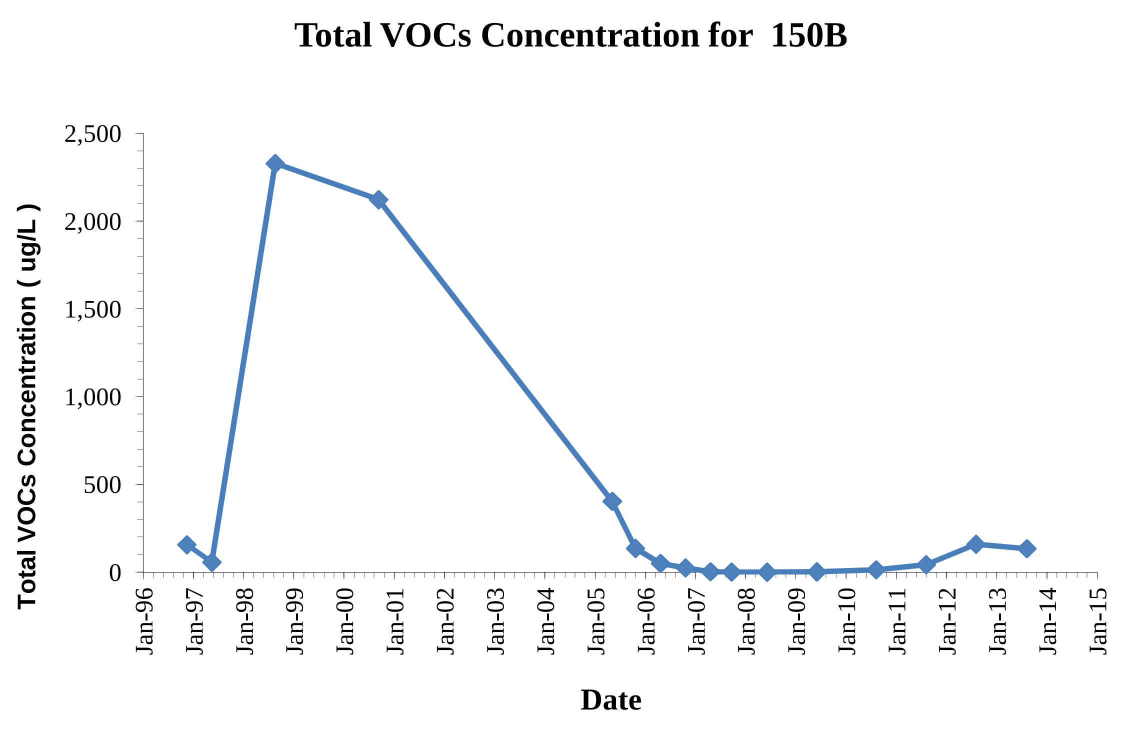
Total VOCs Concentration for 139B

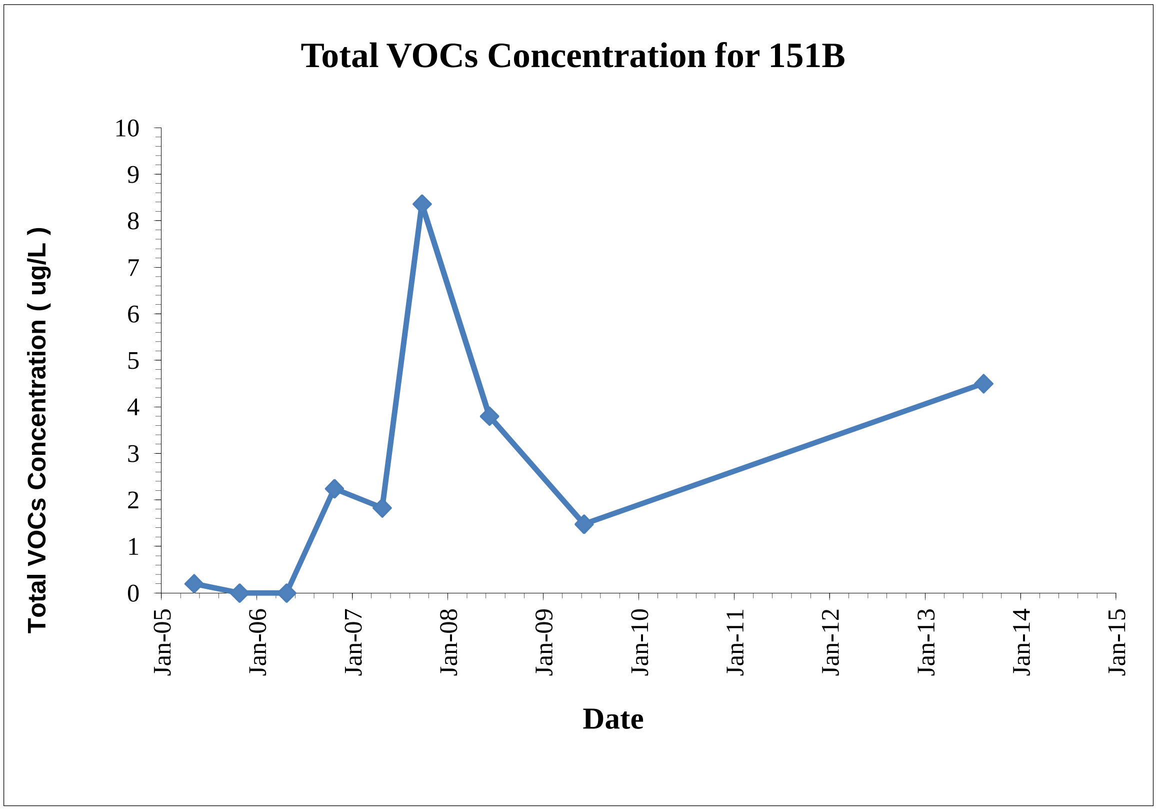


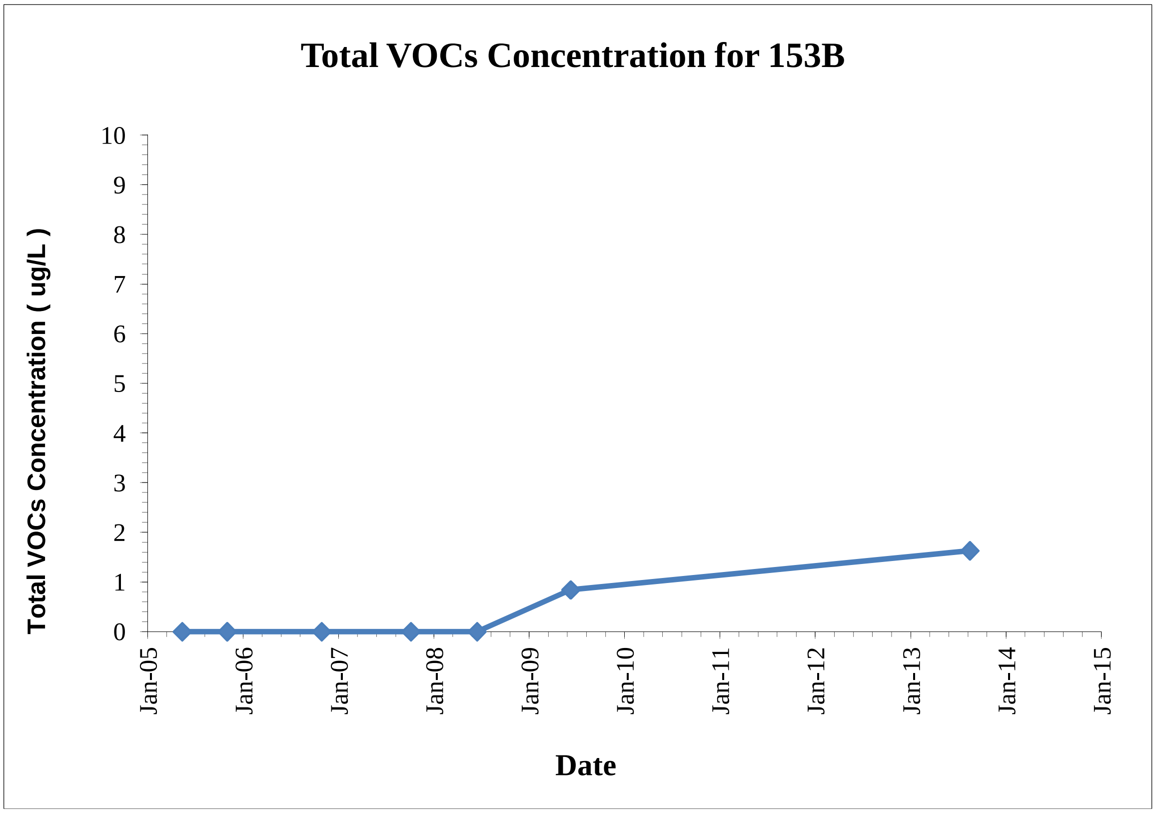

Total VOCs Concentration for 145B
Total VOCs Concentration (ug/L)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date

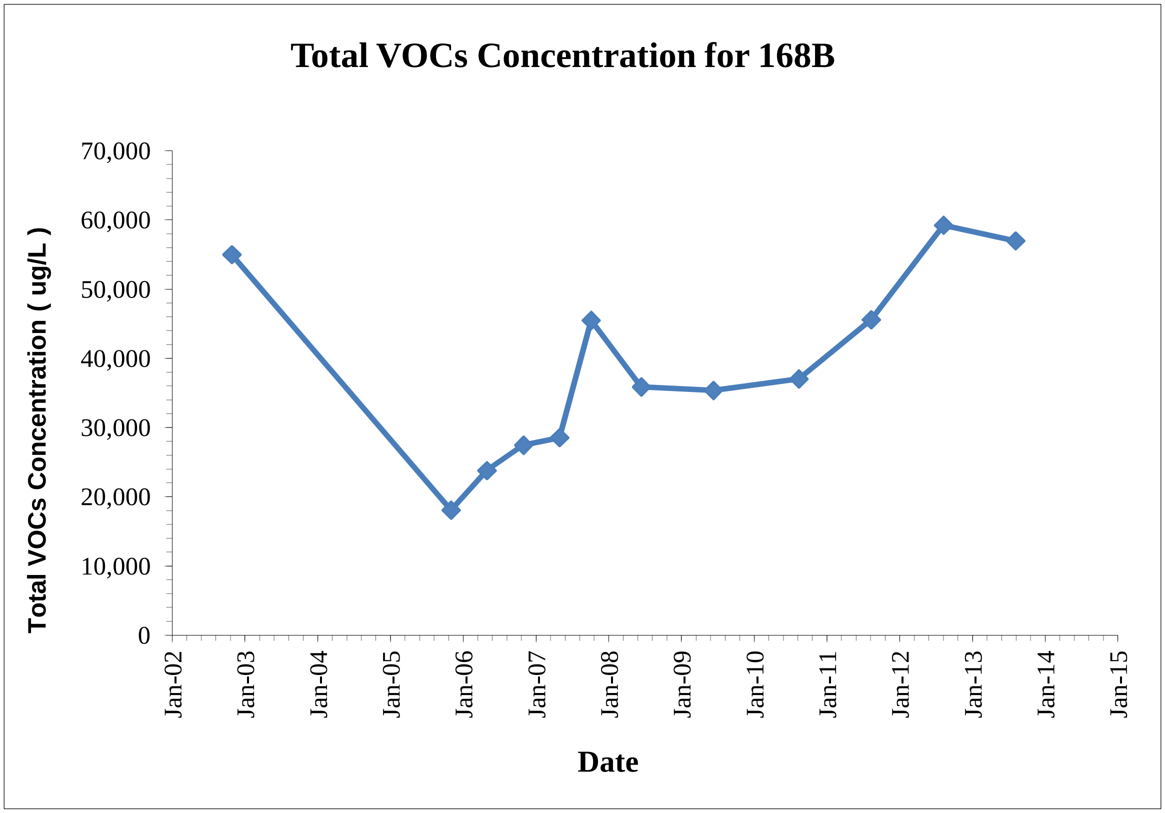

Total VOCs Concentration for 146B
Total VOCs Concentration (ug/L)
120
100
80
60
40
20
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date

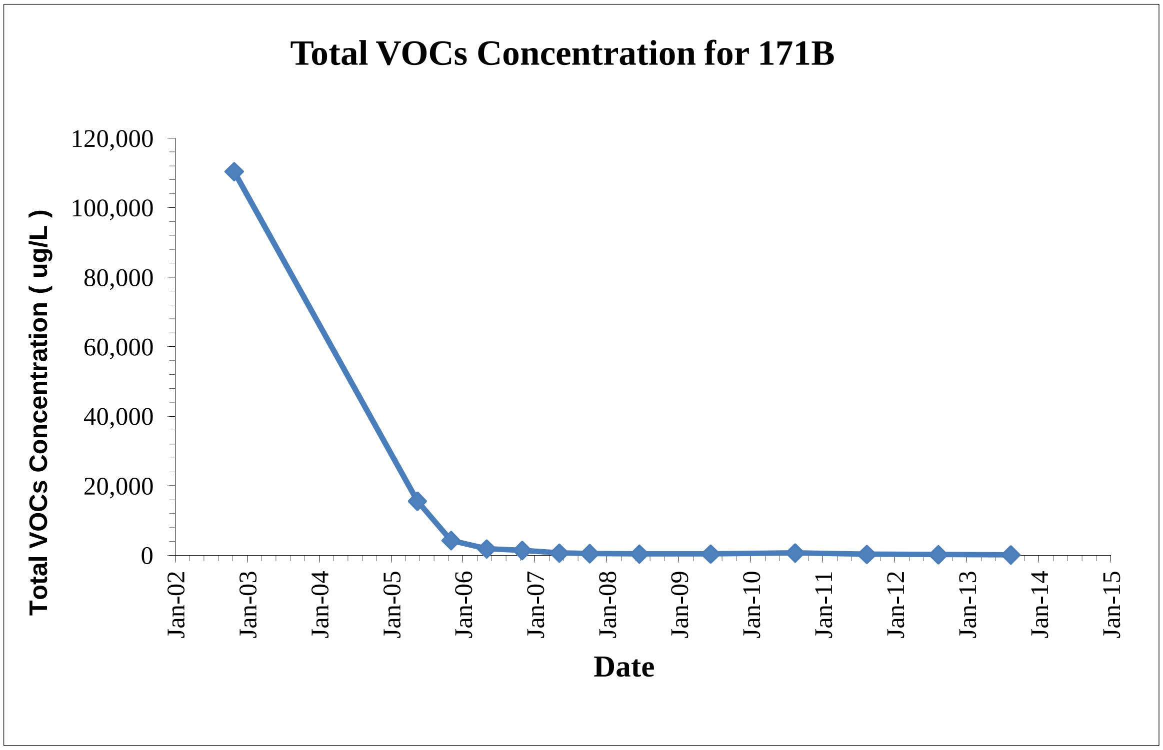

Total VOCs Concentration for 149B
Total VOCs Concentration (ug/L)
100
90
80
70
60
50
40
30
20
10
0
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date

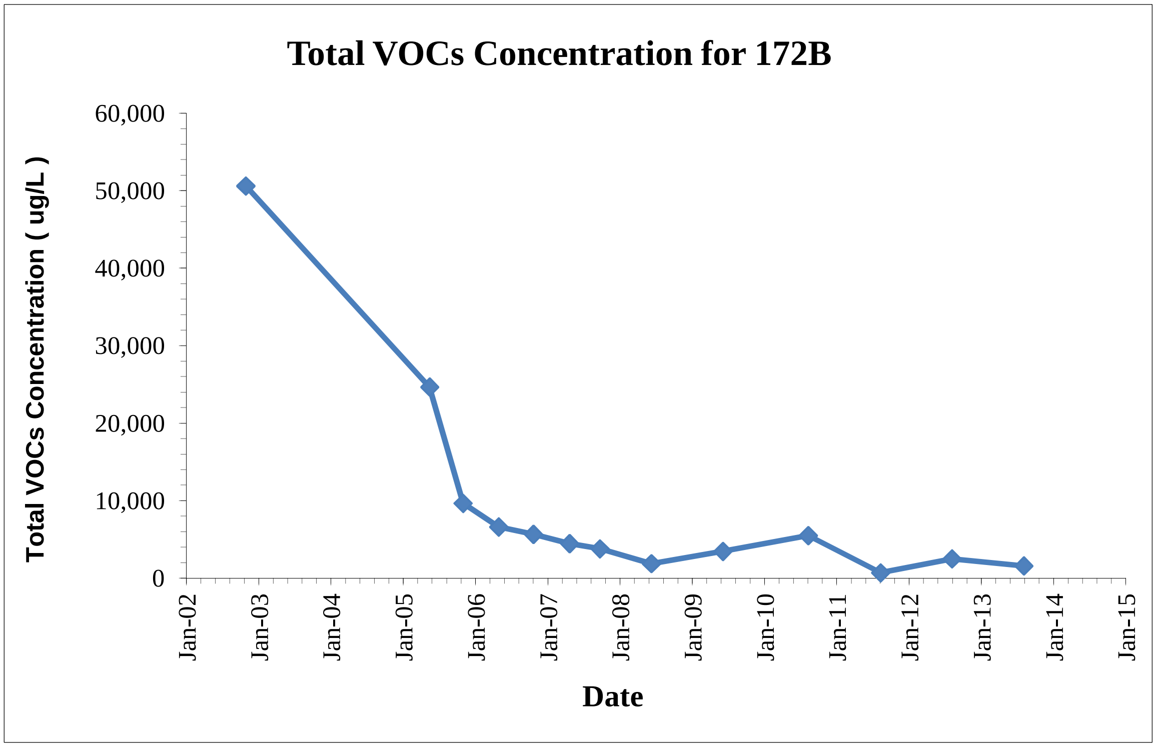

Total VOCs Concentration for 150B
Total VOCs Concentration (ug/L)
2,500
2,000
1,500
1,000
500
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date

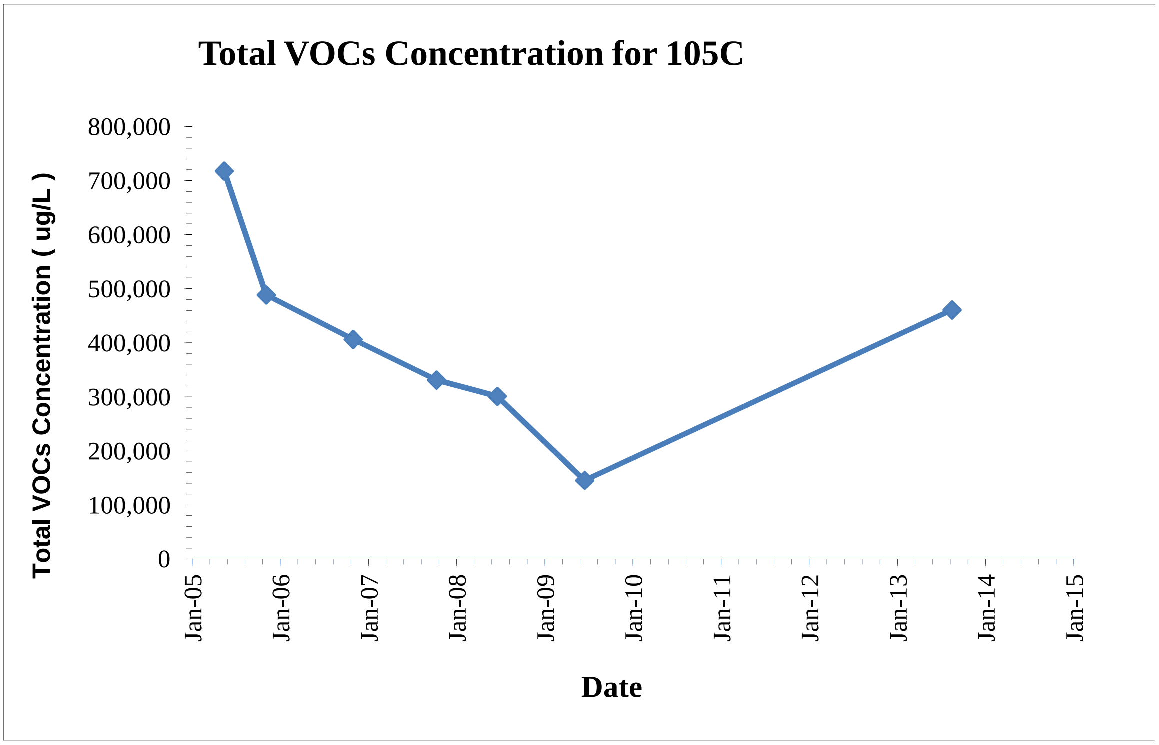

Total VOCs Concentration for 151B
Total VOCs Concentration (ug/L)
0
1
2
3
4
5
6
7
8
9
10
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date

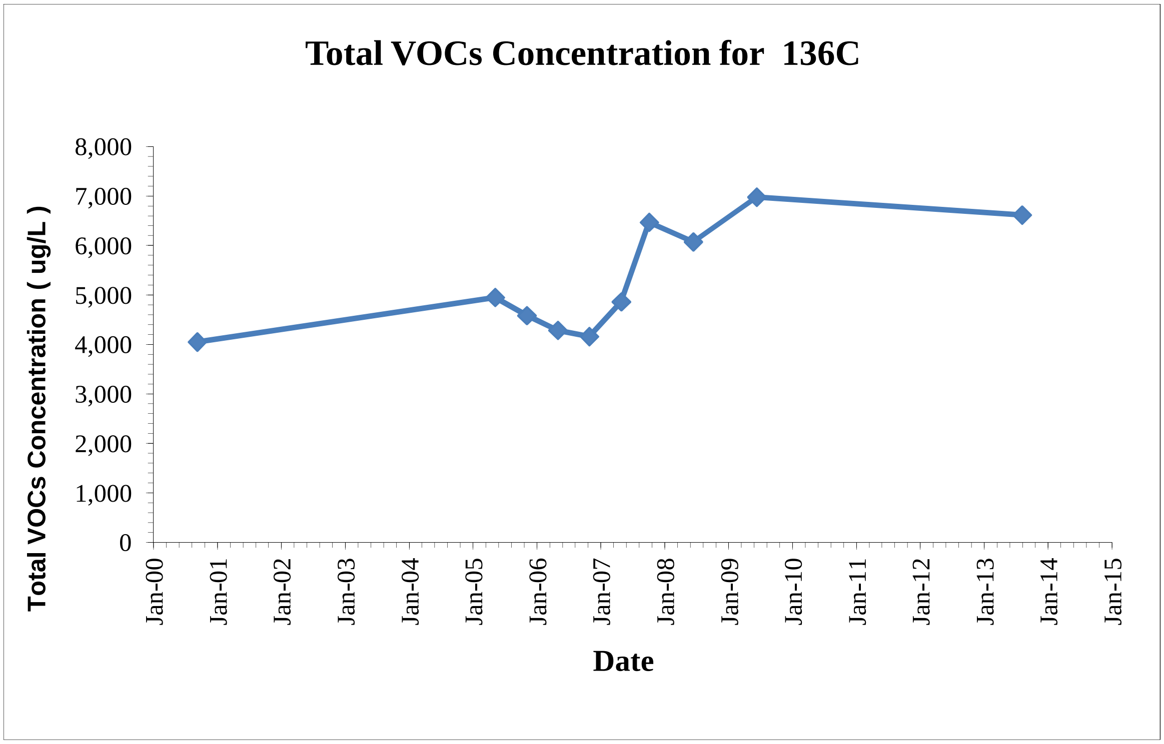

Total VOCs Concentration for 153B
Total VOCs Concentration (ug/L)
0
1
2
3
4
5
6
7
8
9
10
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date

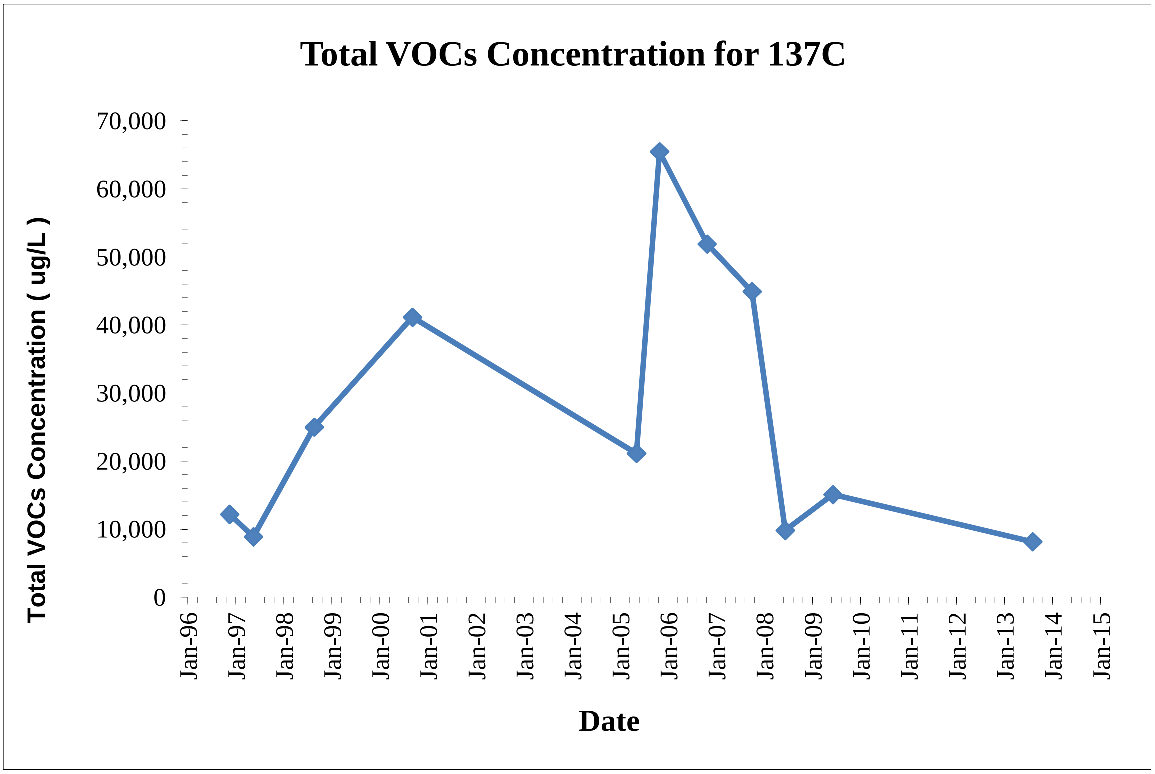

Total VOCs Concentration for 168B
Total VOCs Concentration (ug/L)
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date


Total VOCs Concentration for 171B
Total VOCs Concentration (ug/L)
120,000
100,000
80,000
60,000
40,000
20,000
0
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date

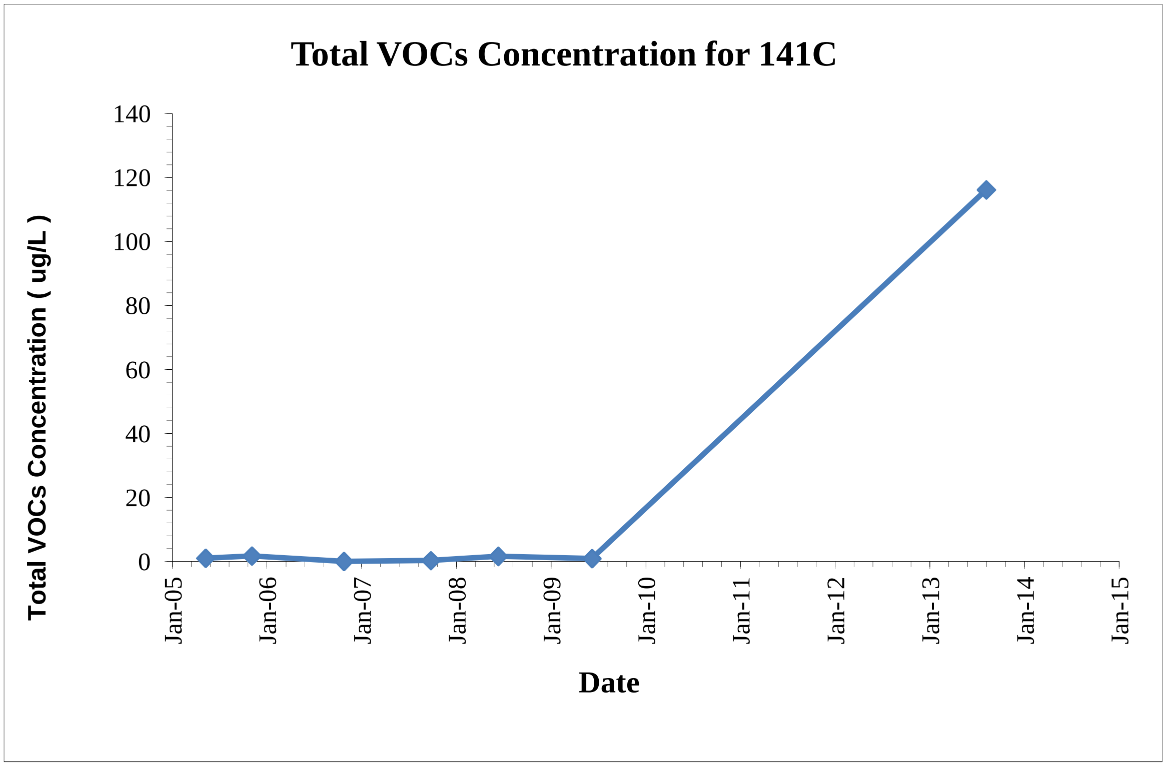

Total VOCs Concentration for 172B
Total VOCs Concentration (ug/L)
60,000
50,000
40,000
30,000
20,000
10,000
0
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date


Total VOCs Concentration for 105C
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
Total VOCs Concentration (ug/L)
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date

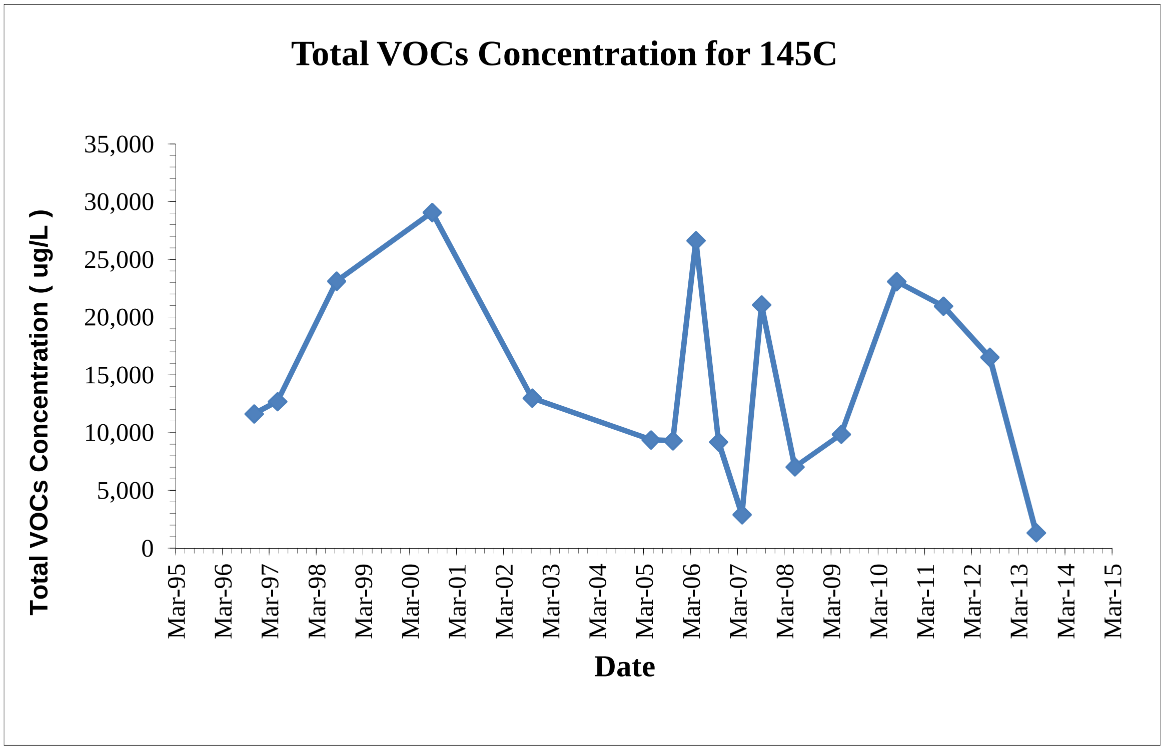

Total VOCs Concentration for 136C
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Total VOCs Concentration (ug/L)
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date

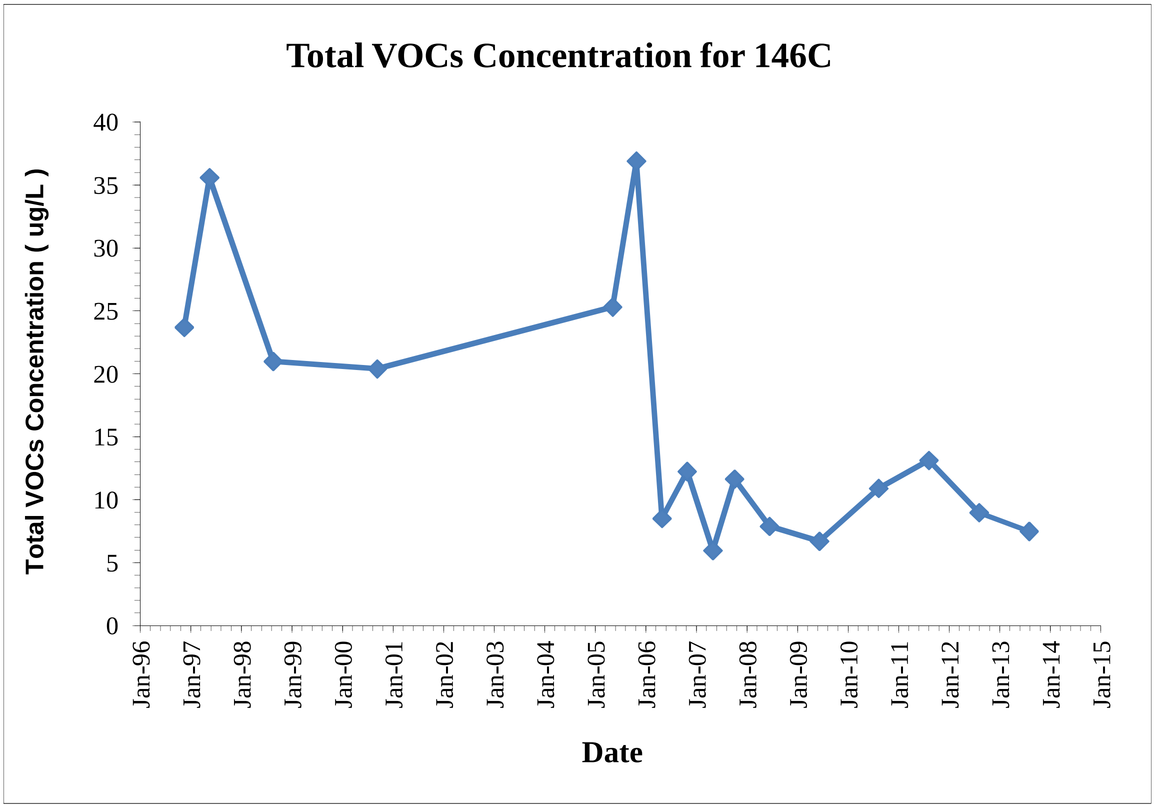


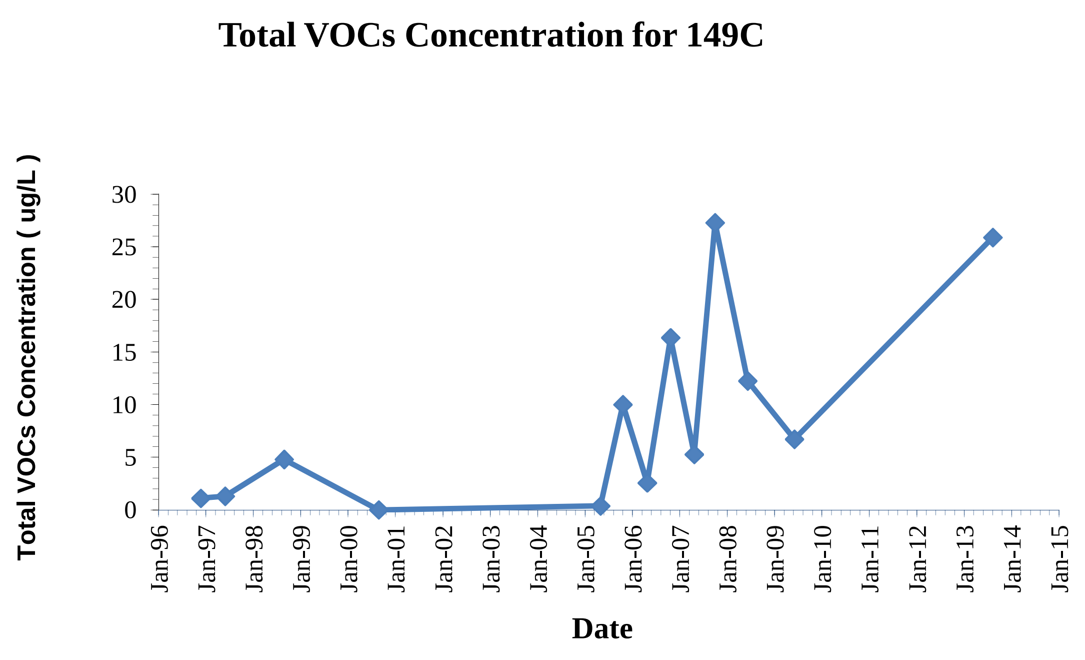
Total VOCs Concentration for 137C

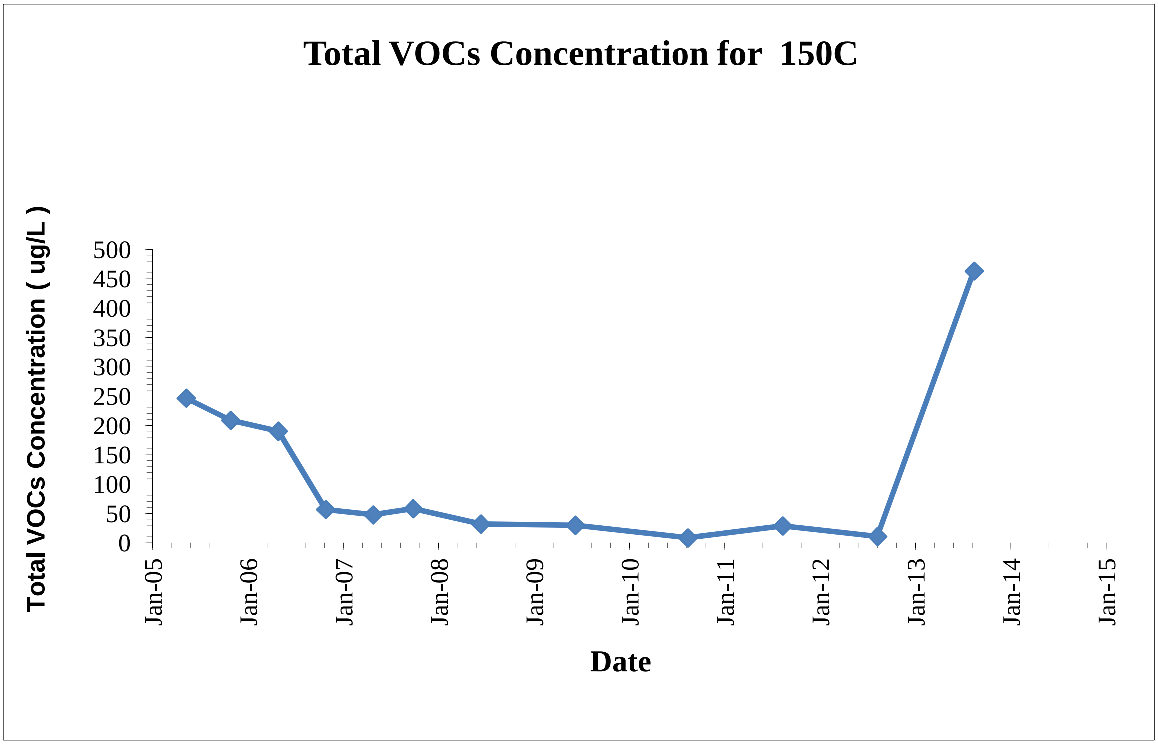


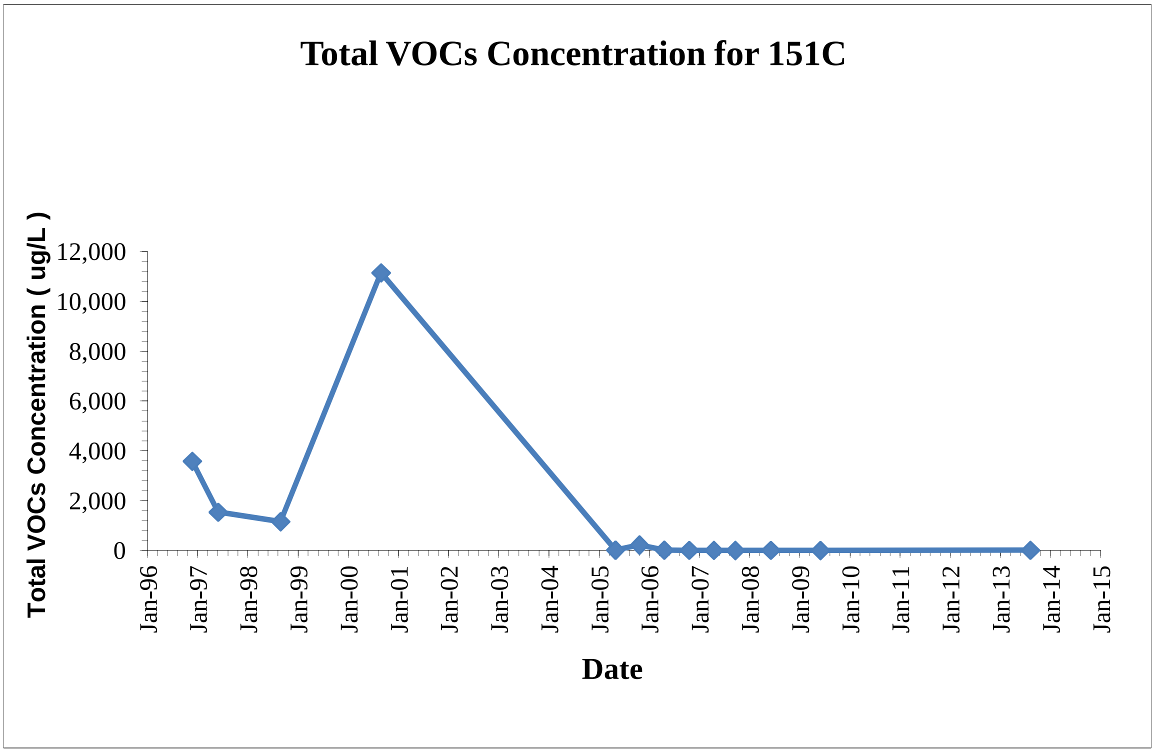
Total VOCs Concentration for 141C

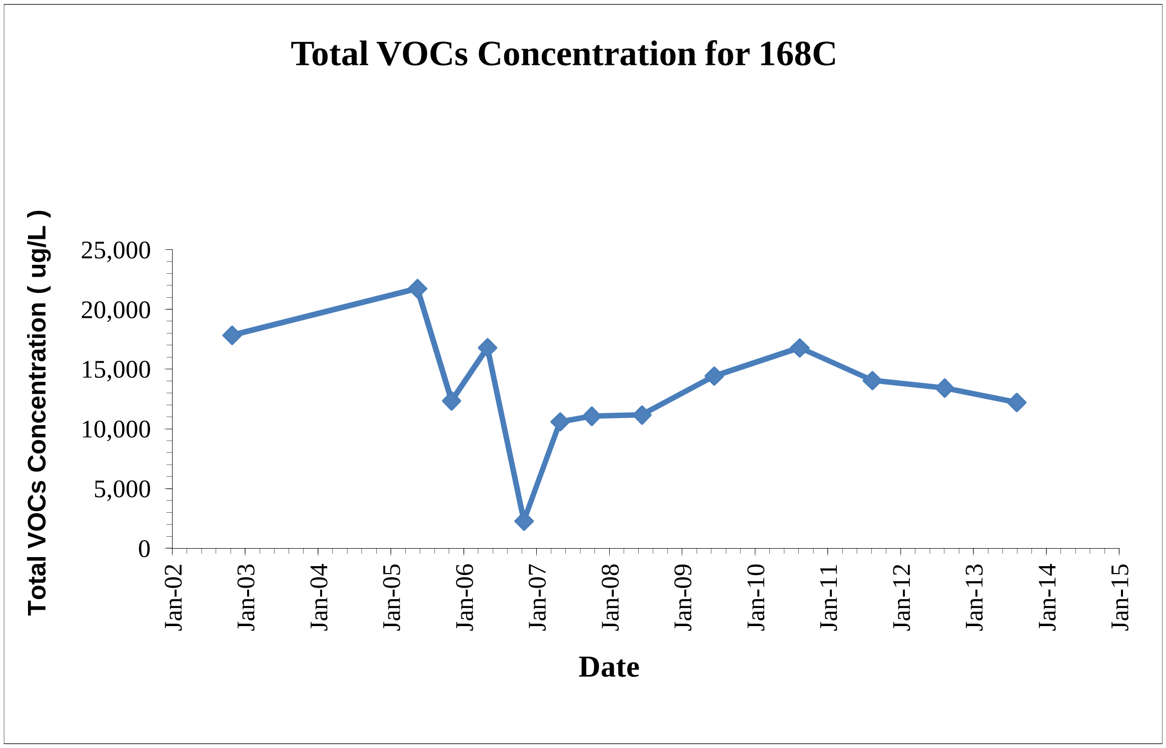

Total VOCs Concentration for 145C
Total VOCs Concentration (ug/L)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Mar-95
Mar-96
Mar-97
Mar-98
Mar-99
Mar-00
Mar-01
Mar-02
Mar-03
Mar-04
Mar-05
Mar-06
Mar-07
Mar-08
Mar-09
Mar-10
Mar-11
Mar-12
Mar-13
Mar-14
Mar-15
Date

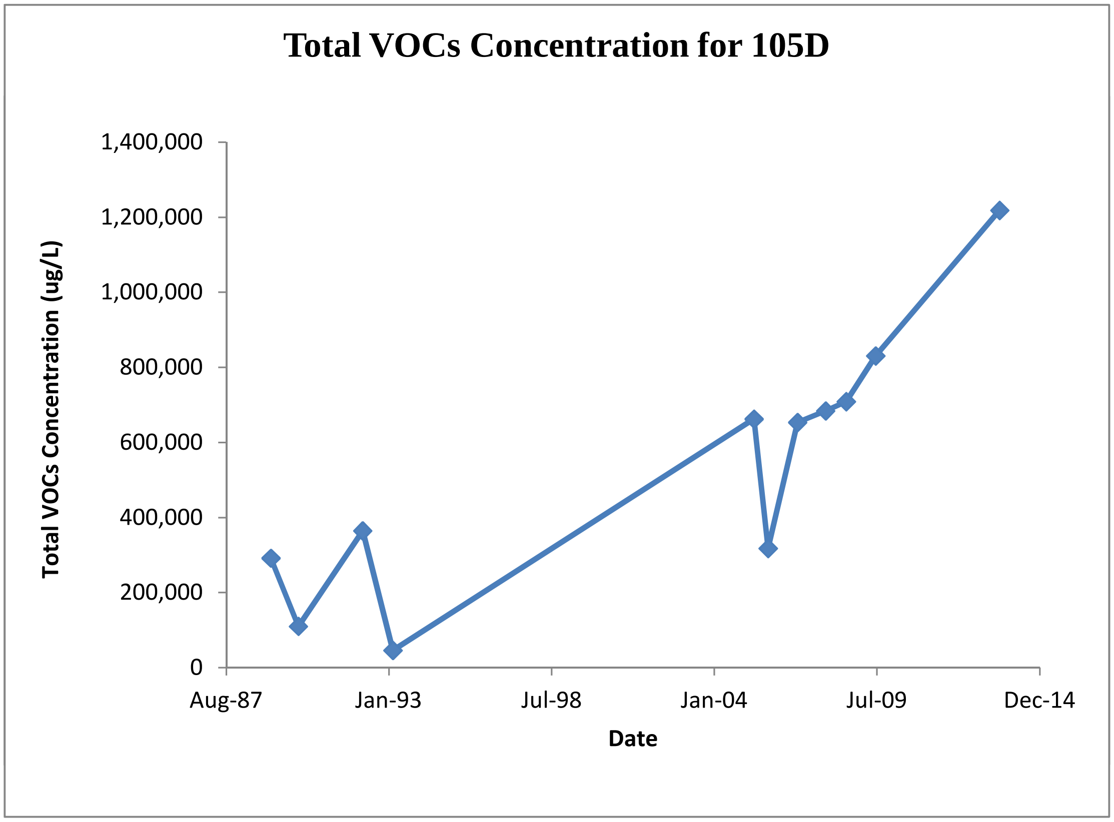

Total VOCs Concentration for 146C
Total VOCs Concentration (ug/L)
40
35
30
25
20
15
10
5
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date

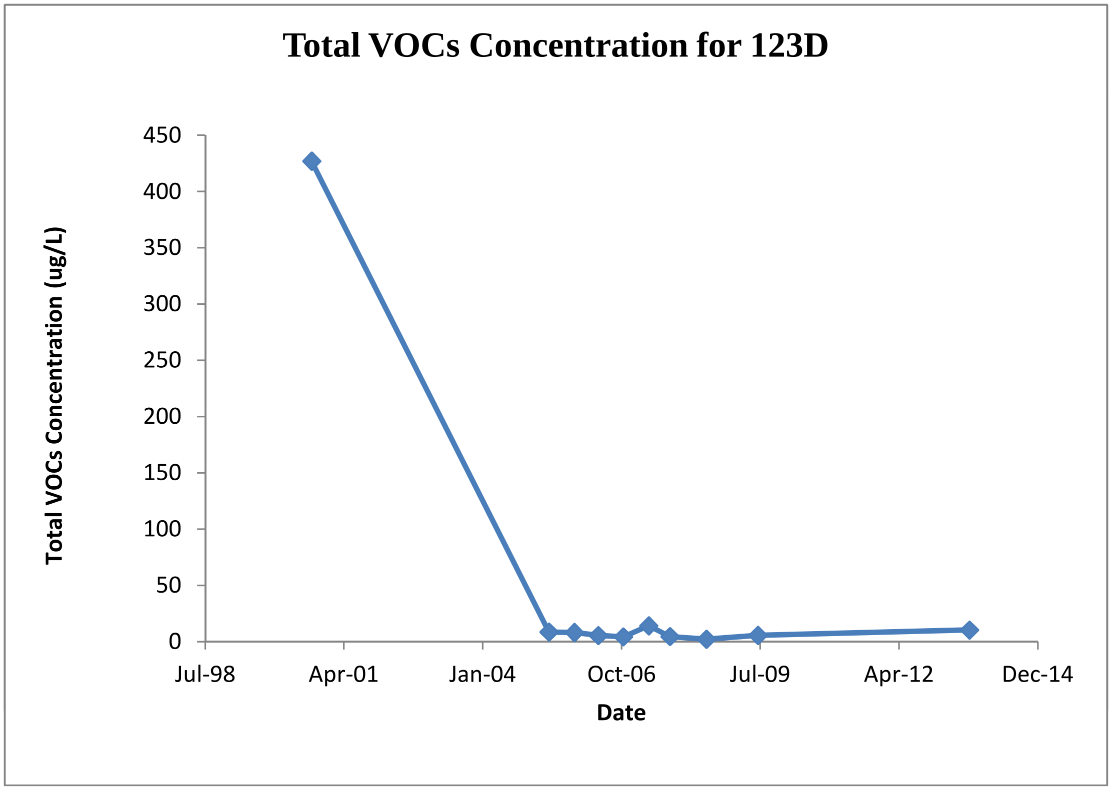

Total VOCs Concentration for 149C
Total VOCs Concentration (ug/L)
0
5
10
15
20
25
30
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date

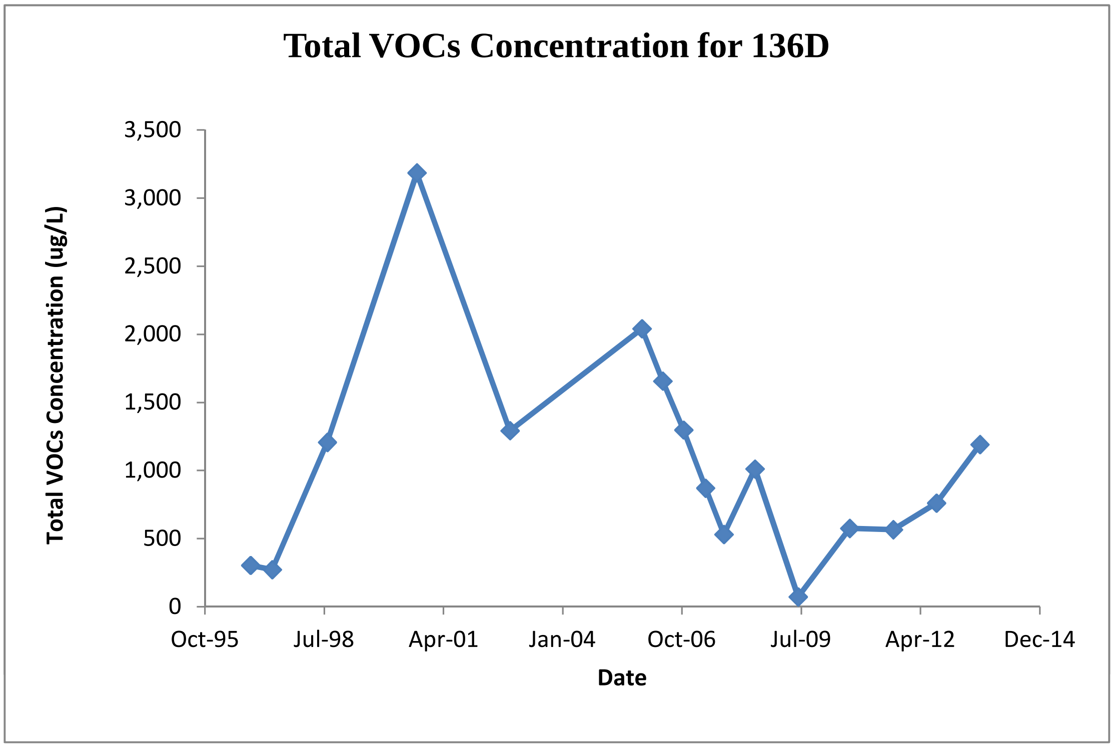

Total VOCs Concentration for 150C
Total VOCs Concentration (ug/L)
0
50
100
150
200
250
300
350
400
450
500
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date

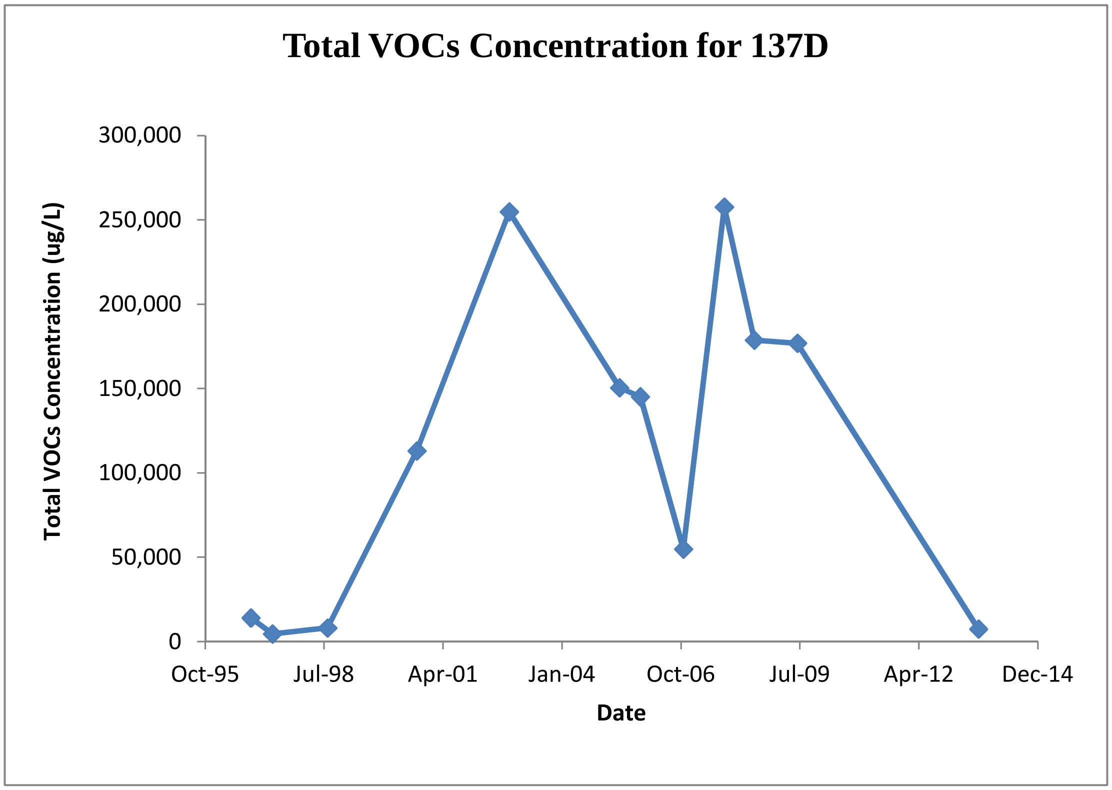

Total VOCs Concentration for 151C
Total VOCs Concentration (ug/L)
12,000
10,000
8,000
6,000
4,000
2,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date


Total VOCs Concentration for 168C
Total VOCs Concentration (ug/L)
25,000
20,000
15,000
10,000
5,000
0
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date

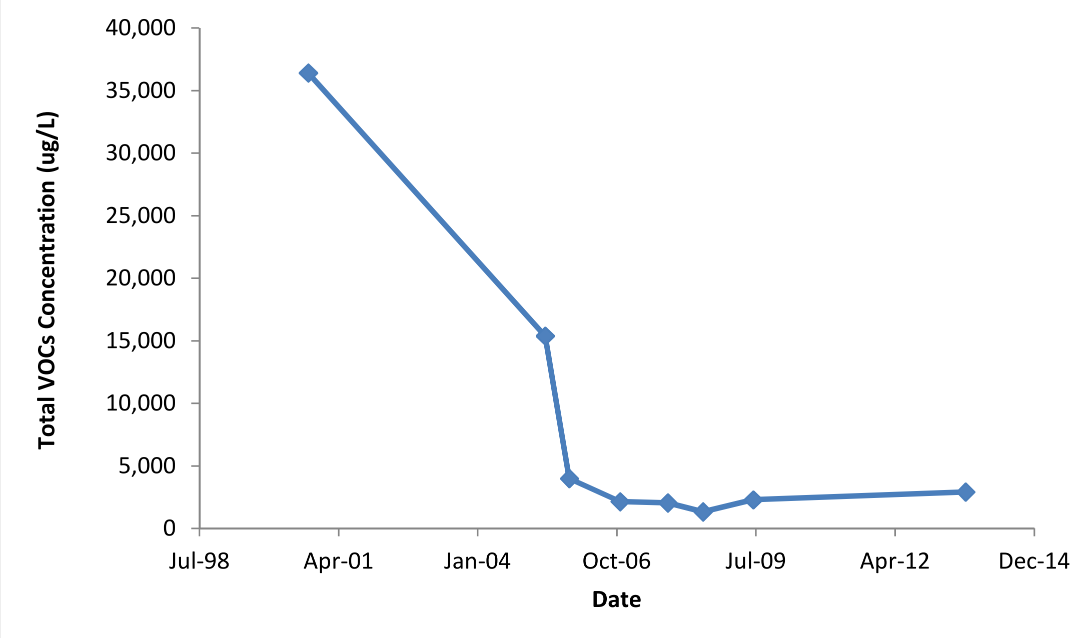

Total VOCs Concentration for 105D
Total VOCs Concentration (ug/L)
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Aug-87
Jan-93
Jul-98
Jan-04
Jul-09
Dec-14
Date


Total VOCs Concentration for 123D
Total VOCs Concentration (ug/L)
450
400
350
300
250
200
150
100
50
0
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Date

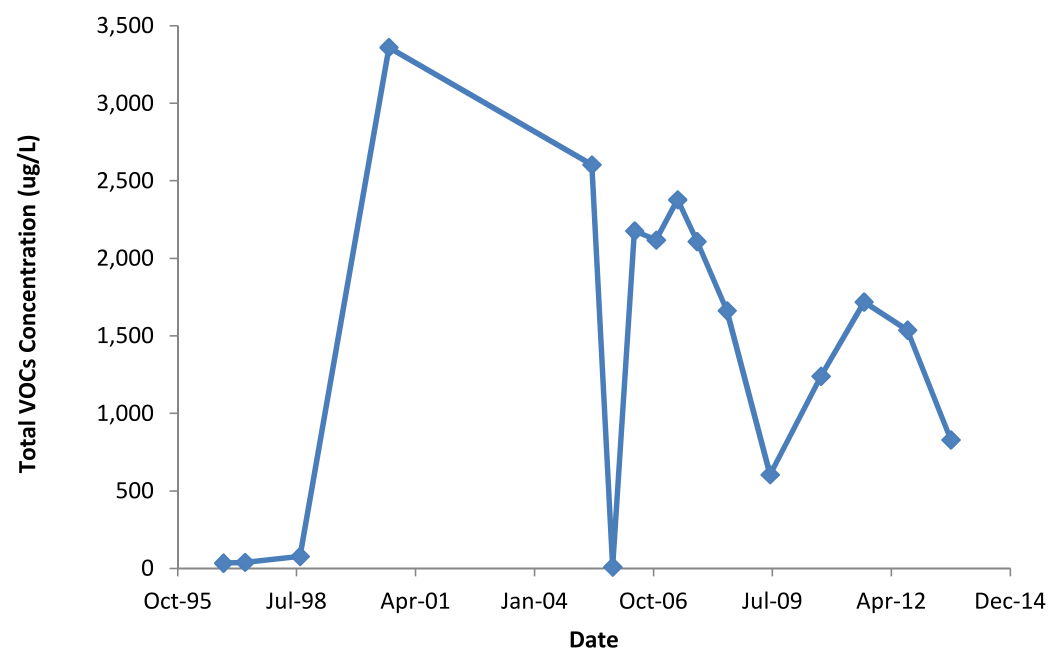

Total VOCs Concentration for 136D
Total VOCs Concentration (ug/L)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Date

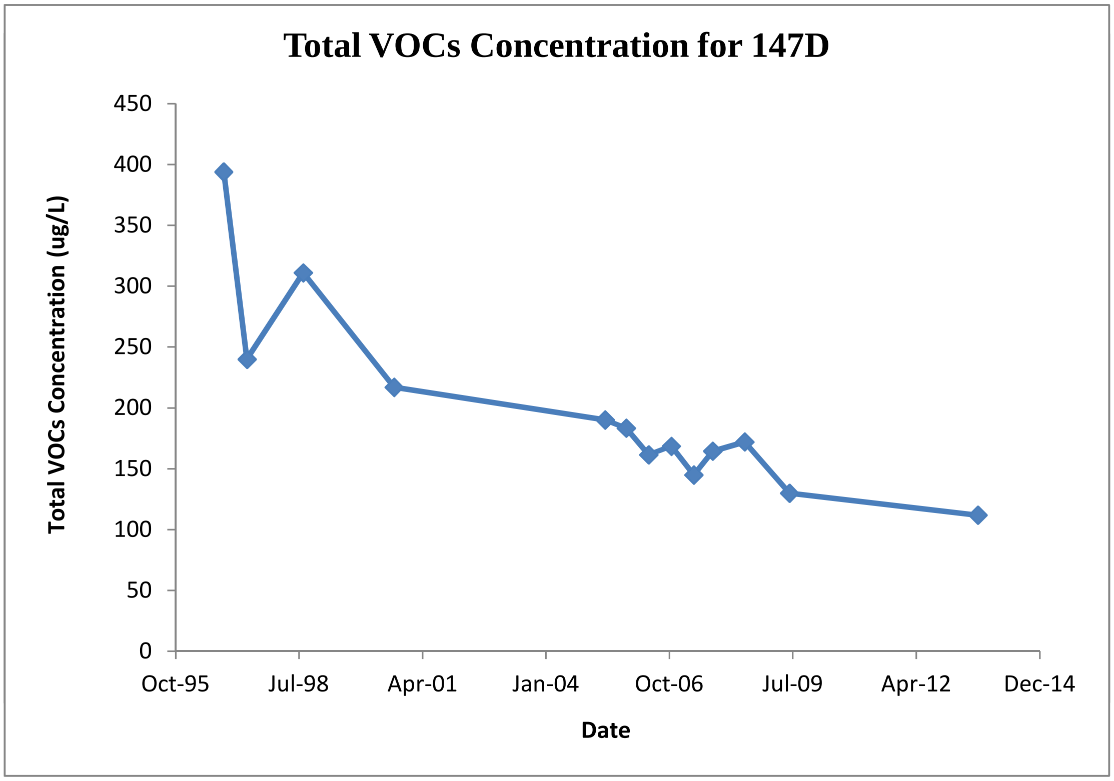

Total VOCs Concentration for 137D
Total VOCs Concentration (ug/L)
300,000
250,000
200,000
150,000
100,000
50,000
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Date

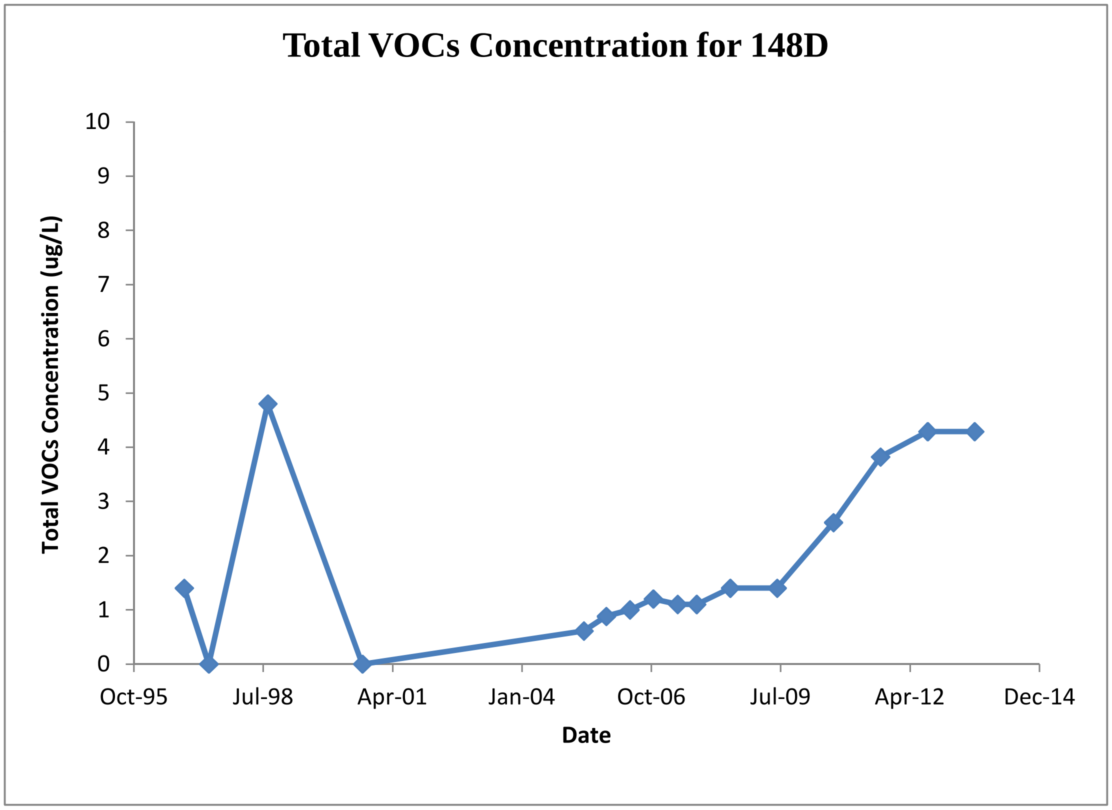
Total VOCs Concentration for 139D



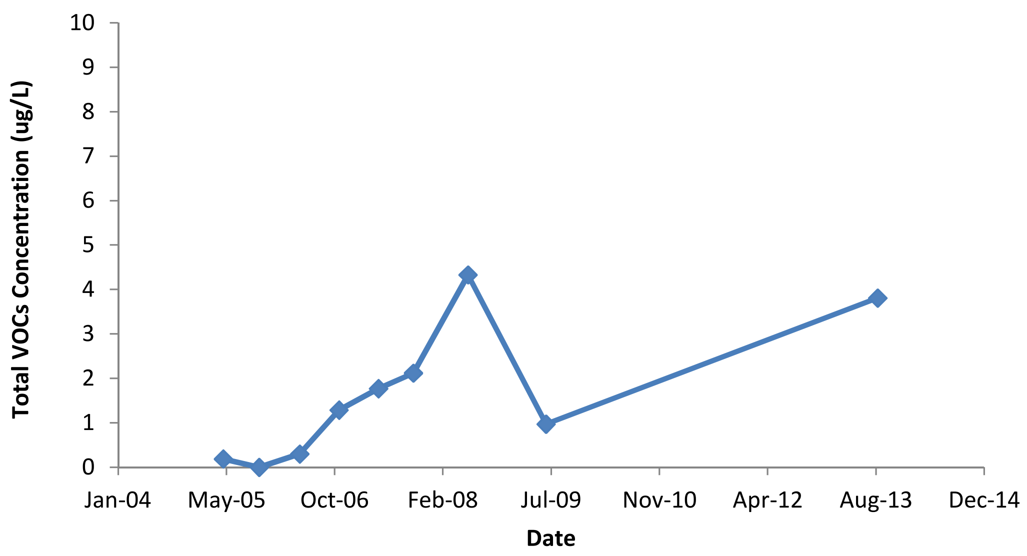
Total VOCs Concentration for 145D



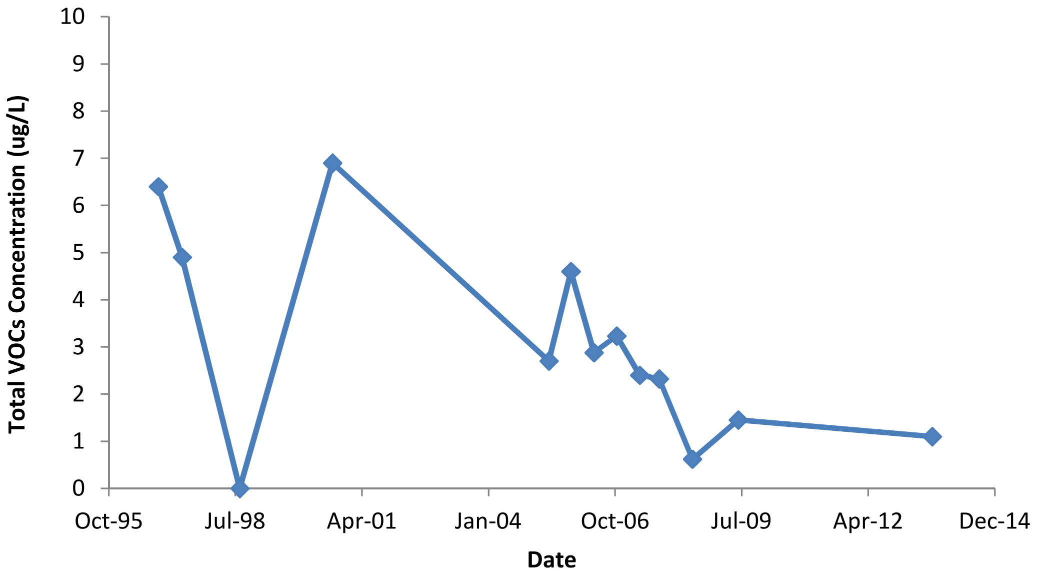

Total VOCs Concentration for 147D
Total VOCs Concentration (ug/L)
450
400
350
300
250
200
150
100
50
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Date

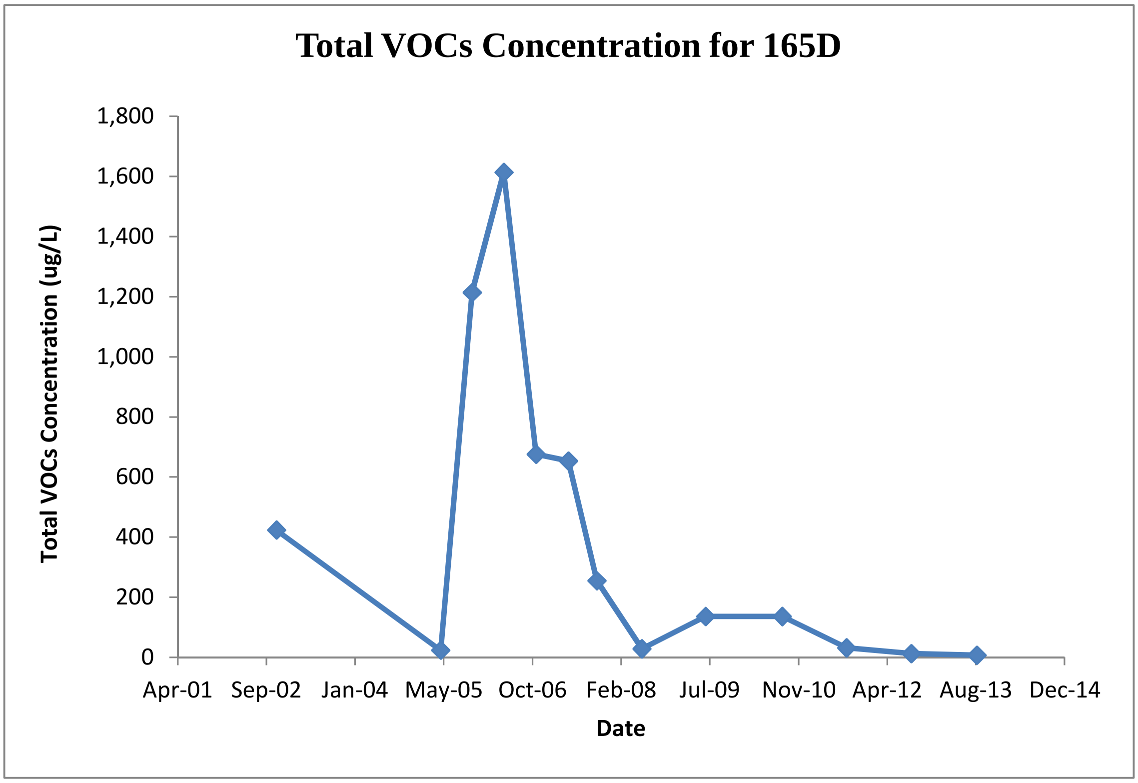

Total VOCs Concentration for 148D
Total VOCs Concentration (ug/L)
10
9
8
7
6
5
4
3
2
1
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Date

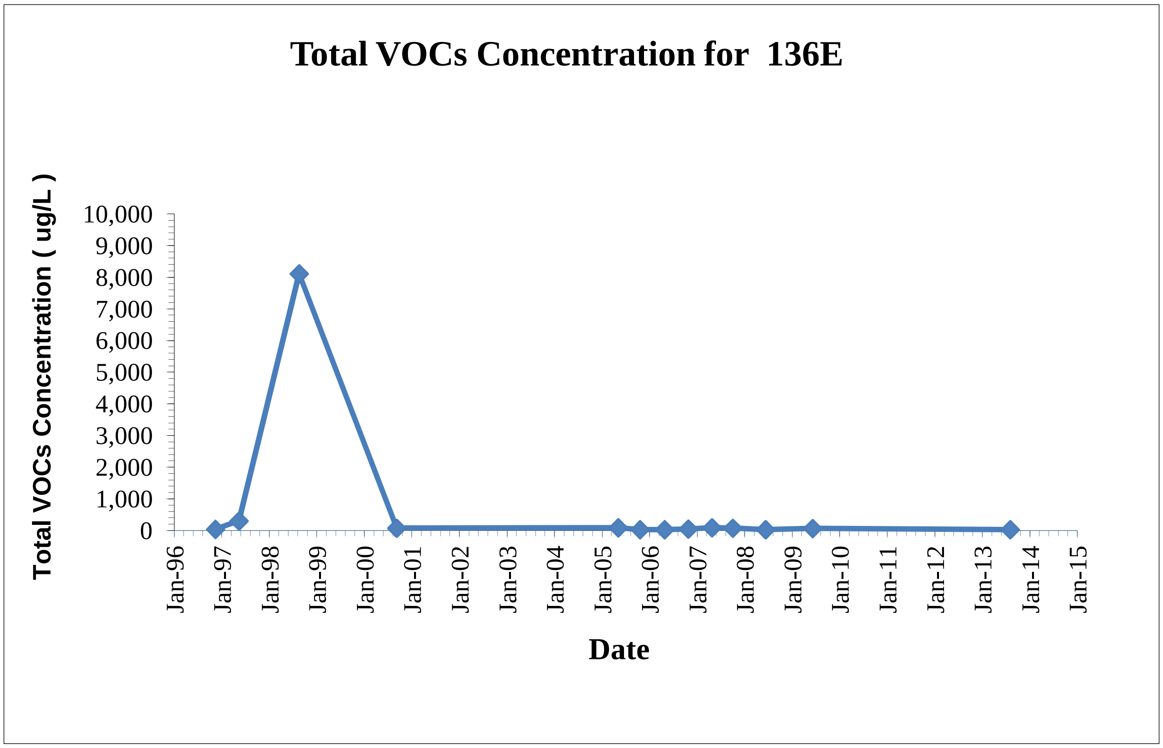
Total VOCs Concentration for 149D

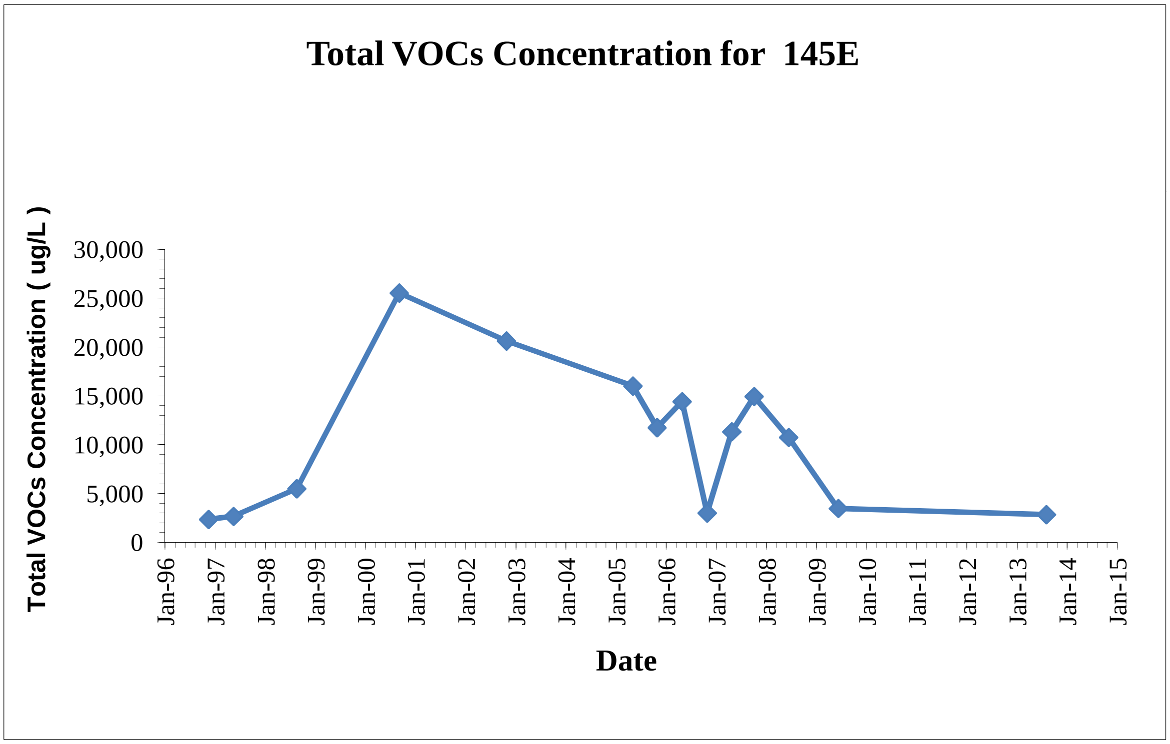


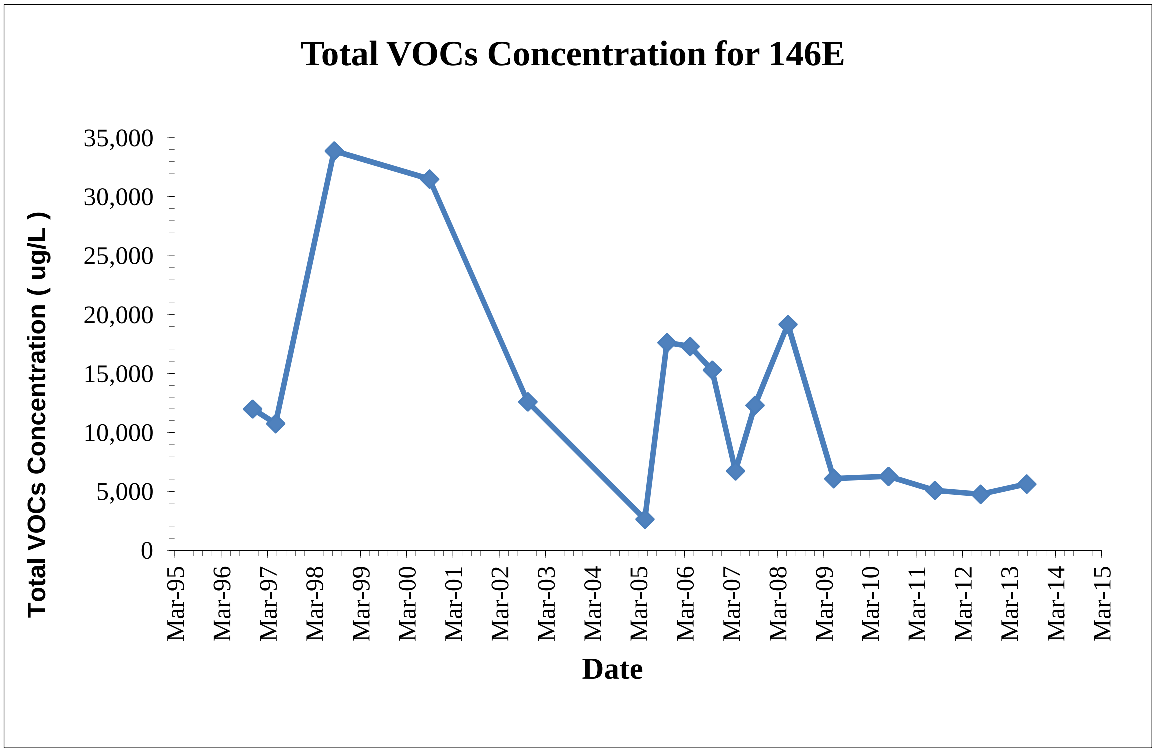
Total VOCs Concentration for 156D

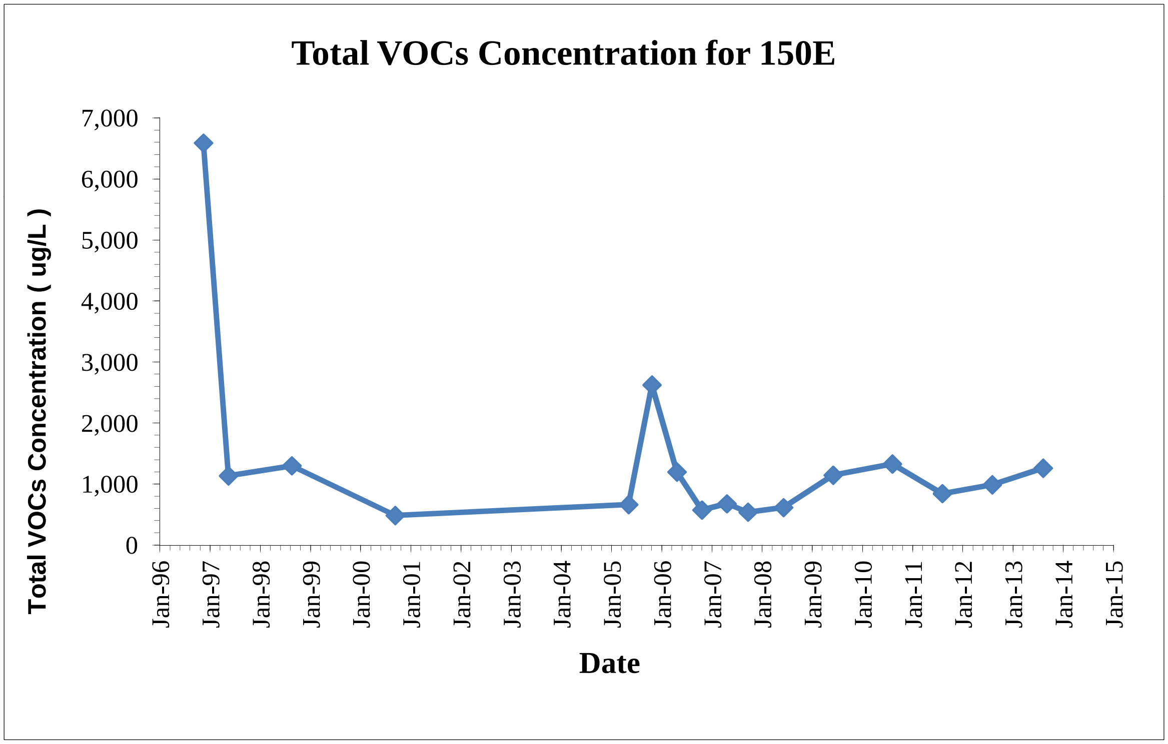


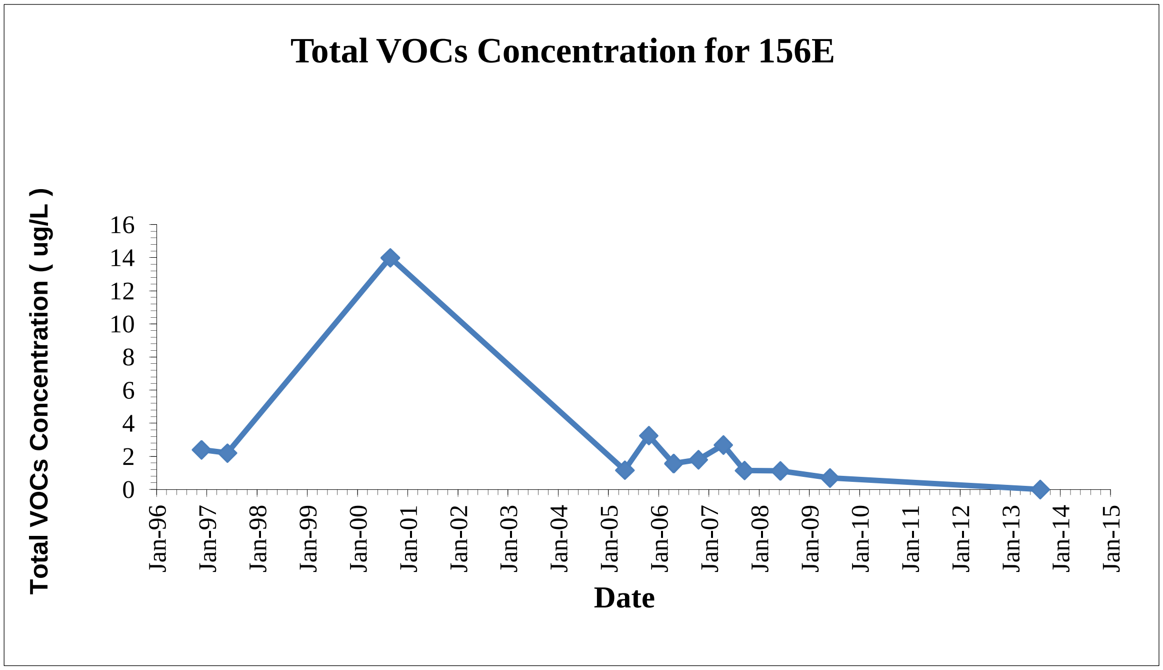

Total VOCs Concentration for 165D
Total VOCs Concentration (ug/L)
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Dec-14
Date

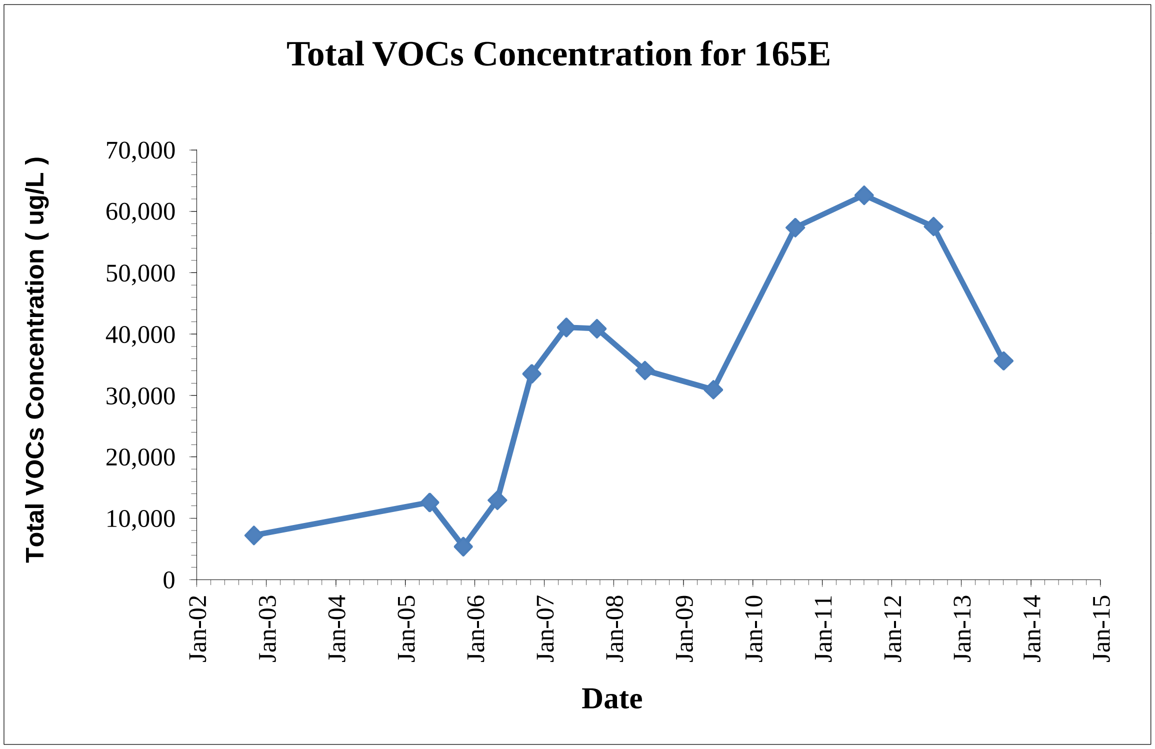

Total VOCs Concentration for 136E
Total VOCs Concentration (ug/L)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date

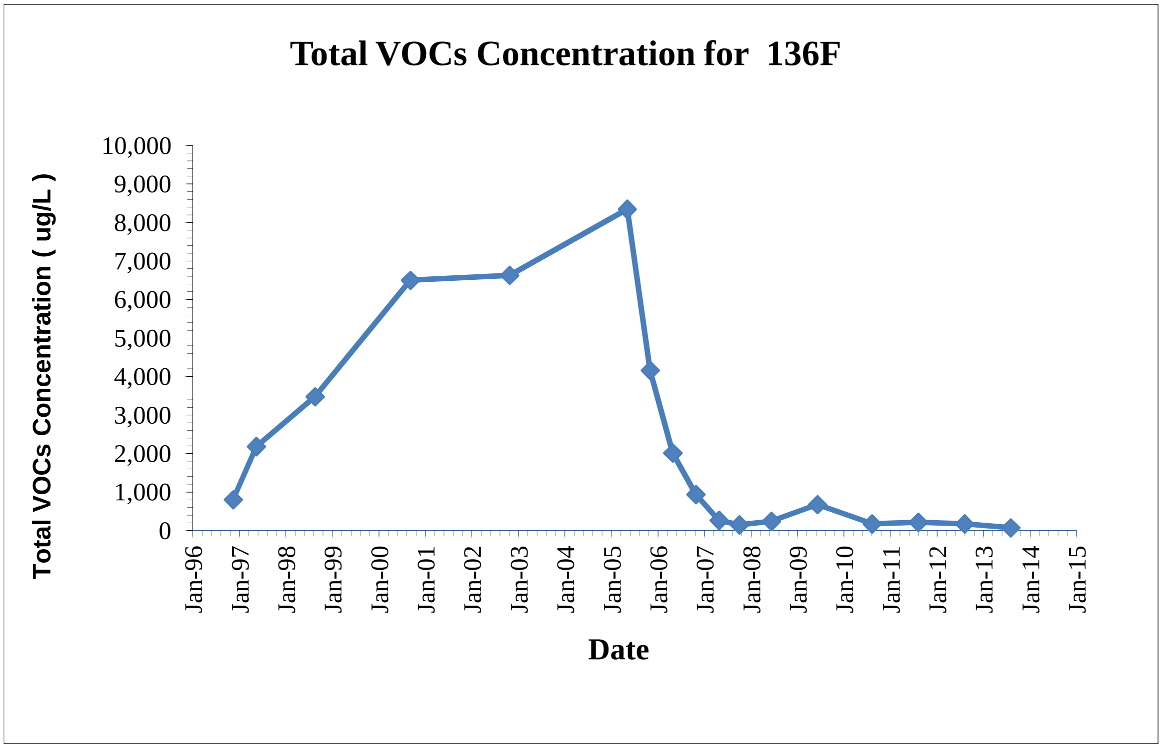

Total VOCs Concentration for 145E
Total VOCs Concentration (ug/L)
30,000
25,000
20,000
15,000
10,000
5,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date

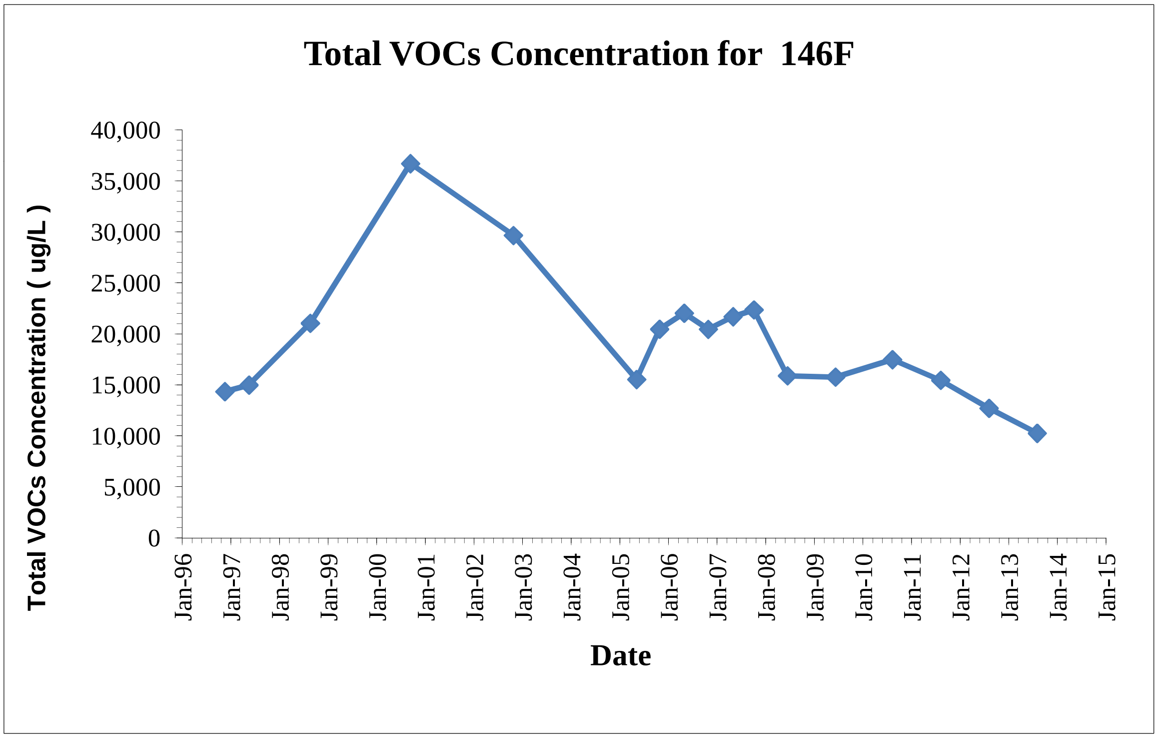

Total VOCs Concentration for 146E
Total VOCs Concentration (ug/L)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Mar-95
Mar-96
Mar-97
Mar-98
Mar-99
Mar-00
Mar-01
Mar-02
Mar-03
Mar-04
Mar-05
Mar-06
Mar-07
Mar-08
Mar-09
Mar-10
Mar-11
Mar-12
Mar-13
Mar-14
Mar-15
Date

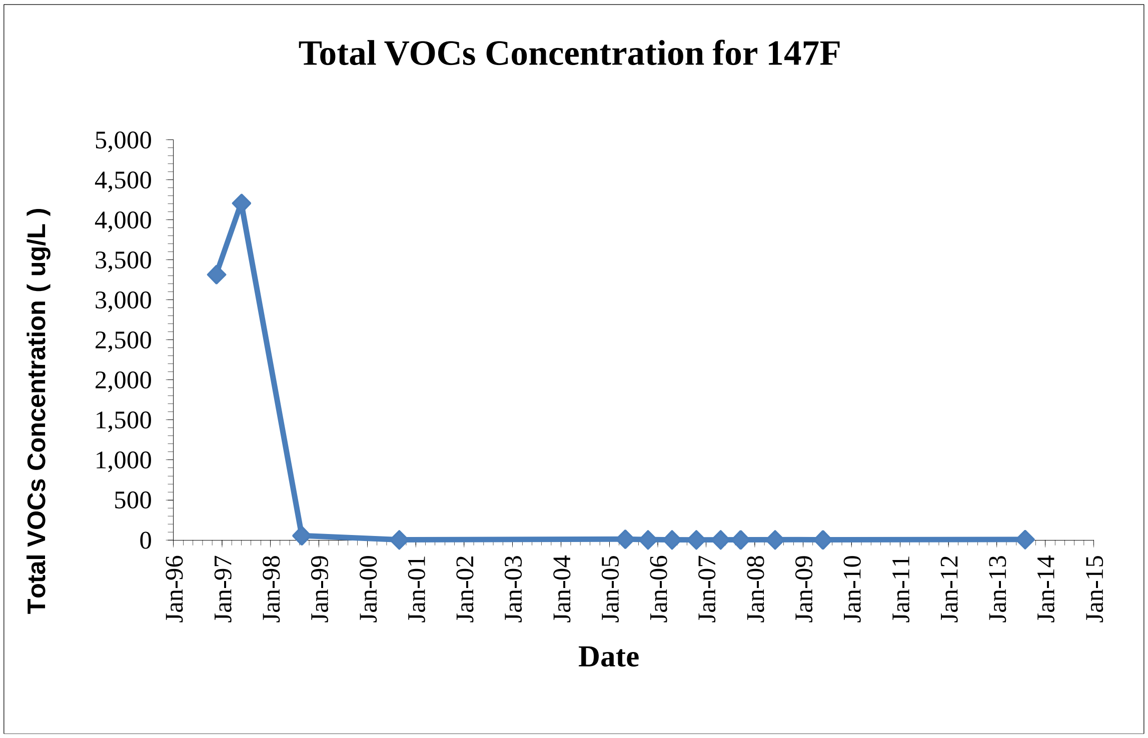

Total VOCs Concentration for 150E
Total VOCs Concentration (ug/L)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date

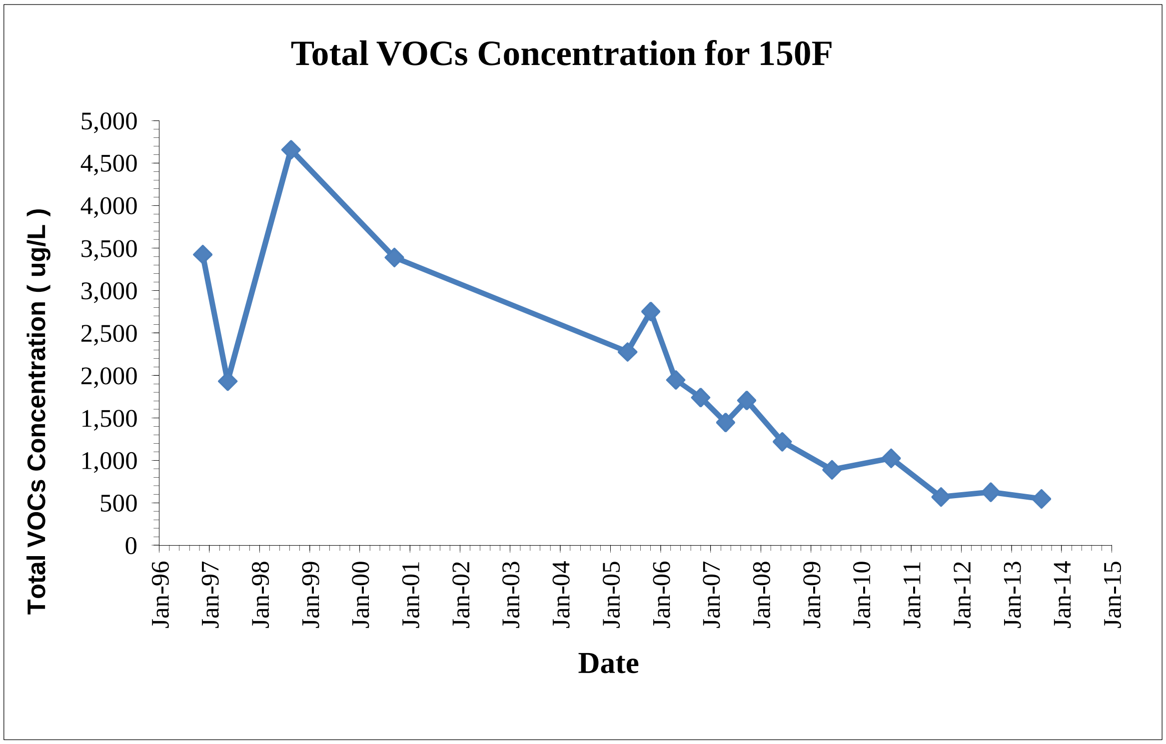

Total VOCs Concentration for 156E
Total VOCs Concentration (ug/L)
16
14
12
10
8
6
4
2
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date

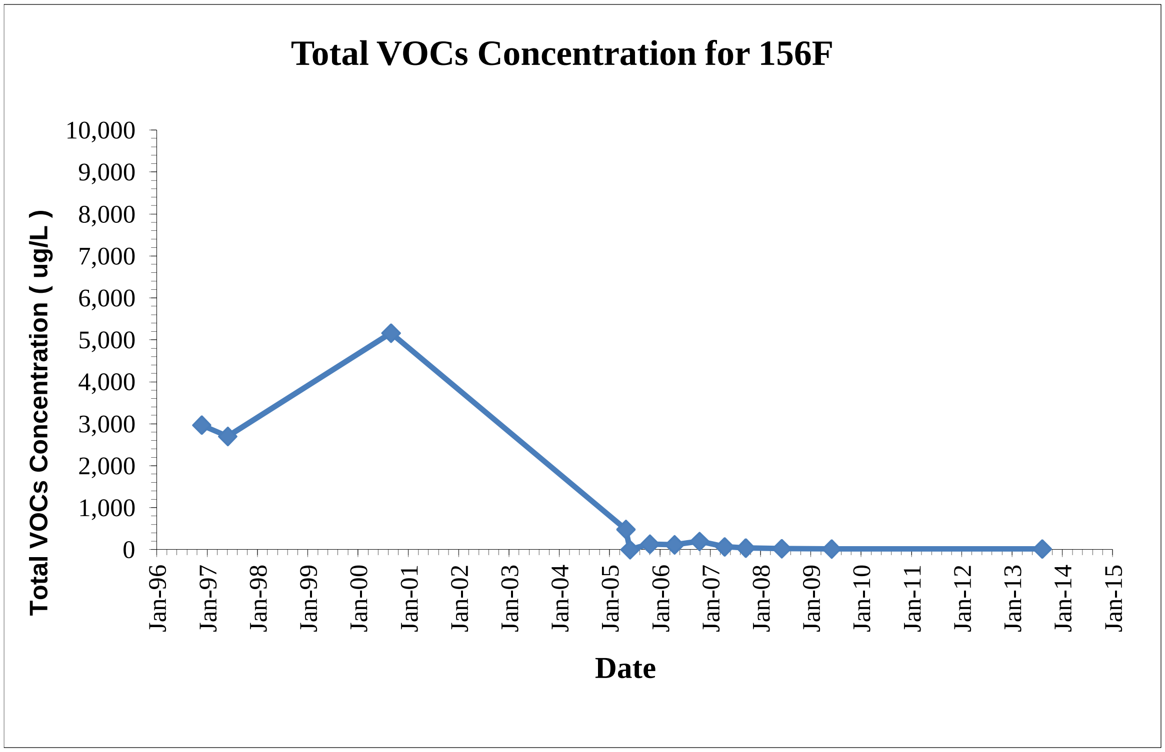

Total VOCs Concentration for 165E
Total VOCs Concentration (ug/L)
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date

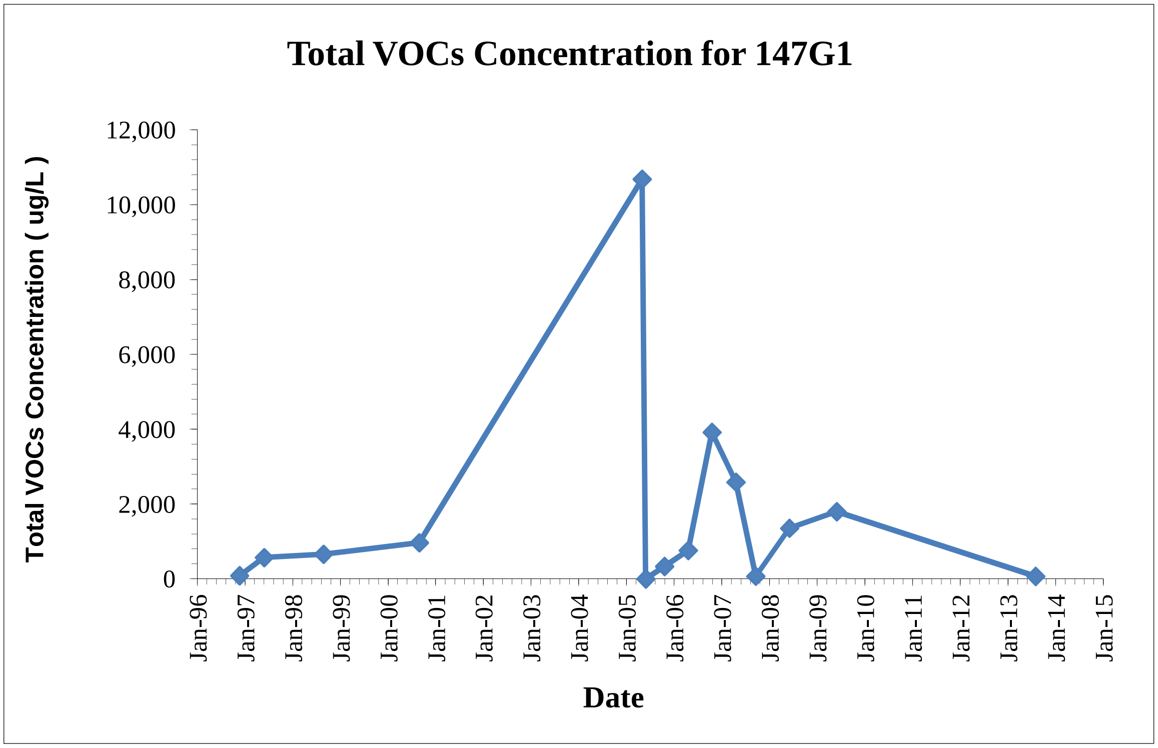

Total VOCs Concentration for 136F
Total VOCs Concentration (ug/L)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date


Total VOCs Concentration for 146F
Total VOCs Concentration (ug/L)
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date


Total VOCs Concentration for 147F
Total VOCs Concentration (ug/L)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date


Total VOCs Concentration for 150F
Total VOCs Concentration (ug/L)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date


Total VOCs Concentration for 156F
Total VOCs Concentration (ug/L)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date


Total VOCs Concentration for 147G1
Total VOCs Concentration (ug/L)
12,000
10,000
8,000
6,000
4,000
2,000
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Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
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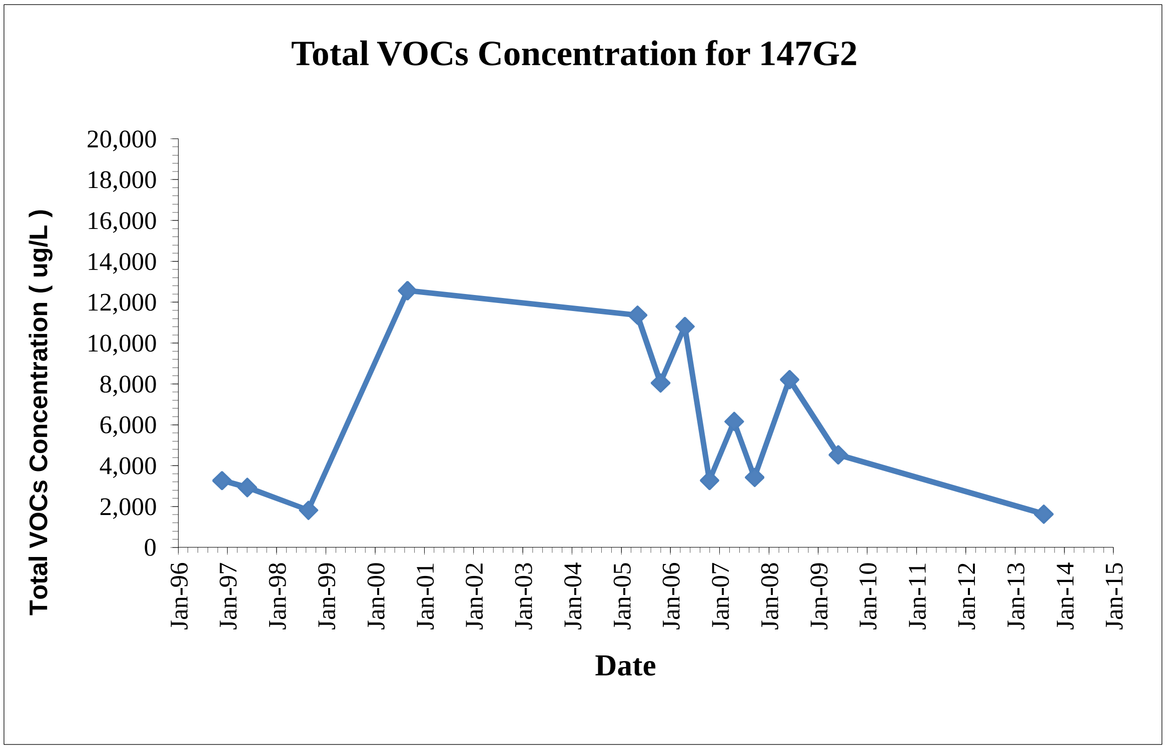
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date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Total VOCs Concentration (ug/L)
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18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
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Jan-08
Jan-09
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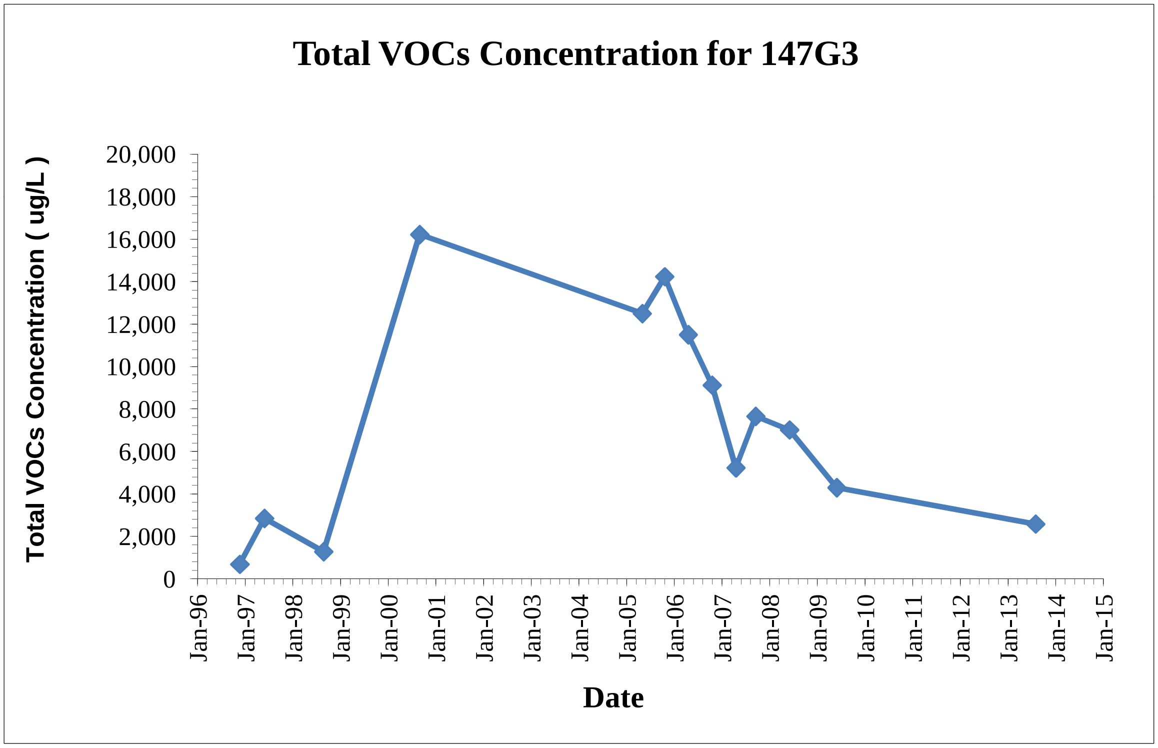
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date


Total VOCs Concentration for 147G3
Total VOCs Concentration (ug/L)
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Date

APPENDIX D

MONITORED NATURAL ATTENUATION CONCENTRATION PLOTS

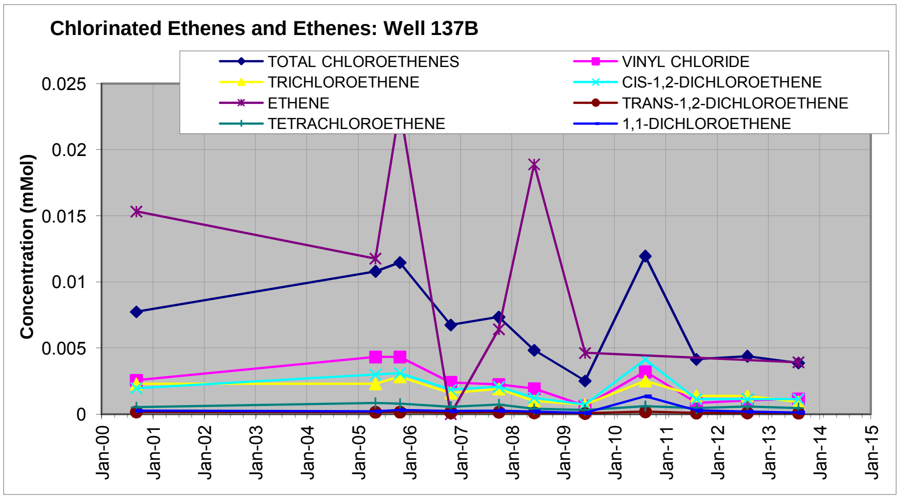
Appendix D: Chlorinated Ethenes and Ethene
Bedrock Wells
DuPont Necco Park

WELL 137B

Monitoring Well Summary

- Source area
- Decrease of Total Chlorinated from Ethenes 2005-2013
- Mostly TCE, cDCE, VC
- Significant ethene Production
- Inversion of moles of TCE and DCE/VC

2013 Sample Results	**(ppb)**
PCE	85 J
TCE	140 J
Cis- 1,2 DCE	130 J
VC	84
Trans-1,2 DCE	8.2
1,1-DCE	12
TOTAL	**459**

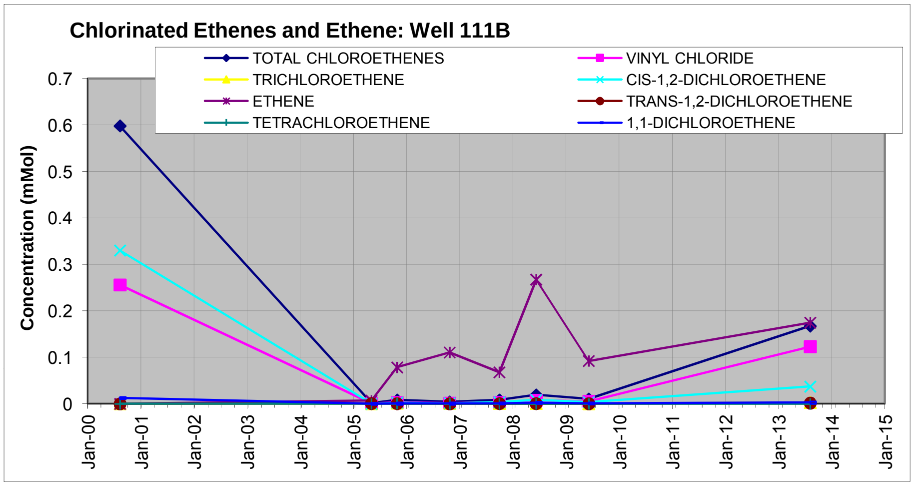


WELL 111B

Monitoring Well Summary

- Source area
- Slight increase in Total Chlorinated
- Ethenes 2005-2009 due to mostly cDCE, VC
- Moderate increase in 1,1- DCE from 2005-2013
- Ethene production greater than other VOCs
- Inversion of DCE and VC over time

2013 Sample Results	**(ppb)**
PCE	120
TCE	390
Cis- 1,2 DCE	3600
VC	7700
Trans-1,2 DCE	150
1,1-DCE	250
TOTAL	**12210**

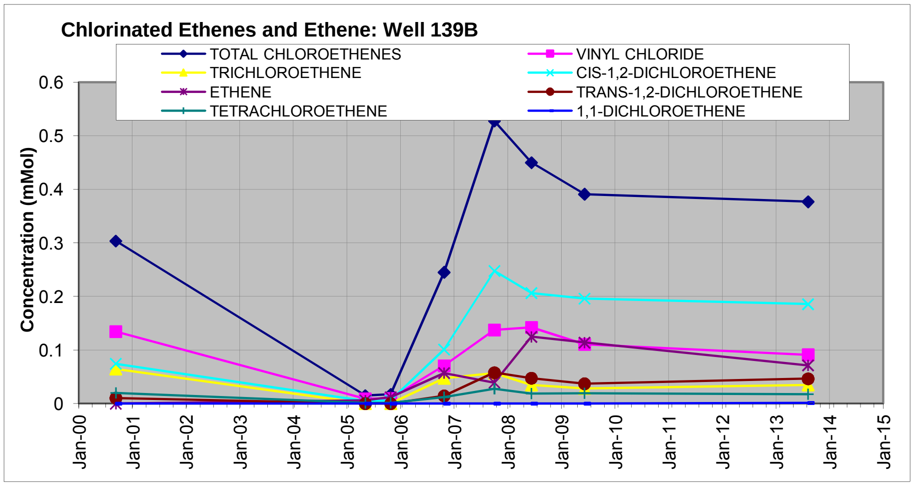


WELL 139B

Monitoring Well Summary

- Source area - adjacent to RW-4
- NAPL observed in 1992
- Apparent increase in Total Chlorinated
- Ethenes 2005-2009
- Mostly cDCE, VC, TCE, tDCE, PCE
- Notable ethene production
- Exceeds 1% Pure Phase Solubility Criteria (PCE)

2013 Sample Results	**(ppb)**
PCE	2,900
TCE	4,600
Cis- 1,2 DCE	18,000
VC	5,700
Trans-1,2 DCE	4,500
1,1-DCE	110
TOTAL	**35,810**



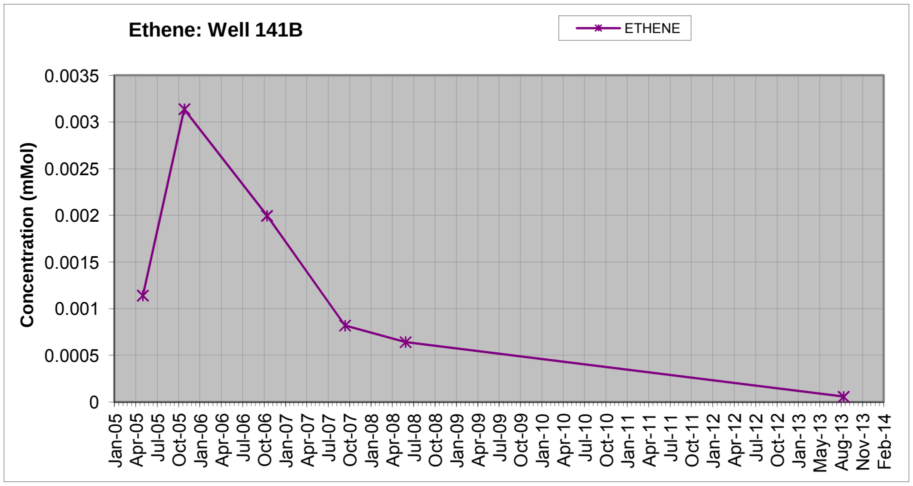
Appendix D: Chlorinated Ethenes and Ethene
Bedrock Wells
DuPont Necco Park

WELL 141B

Monitoring Well Summary

- Upgradient Well
- No Chlorinated Ethenes detected
- Moderate Ethene production

2013 Sample Results	(ppb)
PCE	<0.29
TCE	<0.17
Cis- 1,2 DCE	<0.17
VC	<0.22
Trans-1,2 DCE	<0.19
1,1-DCE	<0.19
TOTAL	**0**

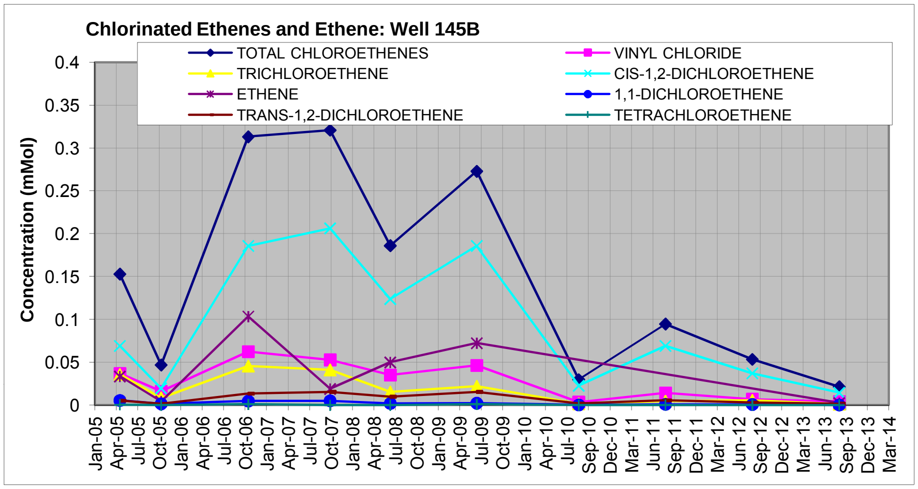


WELL 145B

Monitoring Well Summary

- Down gradient Well
- Decrease in Total CVOCs - plume retraction
- Mostly degradation product cDCE
- Notable ethene production

2013 Sample Results	(ppb)
PCE	8
TCE	130
Cis- 1,2 DCE	1,400
VC	260
Trans-1,2 DCE	160
1,1-DCE	16
TOTAL	**1,974**

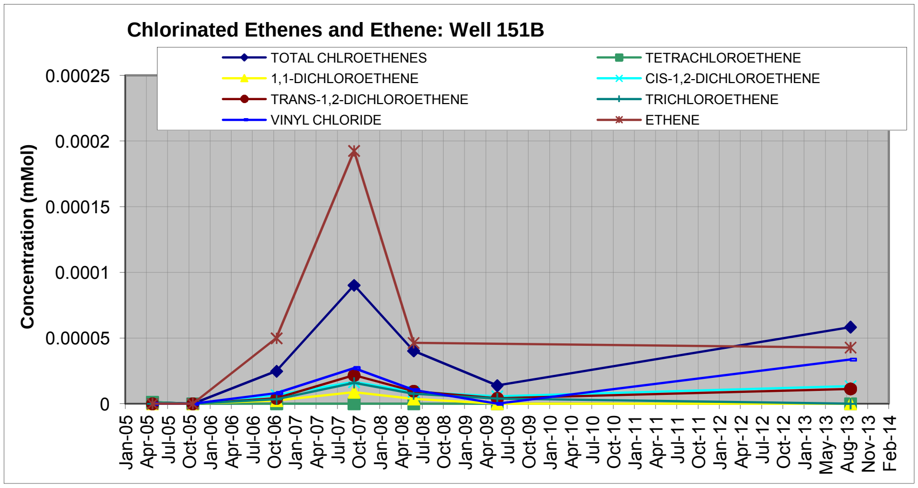


WELL 151B

Monitoring Well Summary

- Far downgradient well
- Below or near MCL
- Mostly low conc. of VC, TCE, tDCE,cDCE
- Weak ethene production

2013 Sample Results	(ppb)
PCE	<0.29
TCE	<0.17
Cis- 1,2 DCE	1.3
VC	2.1
Trans-1,2 DCE	1.1
1,1-DCE	<0.19
TOTAL	**4.50**



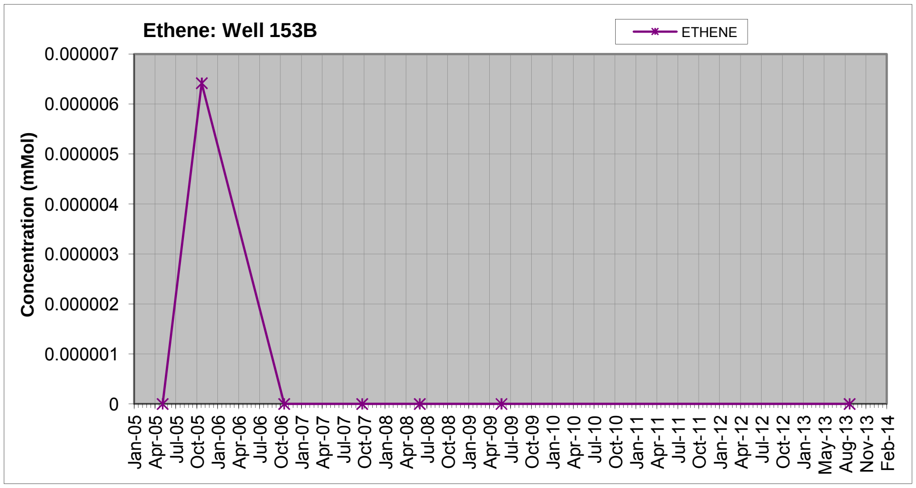
Appendix D: Chlorinated Ethenes and Ethene
Bedrock Wells
DuPont Necco Park

WELL 153B

Monitoring Well Summary

- East side gradient well
- No Chlorinated Ethenes detected

2013 Sample Results	(ppb)
PCE	<0.29
TCE	0.50 J
Cis- 1,2 DCE	<0.17
VC	<0.22
Trans-1,2 DCE	0.85 J
1,1-DCE	<0.19
TOTAL	**1.35**

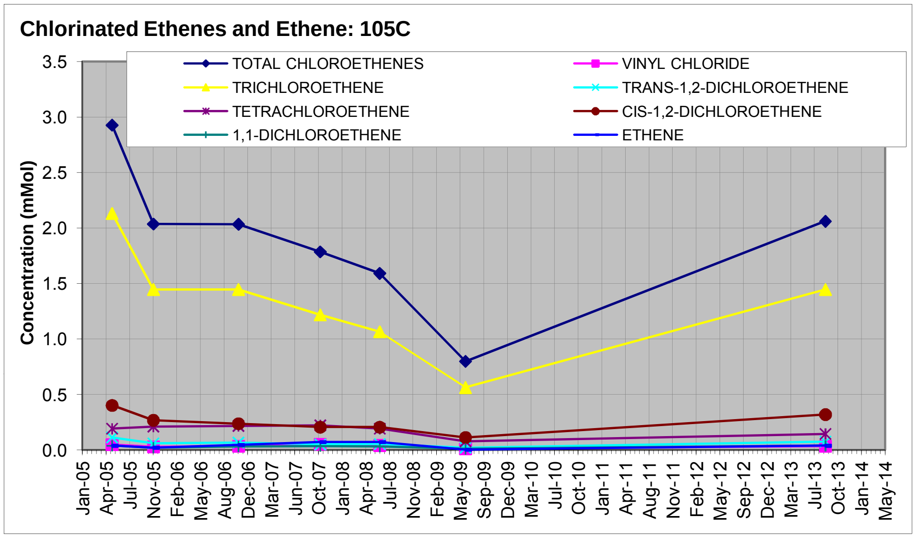


WELL 105C

Monitoring Well Summary

- Source area
- DNAPL observed in 1992
- Exceeds effective solubility and 1% absolute solubility for: PCE, TCE, CF
- Slight decrease Total Chlorinated
- Ethene production

2013 Sample Results	(ppb)
PCE	24,000
TCE	190,000
Cis- 1,2 DCE	31,000
VC	2,200
Trans-1,2 DCE	7,400
1,1-DCE	3,800
TOTAL	**258,400**

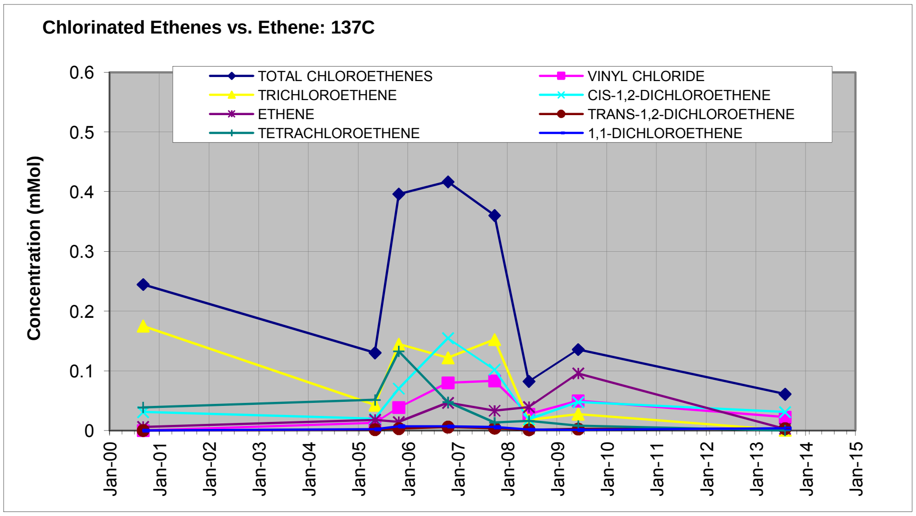


WELL: 137C

Monitoring Well Summary

- Source area
- Inversion of TCE and degradation products
- Decreasing Total CVOCs
- Ethene production
- Inversion of TCE and degradation products
- Greater than two orders of magnitude decrease in TCE

2013 Sample Results	(ppb)
PCE	11 J
TCE	67
Cis- 1,2 DCE	3,000
VC	1,400
Trans-1,2 DCE	310
1,1-DCE	370
TOTAL	**5,158**



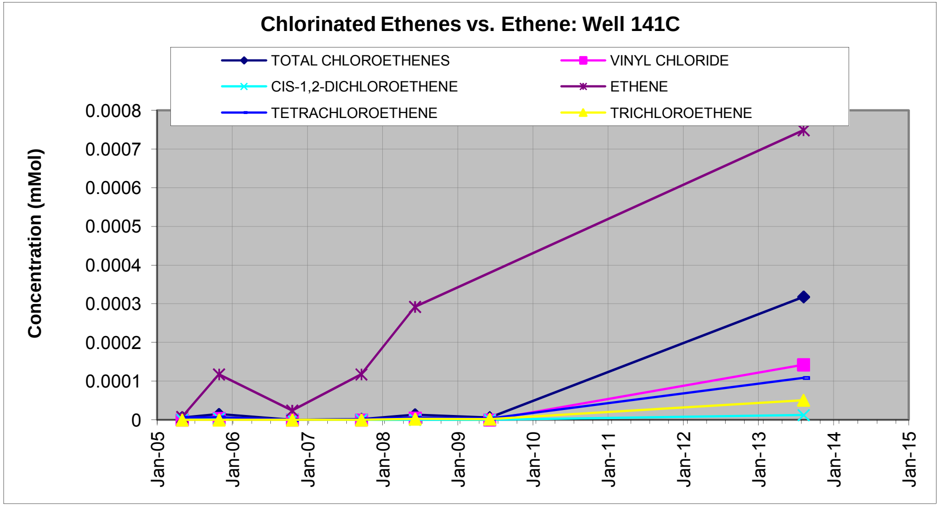
Appendix D: Chlorinated Ethenes and Ethene
Bedrock Wells
Necco Park

WELL: 141C

Monitoring Well Summary

- Upgradient
- Low conc. of VC, TCE, PCE - near MCL
- Ethene production

2013 Sample Results	(ppb)
PCE	18
TCE	6.70
Cis- 1,2 DCE	1.2
VC	8.9
Trans-1,2 DCE	<0.19
1,1-DCE	0.36 J
TOTAL	**35.16**

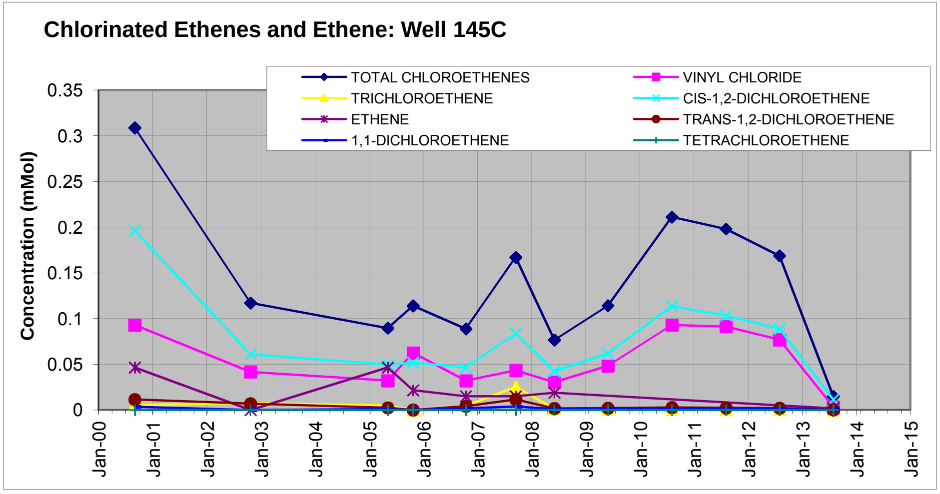


WELL: 145C

Monitoring Well Summary

- Downgradient
- Near Source Boundary
- Decrease in Total Chlorinated Ethenes
- Mostly cDCE and VC
- Ethene production

2013 Sample Results	(ppb)
PCE	1.8 J
TCE	9.5
Cis- 1,2 DCE	1,100
VC	200
Trans-1,2 DCE	10
1,1-DCE	6.1
TOTAL	**1,327**

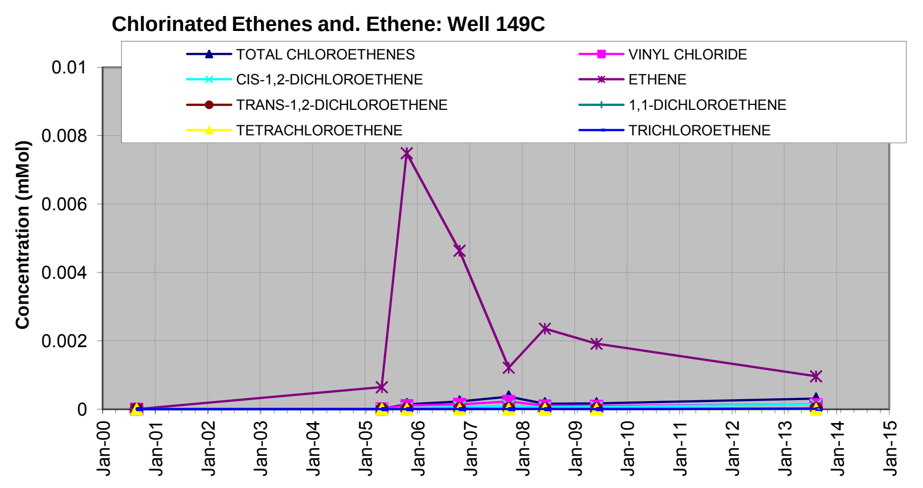


WELL: 149C

Monitoring Well Summary

- Downgradient
- Low Total CVOCs - near MCL
- Mostly cDCE, VC
- Strong ethene production

2013 Sample Results	(ppb)
PCE	<0.29
TCE	0.99 J
Cis- 1,2 DCE	13
VC	8.4
Trans-1,2 DCE	1.9
1,1-DCE	1.3
TOTAL	**25.59**



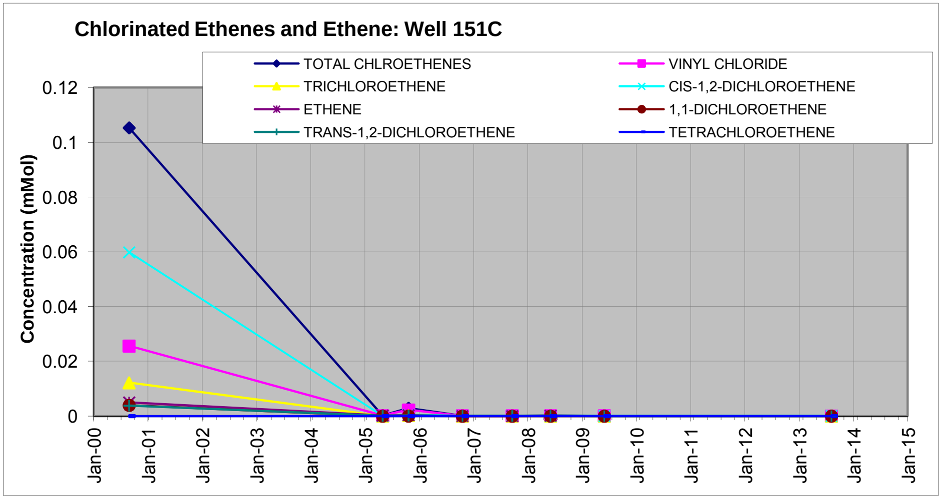
Appendix D: Chlorinated Ethenes and Ethene
Bedrock Wells
Necco Park

WELL: 151C

Monitoring Well Summary

- Far downgradient
- Declining Total CVOCs - Near MCL
- Decreases of 2 orders of magnitude
- Mostly DCE, VC

2013 Sample Results	(ppb)
PCE	0.60 J
TCE	1.5
Cis- 1,2 DCE	6.4
VC	2.1
Trans-1,2 DCE	0.23 J
1,1-DCE	0.25 J
TOTAL	**11.08**

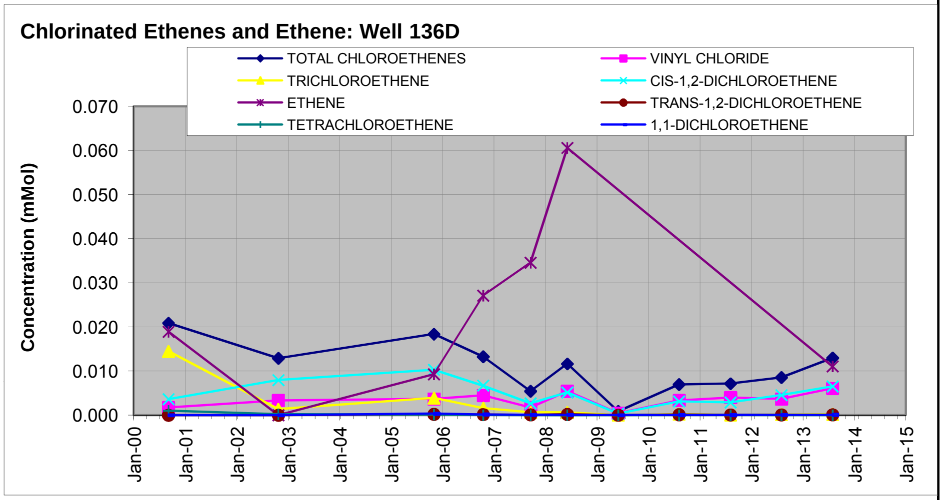


WELL: 136D

Monitoring Well Summary

- Near downgradient well
- Inversion of TCE and degradation product since 2000
- Mostly cDCE, VC
- Strong ethene production

2013 Sample Results	(ppb)
PCE	0.79 J
TCE	28
Cis- 1,2 DCE	630
VC	380
Trans-1,2 DCE	9.7 J
1,1-DCE	10
TOTAL	**1,058**

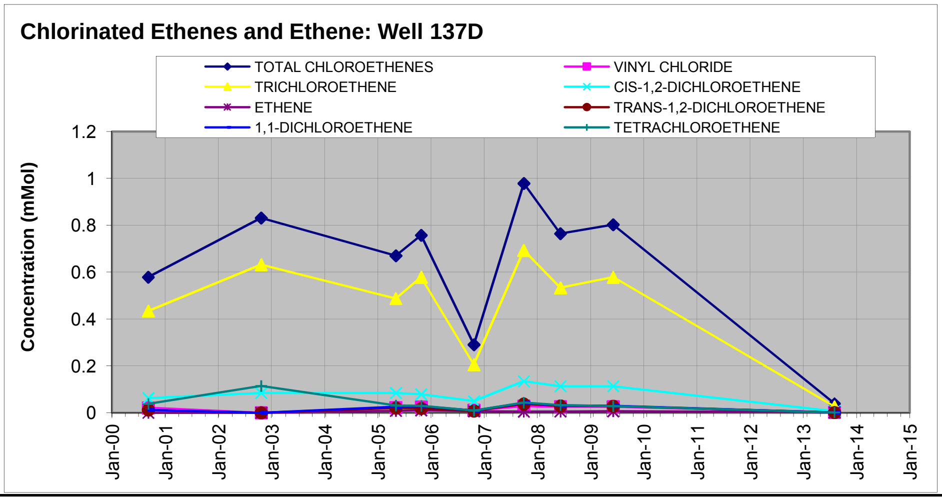


WELL: 137D

Monitoring Well Summary

- Source area
- Exceeded 1% solubility for PCE, TCE prior to 2013
- Strong decrease in Total CVOCs
- Plume retraction

2013 Sample Results	(ppb)
PCE	250
TCE	3,400
Cis- 1,2 DCE	640
VC	120
Trans-1,2 DCE	120
1,1-DCE	140
TOTAL	**4,670**



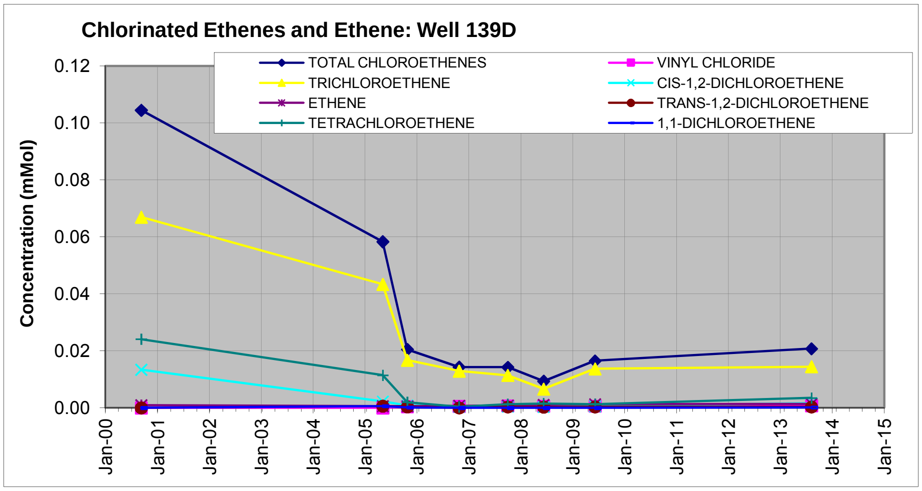
Appendix D: Chlorinated Ethenes and Ethene
Bedrock Wells
Necco Park

WELL: 139D

Monitoring Well Summary

- Source area
- DNAPL observed 1992
- Strong Decrease in Total CVOCs
- Mostly TCE and PCE
- Weak ethene production

2013 Sample Results	**(ppb)**
PCE	580
TCE	1,900
Cis- 1,2 DCE	160
VC	44
Trans-1,2 DCE	32
1,1-DCE	13
TOTAL	**2,729**

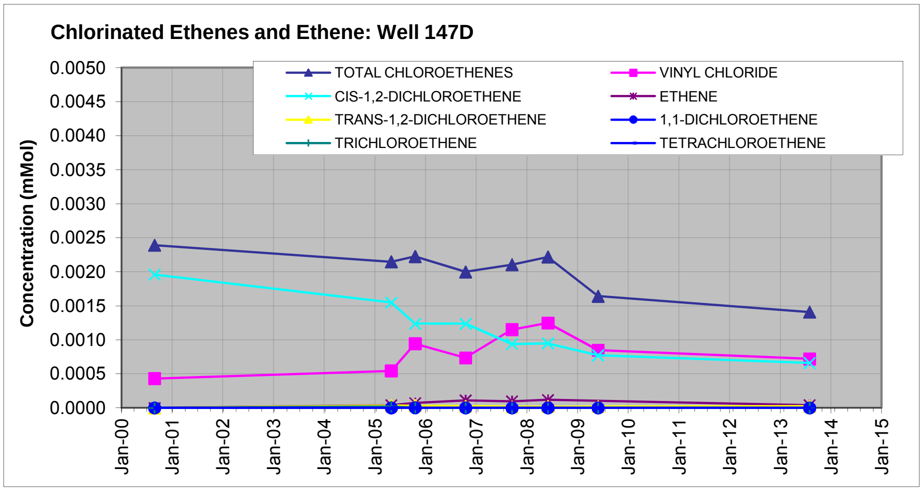

Chlorinated Ethenes and Ethene: Well 139D

WELL: 147D

Monitoring Well Summary

- Far downgradient
- Decreasing Total CVOCs from 2000-2013
- Mostly cDCE, VC - inversion of DCE and VC
- Steady DCE reduction
- Weak ethene production

2013 Sample Results	**(ppb)**
PCE	<0.29
TCE	0.31 J
Cis- 1,2 DCE	64
VC	45
Trans-1,2 DCE	2.6
1,1-DCE	<0.19
TOTAL	**112**

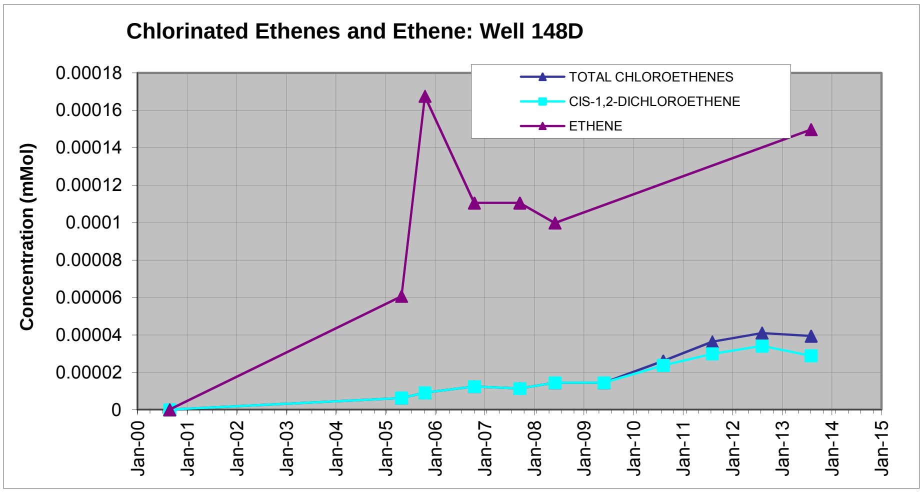

Chlorinated Ethenes and Ethene: Well 147D

WELL: 148D

Monitoring Well Summary

- Downgradient - below MCL
- Flat Total Chlorinated Ethene 2005-2009
- Mostly cDCE
- Notable ethene / ethane production

2013 Sample Results	**(ppb)**
PCE	0.54 J
TCE	0.95 J
Cis- 1,2 DCE	2.8
VC	<0.22
Trans-1,2 DCE	<0.19
1,1-DCE	<0.19
TOTAL	**4.3**


Chlorinated Ethenes and Ethene: Well 148D

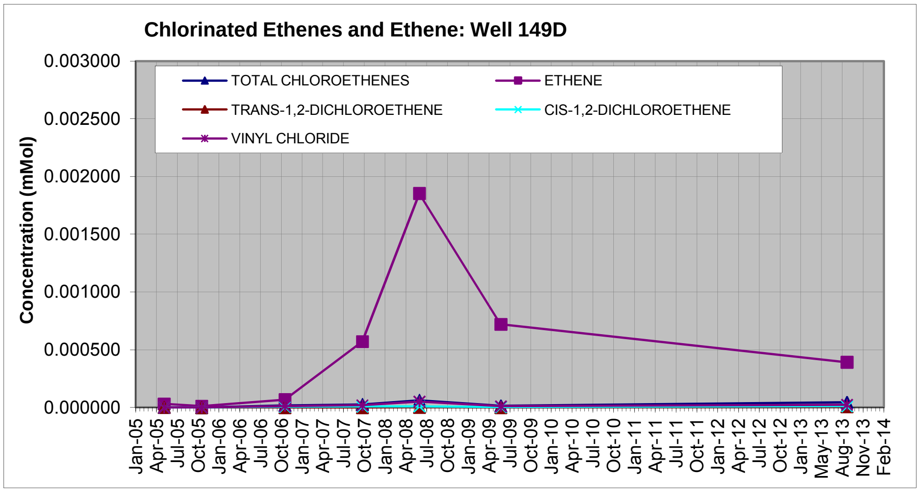
Appendix D: Chlorinated Ethenes and Ethene
Bedrock Wells
Necco Park

WELL: 149D

Monitoring Well Summary

- Side gradient - below MCL
- Mostly VC
- Weak Ethene production

2013 Sample Results	**(ppb)**
PCE	<0.29
TCE	0.31 J
Cis- 1,2 DCE	1
VC	1.5
Trans-1,2 DCE	0.59 J
1,1-DCE	0.20 J
TOTAL	**3.60**

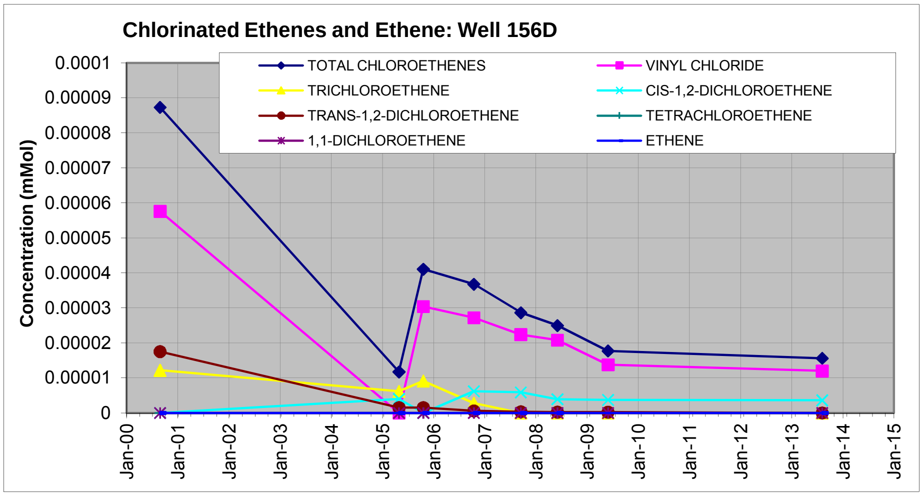


WELL: 156D

Monitoring Well Summary

- Far downgradient - below MCLs
- Decrease Total Chlorinated Ethenes
- Plume retraction

2013 Sample Results	**(ppb)**
PCE	<0.29
TCE	<0.17
Cis- 1,2 DCE	0.35 J
VC	0.75 J
Trans-1,2 DCE	<0.19
1,1-DCE	<0.19
TOTAL	**1.10**

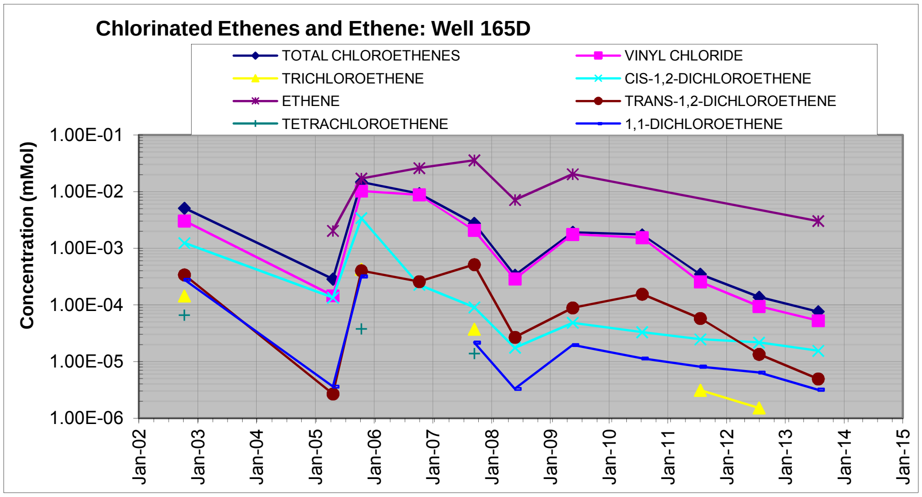


WELL: 165D

Monitoring Well Summary

- Source area
- Near source boundary
- Decreasing Total CVOCs by 2 orders of magnitude
- Plume retraction to near MCLs
- Moderate ethene production
- Primarily VC
- Y-axis is log scale

2013 Sample Results	**(ppb)**
PCE	<0.29
TCE	<0.17
Cis- 1,2 DCE	1.5
VC	3.3
Trans-1,2 DCE	0.48 J
1,1-DCE	0.31 J
TOTAL	**5.6**



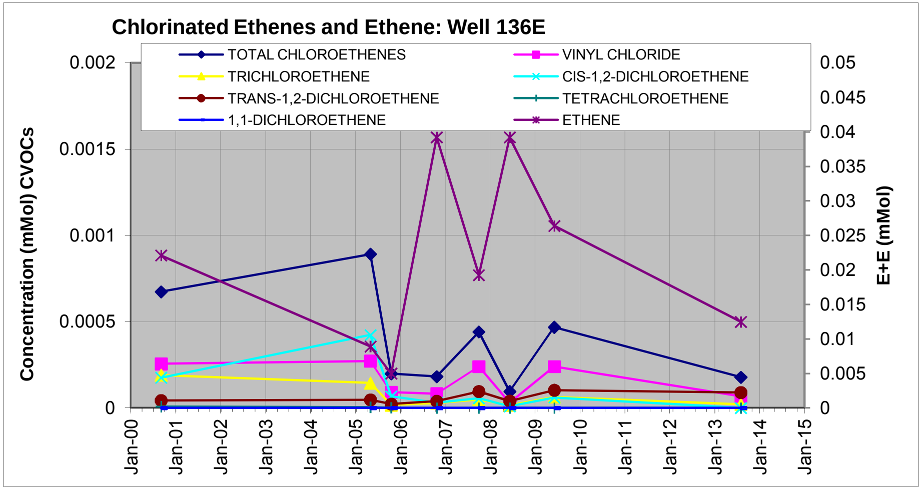
Appendix D: Chlorinated Ethenes and Ethene
Bedrock Wells
Necco Park

WELL: 136E

Monitoring Well Summary

- Near downgradient
- Order of magnitude decrease in Total CVOCs
- Near MCLs
- Strong ethene production

2013 Sample Results	(ppb)
PCE	<0.29
TCE	2.8
Cis- 1,2 DCE	<0.17
VC	4.2
Trans-1,2 DCE	8.7
1,1-DCE	<0.19
TOTAL	**15.7**

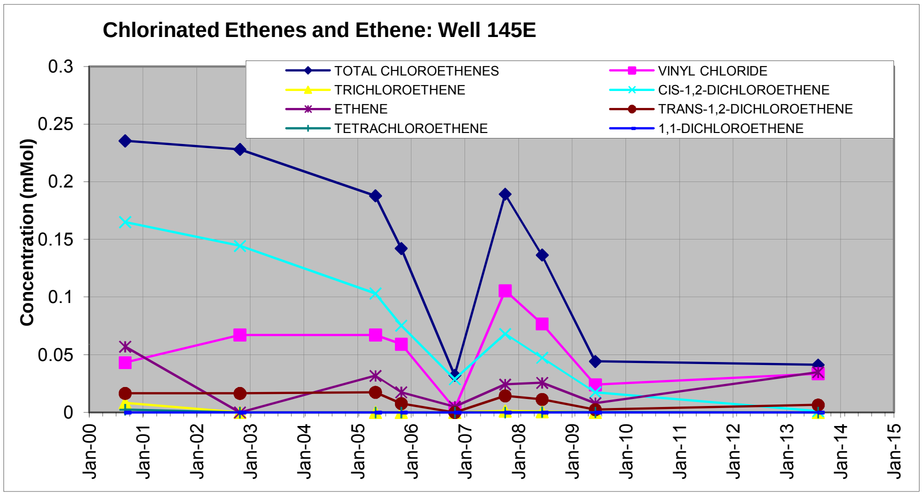


WELL: 145E

Monitoring Well Summary

- Side gradient
- Strong decrease in Total CVOCs
- Inversion of DCE and VC
- Strong ethene production

2013 Sample Results	(ppb)
PCE	<4.8
TCE	<2.8
Cis- 1,2 DCE	110
VC	2,100
Trans-1,2 DCE	630
1,1-DCE	<3.2
TOTAL	**2,840**

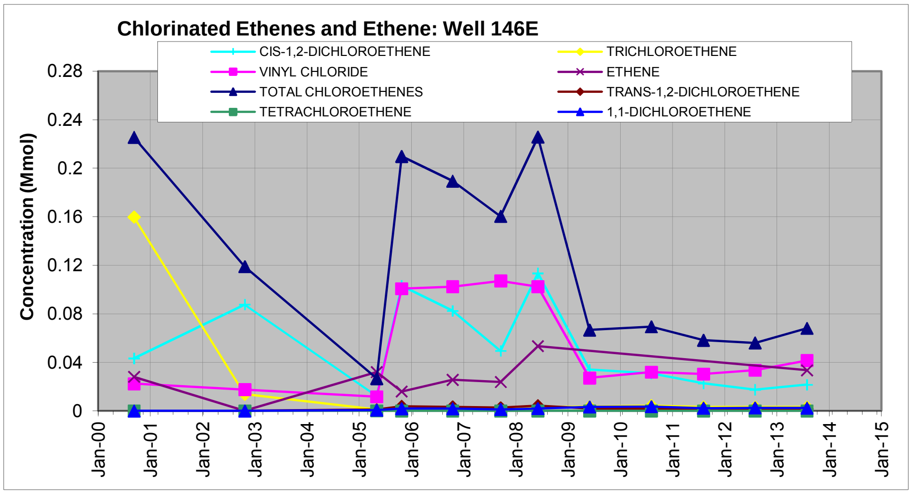


WELL: 146E

Monitoring Well Summary

- Downgradient
- Near source boundary
- Decrease in Total Chlorinated Ethenes 2005-2013
- Primarily VC and cDCE, but also inversion
- Good Ethene production

2013 Sample Results	(ppb)
PCE	<1.9
TCE	420
Cis- 1,2 DCE	2100
VC	2600
Trans-1,2 DCE	160
1,1-DCE	230
TOTAL	**5510**



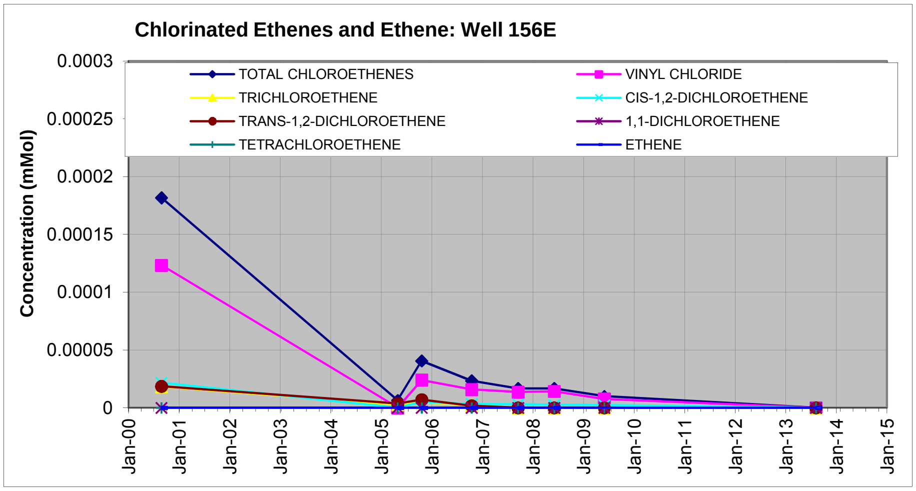
Appendix D: Chlorinated Ethenes and Ethene
Bedrock Wells
Necco Park

WELL: 156E

Monitoring Well Summary

- Far downgradient
- DecreaseTotal Chlorinated Ethenes 2005-2013
- Below MCLs

2013 Sample Results	(ppb)
PCE	<0.29
TCE	<0.17
Cis- 1,2 DCE	<1.17
VC	<0.22
Trans-1,2 DCE	<0.19
1,1-DCE	<0.19
TOTAL	**0.00**

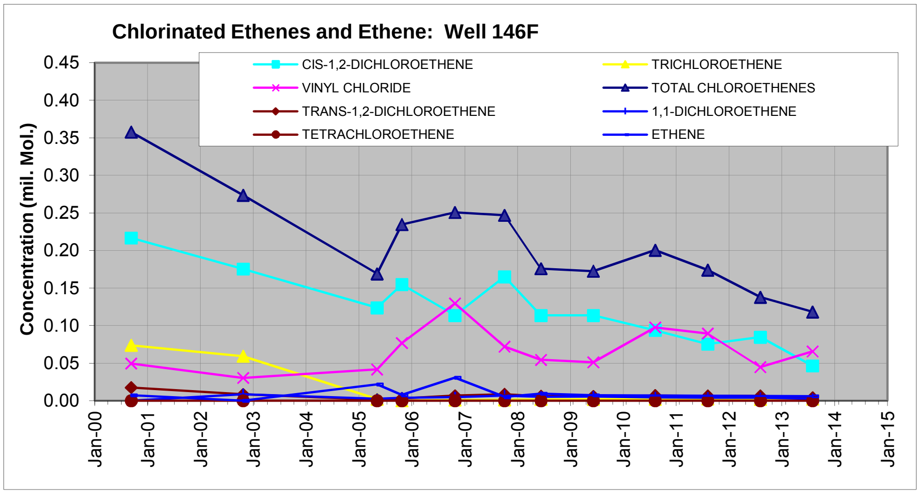


WELL: 146F

Monitoring Well Summary

- Downgradient
- Near source boundary
- Decreases in Total CVOCs 2000-2013
- Primarily cDCE, VC, inversion of DCE and VC
- Moderate Ethene production

2013 Sample Results	(ppb)
PCE	<15
TCE	280
Cis- 1,2 DCE	4500
VC	4100
Trans-1,2 DCE	380
1,1-DCE	230
TOTAL	**9490**

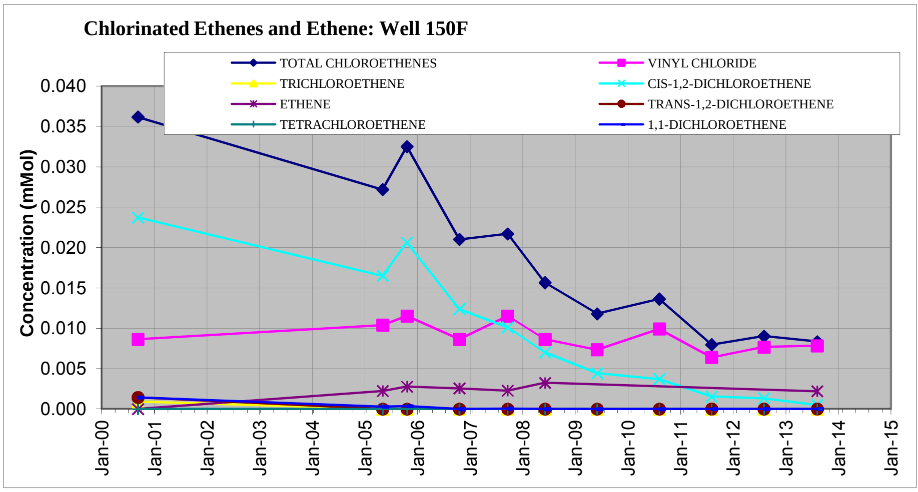


WELL: 150F

Monitoring Well Summary

- Sidegradient
- Strong decrease in Total CVOCs
- Inversion of DCE and VC
- Stong ethene production

2013 Sample Results	(ppb)
PCE	<0.97
TCE	<0.57
Cis- 1,2 DCE	49
VC	490
Trans-1,2 DCE	1.1 J
1,1-DCE	0.38 J
TOTAL	**540**



APPENDIX E

MONITORED NATURAL ATTENUATION SCORING DETAILS

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APPENDIX E
MNA Scoring Details
Evaluation of Biodegradation - 2013 Analytical Results

				Well ID	**111B**			**137B**			**139B**			**141B**		
Analyte	**units**	**Concentration**	**Score Interpretation**	**Value**	**8/19/13 Concentration**	**Points**	**Comments**	**8/16/13 Concentration**	**Points**	**Comments**	**8/21/13 Concentration**	**Points**	**Comments**	**8/13/13 Concentration**	**Points**	**Comments**
Oxygen	mg/l	<0.5	Tolerated, suppresses the reductive pathway at higher concentrations	3	0.24	3		0.14	3		0.25	3		0.7	0	
		>5	Not tolerated; however, VC may be oxidized aerobically	-3												
Nitrate	mg/l	<1	At higher concentrations may compete with reductive pathway	2	0.012	2		0.012	2		0.012	2		0.012	2	
Iron (II)	mg/l	>1	Reductive pathway possible; VC may be oxidized under Fe(III)-reducing conditions	3	340	3		0.081	0		460	3		0.081	0	
Sulfate	mg/l	<20	At higher concentrations may compete with reductive pathway	2	1.4	0		23	0		330	0		1200	0	
Sulfide	mg/l	>1	Reductive pathway possible	3	43	3		3.0 J	3		2.4	3		0.95	0	
Methane	mg/l	<0.5	VC oxidizes	0	6.6	3		1.1	3		6.1	3		0.69	3	not analyzed in 2009, using June 2008 results
		>0.5	Ultimate reductive daughter product, VC Accumulates	3												
ORP	mV	<50	Reductive pathway possible	1	-355	2		-545	2		-471	2		-292	2	
		<-100	Reductive pathway likely	2												
pH	SU	5 < pH < 9	Optimal range for reductive pathway	0	6.83	0		12.85	-2	above 9 since 2008	7.17	0		9.61	-2	above 9 in 2005, 2008, 2013
		5 > pH > 9	Outside optimal range for reductive pathway	-2												
TOC	mg/l	> 20	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	2	2300	2		22	2		170	2		7.3	0	
Temperature	Celc	> 20	At T >20oC biochemical process is accelerated	1	14.53	0		13.84	0		13.25	0		15.01	0	
Alkalinity	mg/l	> 2x background	Results from interaction between CO2 and aquifer minerals	1	1200	NA	unknown background	870	NA	unknown background	26	NA	unknown background	82	NA	unknown background
Chloride	mg/l	> 2x background	Daughter product of organic chlorine	2	10000	NA	unknown background	450	NA	unknown background	13000	NA	unknown background	880	NA	unknown background
Tetrachloroethene	ug/l		Material released	0	120	0	source	85 J	0	source	2900	0	source	0.29	0	source
Trichloroethene*	ug/l		Material released	0	390	0	source	140 J	0	source	4600	0	source	0.17	0	source
			Daughter product of PCE	2*												
DCE*	ug/l		Material released	0	4000	2	1,1-dce = 250, cis-1,2 = 3600, trans-1,2 = 150	150.2	2	1,1-dce = 12, cis-1,2 = 130 J, trans-1,2 = 8.2	22610	2	1,1-dce = 110, cis-1,2 = 18000, trans-1,2 = 4500	0	0	1,1-dce <0.19, cis-1,2 <0.17, trans-1,2 <0.19
			Daughter product of PCE. If cis is > 80% of total DCE it is likely a daughter product 1,1-DCE can be chemical reaction product of TCA	2*												
VC*	ug/l		Material released	0	7700	2	daughter product	84	2	daughter product	5700	2	daughter product	0.22	0	daughter product
			Daughter product of PCE	2*												
1,1,2-Trichloroethane*	ug/l		Material released	0	100	0	1,1,2-TCA <6.8	0.27	0		950	0		0.27	0	
DCA	ug/l		Daughter product of TCA under reducing conditions	2	990	2	1,2-DCA	4	2	1,2-DCA	200	2	1,2-DCA	0.22	0	1,2-DCA
Carbon Tetrachloride	ug/l		Material released	0	7.2	0	source	0.13	0	source	6.5	0	source	0.13	0	source
Ethene/Ethane	ug/l	> 10	Daughter product of VC/ethene	2	4928	3	ethane = 28, ethene = 4900	162	3	ethane 52, ethene = 110	2160	3	ethane 160, ethene = 2000	15.6	2	ethane 14, ethene = 1.6
		> 100		3												
Carbon Dioxide	mg/l	> 2x background	Ultimate oxidative daughter product	1	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
Hydrogen	nM	> 1	Reductive pathway possible, VC may accumulate	3	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
		< 1	VC oxidized	0												
Volatile Fatty Acids	mg/l	> 0.1	Intermediates resulting from biodegradation of more complex compounds; carbon and energy source	2	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
BTEX*	mg/l	> 0.1	Carbon and energy source; drives dechlorination	2	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
Chloroethane*	ug/l		Daughter product of DCA or VC under reducing conditions	2	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
Chloroform	ug/l		Material released	0	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
			Daughter product of Carbon Tetrachloride	2												
Dichloromethane	ug/l		Material released	0	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
			Daughter product of Chloroform	2												
				Total Points		**27**			**22**			**27**			**7**	

Notes:

* Required analysis. Points awarded only if it can be shown that the compound is a daughter product (i.e., not a constituent of the source NAPL).

NA = not applicable / not accounted for

APPENDIX E
MNA Scoring Details
Evaluation of Biodegradation - 2013 Analytical Results

				Well ID	145B			151B			153B			105C		
Analyte	**units**	**Concentration**	**Score Interpretation**	**Value**	**8/15/13 Concentration**	**Points**	**Comments**	**8/19/13 Concentration**	**Points**	**Comments**	**8/22/13 Concentration**	**Points**	**Comments**	**8/21/13 Concentration**	**Points**	**Comments**
Oxygen	mg/l	<0.5	Tolerated, suppresses the reductive pathway at higher concentrations	3	0.19	3		0.09	3		0.35	3		0.27	3	
		>5	Not tolerated; however, VC may be oxidized aerobically	-3												
Nitrate	mg/l	<1	At higher concentrations may compete with reductive pathway	2	0.012	2		0.012	2		0.012	2		<0.012	2	
Iron (II)	mg/l	>1	Reductive pathway possible; VC may be oxidized under Fe(III)-reducing conditions	3	0.081	0		9.7	3		12	3		59	3	
Sulfate	mg/l	<20	At higher concentrations may compete with reductive pathway	2	870	0		390	0		1500	0		420	0	
Sulfide	mg/l	>1	Reductive pathway possible	3	0.54 J	0		1.9	3		19	3		0.81	0	
Methane	mg/l	<0.5	VC oxidizes	0	0.39	0		0.63	3		0.88	3		2.6	3	
		>0.5	Ultimate reductive daughter product, VC Accumulates	3												
ORP	mV	<50	Reductive pathway possible	1	-370	2		-309	2		-241	2		-405	2	
		<-100	Reductive pathway likely	2												
pH	SU	5 < pH < 9	Optimal range for reductive pathway	0	10.05	-2	anomalous	7.39	0	12.5 in 2008, 7 < pH < 9.65 2007 & earlier	7.17	0		7.61	0	
		5 > pH > 9	Outside optimal range for reductive pathway	-2												
TOC	mg/l	> 20	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	2	15	0		2.9	0		9.1	0		2100	2	
Temperature	Celc	> 20	At T >20oC biochemical process is accelerated	1	15.61	0		21.31	1	anomalous?	17.46	0		15.1	0	
Alkalinity	mg/l	> 2x background	Results from interaction between CO2 and aquifer minerals	1	47 J	NA	unknown background	16	NA	unknown background	270	NA	unknown background	990	NA	unknown background
Chloride	mg/l	> 2x background	Daughter product of organic chlorine	2	5000	NA	unknown background	490	NA	unknown background	1300	NA	unknown background	8600	NA	unknown background
Tetrachloroethene	ug/l		Material released	0	7.5	0	source	0.29	0	source	0.29	0	source	24000	0	source
Trichloroethene*	ug/l		Material released	0	130	0	source	0.17	0	source	0.5 J	0	source	190000	0	source
			Daughter product of PCE	2*												
DCE*	ug/l		Material released	0	1576	2	1,1-dce = 16, cis-1,2 = 1400, trans-1,2 = 160	2.4	2	1,1-dce <0.19, cis-1,2 = 1.3, trans-1,2 = 1.1	0.85	2	1,1-dce <0.19, cis-1,2 <0.17, trans-1,2 = 0.85 J	42200	2	1,1-dce = 3800, cis-1,2 = 31000, trans-1,2 = 7400
			Daughter product of PCE. If cis is > 80% of total DCE it is likely a daughter product 1,1-DCE can be chemical reaction product of TCA	2*												
VC*	ug/l		Material released	0	260	2	daughter product	2.1	2	daughter product	0.22	0	daughter product	2200	2	daughter product
			Daughter product of PCE	2*												
1,1,2-Trichloroethane*	ug/l		Material released	0	7.3	0		0.27	0		0.27	0	1,1,2-TCA <0.27	47000	0	
DCA	ug/l		Daughter product of TCA under reducing conditions	2	1.1	2	1,2-DCA	0.22	0	1,2-DCA	0.22	0	1,2-DCA	2800	2	1,2-DCA
Carbon Tetrachloride	ug/l		Material released	0	0.65	0	source	0.13	0	source	0.28 J	0	source	460	0	source
Ethene/Ethane	ug/l	> 10	Daughter product of VC/ethene	2	76.6	2	ethane 5.6, ethene = 71	7.8	0	ethane = 6.6, ethene = 1.2	76.18	2	ethane = 76, ethene = 0.18	1146	3	ethane = 46, ethene = 1100
		> 100		3												
Carbon Dioxide	mg/l	> 2x background	Ultimate oxidative daughter product	1	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
Hydrogen	nM	> 1	Reductive pathway possible, VC may accumulate	3	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
		< 1	VC oxidized	0												
Volatile Fatty Acids	mg/l	> 0.1	Intermediates resulting from biodegradation of more complex compounds; carbon and energy source	2	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
BTEX*	mg/l	> 0.1	Carbon and energy source; drives dechlorination	2	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
Chloroethane*	ug/l		Daughter product of DCA or VC under reducing conditions	2	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
Chloroform	ug/l		Material released	0	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
			Daughter product of Carbon Tetrachloride	2												
Dichloromethane	ug/l		Material released	0	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
			Daughter product of Chloroform	2												
				Total Points		**13**			**21**			**20**			**24**	

Notes:

* Required analysis. Points awarded only if it can be shown that the compound is a daughter product (i.e., not a constituent of the source NAPL).

NA = not applicable / not accounted for

APPENDIX E
MNA Scoring Details
Evaluation of Biodegradation - 2013 Analytical Results

				Well ID	137C			141C			145C			149C		
Analyte	**units**	**Concentration**	**Score Interpretation**	**Value**	**8/16/13 Concentration**	**Points**	**Comments**	**8/13/13 Concentration**	**Points**	**Comments**	**8/12/13 Concentration**	**Points**	**Comments**	**8/12/13 Concentration**	**Points**	**Comments**
Oxygen	mg/l	<0.5	Tolerated, suppresses the reductive pathway at higher concentrations	3	0.18	3		0.13	3		0.12	3		0.12	3	
		>5	Not tolerated; however, VC may be oxidized aerobically	-3												
Nitrate	mg/l	<1	At higher concentrations may compete with reductive pathway	2	0.012	2		0.026 J	2		0.012	2		0.012	2	
Iron (II)	mg/l	>1	Reductive pathway possible; VC may be oxidized under Fe(III)-reducing conditions	3	550	3		0.088 J	0		28	3		0.081	0	
Sulfate	mg/l	<20	At higher concentrations may compete with reductive pathway	2	1.1	2		92	0		440	0		350	2	
Sulfide	mg/l	>1	Reductive pathway possible	3	43	3		3.6	3		0.41	0		4.9	3	
Methane	mg/l	<0.5	VC oxidizes	0	0.27	0		4.1	3		0.28	0		0.81	0	
		>0.5	Ultimate reductive daughter product, VC Accumulates	3												
ORP	mV	<50	Reductive pathway possible	1	-466	2		-507	2		-346	2		-397	2	
		<-100	Reductive pathway likely	2												
pH	SU	5 < pH < 9	Optimal range for reductive pathway	0	7.42	0		12.32	-2	anomalous? 10.07 in 2008, >9 2009, <9 before that	7.6	0		9.64	-2	
		5 > pH > 9	Outside optimal range for reductive pathway	-2												
TOC	mg/l	> 20	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	2	370	2		98	2		7.9	0		5.5	0	
Temperature	Celc	> 20	At T >20oC biochemical process is accelerated	1	15.97	0		15.63	0		18.48	0		16.64	0	
Alkalinity	mg/l	> 2x background	Results from interaction between CO2 and aquifer minerals	1	120	NA	unknown background	1300	NA	unknown background	87	NA	unknown background	13	NA	unknown background
Chloride	mg/l	> 2x background	Daughter product of organic chlorine	2	2500	NA	unknown background	2000	NA	unknown background	320	NA	unknown background	200	NA	unknown background
Tetrachloroethene	ug/l		Material released	0	11 J	0	source	18	0	source	1.8 J	0	source	0.29	0	source
Trichloroethene*	ug/l		Material released	0	67	0	source	6.7	0	source	9.5	0	source	0.99 J	0	source
			Daughter product of PCE	2*												
DCE*	ug/l		Material released	0	3680	2	1,1-dce = 370, cis-1,2 = 3000, trans-1,2 = 310	1.56	2	1,1-dce = 0.36 J, cis-1,2 = 1.2, trans-1,2 <0.19	1116.1	2	1,1-dce = 6.1, cis-1,2 = 1100, trans-1,2 = 10	16.2	2	1,1-dce = 1.3, cis-1,2 = 13, trans-1,2 = 1.9
			Daughter product of PCE. If cis is > 80% of total DCE it is likely a daughter product 1,1-DCE can be chemical reaction product of TCA	2*												
VC*	ug/l		Material released	0	1400	2	daughter product	8.9	0	daughter product	200	2	daughter product	8.4	2	daughter product
			Daughter product of PCE	2*												
1,1,2-Trichloroethane*	ug/l		Material released	0	41	0		0.27	0	1,1,2-TCA = 120 J	1.1	0	1,1,2-TCA = 270	0.27	0	1,1,2-TCA <0.27
DCA	ug/l		Daughter product of TCA under reducing conditions	2	50	2	1,2-DCA	0.22	0	1,2-DCA	0.88	2	1,2-DCA	0.22	0	1,2-DCA
Carbon Tetrachloride	ug/l		Material released	0	1.6	0	source	0.13	0	source	0.52	0	source	0.3 J	0	source
Ethene/Ethane	ug/l	> 10	Daughter product of VC/ethene	2	121	3	ethane = 41, ethene = 80	32	2	ethane = 11, ethene = 21	57	2	ethane = 12, ethene = 45	32.4	2	ethane = 5.4, ethene = 27
		> 100		3												
Carbon Dioxide	mg/l	> 2x background	Ultimate oxidative daughter product	1	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
Hydrogen	nM	> 1	Reductive pathway possible, VC may accumulate	3	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
		< 1	VC oxidized	0												
Volatile Fatty Acids	mg/l	> 0.1	Intermediates resulting from biodegradation of more complex compounds; carbon and energy source	2	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
BTEX*	mg/l	> 0.1	Carbon and energy source; drives dechlorination	2	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
Chloroethane*	ug/l		Daughter product of DCA or VC under reducing conditions	2	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
Chloroform	ug/l		Material released	0	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
			Daughter product of Carbon Tetrachloride	2												
Dichloromethane	ug/l		Material released	0	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
			Daughter product of Chloroform	2												
				Total Points		**26**			**17**			**18**			**16**	

Notes:

* Required analysis. Points awarded only if it can be shown that the compound is a daughter product (i.e., not a constituent of the source NAPL).

NA = not applicable / not accounted for

APPENDIX E
MNA Scoring Details
Evaluation of Biodegradation - 2013 Analytical Results

				Well ID	151C			105D			136D			137D		
Analyte	**units**	**Concentration**	**Score Interpretation**	**Value**	**8/19/13 Concentration**	**Points**	**Comments**	**8/21/13 Concentration**	**Points**	**Comments**	**8/12/13 Concentration**	**Points**	**Comments**	**8/16/13 Concentration**	**Points**	**Comments**
Oxygen	mg/l	<0.5	Tolerated, suppresses the reductive pathway at higher concentrations	3	0.18	3		0.25	3		0.22	3		0.15	3	
		>5	Not tolerated; however, VC may be oxidized aerobically	-3												
Nitrate	mg/l	<1	At higher concentrations may compete with reductive pathway	2	<0.02	2	no data typically greater than 0.5	0.013	2		0.012	2		0.012	2	
Iron (II)	mg/l	>1	Reductive pathway possible; VC may be oxidized under Fe(III)- reducing conditions	3	NS	0		14	3		0.35	0		5.8	0	
Sulfate	mg/l	<20	At higher concentrations may compete with reductive pathway	2	1570	0	2009 data	1100	0		280	0		60	0	
Sulfide	mg/l	>1	Reductive pathway possible	3	NA		2009 data	5.9	3		8.9	3		5.4 J	3	
Methane	mg/l	<0.5	VC oxidizes	0	3.6	3	no data typically greater than 0.5	0.59	3		0.34	0		0.38	3	
		>0.5	Ultimate reductive daughter product, VC Accumulates	3												
ORP	mV	<50	Reductive pathway possible	1	-214	2		-114	2		-367	2		-489	2	
		<-100	Reductive pathway likely	2												
pH	SU	5 < pH < 9	Optimal range for reductive pathway	0	7.69	0		6.09	0		8.12	0		8.16	0	
		5 > pH > 9	Outside optimal range for reductive pathway	-2												
TOC	mg/l	> 20	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	2	6	0	2009 data	1500	2		4.7	0		13	2	
Temperature	Celc	> 20	At T >20oC biochemical process is accelerated	1	25.87	1	anomalous?	13.22	0		14.29	0		15.41	0	
Alkalinity	mg/l	> 2x background	Results from interaction between CO2 and aquifer minerals	1	170	NA	2009 data	820	NA	unknown background	170	NA	unknown background	110	NA	unknown background
Chloride	mg/l	> 2x background	Daughter product of organic chlorine	2	5.9	NA	unknown background	6600	NA	unknown background	180	NA	unknown background	110	NA	unknown background
Tetrachloroethene	ug/l		Material released	0	0.6 J	0	source	22000	0		0.79 J	0	source	250	0	source
Trichloroethene*	ug/l		Material released	0	1.5	0	source	250000	0		28	0	source	3400	0	source
			Daughter product of PCE	2*												
DCE*	ug/l		Material released	0	6.86	2	1,1-dce = 0.23 J, cis-1,2 = 6.4, trans-1,2 = 0.23 J	20000	2	1,1-dce = 2600, cis-1,2 = 13000, trans-1,2 = 4400	649.7	2	1,1-dce = 10, cis-1,2 = 630, trans-1,2 = 9.7 J	900	2	1,1-dce = 140, cis-1,2 = 640, trans-1,2 = 120
			Daughter product of PCE. If cis is > 80% of total DCE it is likely a daughter product 1,1-DCE can be chemical reaction product of TCA	2*												
VC*	ug/l		Material released	0	2.1	2	daughter product	560 J	2	daughter product	380	2	daughter product	120	2	daughter product
			Daughter product of PCE	2*												
1,1,2-Trichloroethane*	ug/l		Material released	0	0.35 J	0		290000	0		9.4 J	0		360	0	
DCA	ug/l		Daughter product of TCA under reducing conditions	2	0.48 J	2	1,2-DCA	16000	2	1,2-DCA	9.4 J	2	1,2-DCA	2.4	2	1,2-DCA
Carbon Tetrachloride	ug/l		Material released	0	0.13	0	source	360000	0	source	0.26	0	source	4.9 J	0	source
Ethene/Ethane	ug/l	> 10	Daughter product of VC/ethene	2	NA		2009 was ethane = 57, ethene = 3.6	69.4	2	ethane = 7.4, ethene = 62	316.1	3	ethane = 6.1 , ethene = 310	82	3	ethane = 14, ethene = 68
		> 100		3												
Carbon Dioxide	mg/l	> 2x background	Ultimate oxidative daughter product	1	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
Hydrogen	nM	> 1	Reductive pathway possible, VC may accumulate	3	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
		< 1	VC oxidized	0												
Volatile Fatty Acids	mg/l	> 0.1	Intermediates resulting from biodegradation of more complex compounds; carbon and energy source	2	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
BTEX*	mg/l	> 0.1	Carbon and energy source; drives dechlorination	2	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
Chloroethane*	ug/l		Daughter product of DCA or VC under reducing conditions	2	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
Chloroform	ug/l		Material released	0	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
			Daughter product of Carbon Tetrachloride	2												
Dichloromethane	ug/l		Material released	0	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
			Daughter product of Chloroform	2												
				Total Points		**17**			**26**			**19**			**24**	

Notes:

* Required analysis. Points awarded only if it can be shown that the compound is a daughter product (i.e., not a constituent of the source NAPL).

NA = not applicable / not accounted for

APPENDIX E
MNA Scoring Details
Evaluation of Biodegradation - 2013 Analytical Results

				Well ID	139D			147D			148D			149D		
Analyte	**units**	**Concentration**	**Score Interpretation**	**Value**	**8/21/13 Concentration**	**Points**	**Comments**	**8/13/13 Concentration**	**Points**	**Comments**	**8/13/13 Concentration**	**Points**	**Comments**	**8/22/13 Concentration**	**Points**	**Comments**
Oxygen	mg/l	<0.5	Tolerated, suppresses the reductive pathway at higher concentrations	3	0.24	3		0.24	3		0.16	3		0.2	3	
		>5	Not tolerated; however, VC may be oxidized aerobically	-3												
Nitrate	mg/l	<1	At higher concentrations may compete with reductive pathway	2	0.012	2		0.012	2		0.017 J	2		0.012	2	
Iron (II)	mg/l	>1	Reductive pathway possible; VC may be oxidized under Fe(III)-reducing conditions	3	15	3		0.62	0		0.081	0		0.081	0	
Sulfate	mg/l	<20	At higher concentrations may compete with reductive pathway	2	1100	0		1300	0		210	0		230	0	
Sulfide	mg/l	>1	Reductive pathway possible	3	2200	3		0.41	0		8.1	3		2.8	3	
Methane	mg/l	<0.5	VC oxidizes	0	0.41	0		0.065	0		0.39	0		0.34	0	
		>0.5	Ultimate reductive daughter product, VC Accumulates	3												
ORP	mV	<50	Reductive pathway possible	1	-203	2		-247	2		-587	2		-386	2	
		<-100	Reductive pathway likely	2												
pH	SU	5 < pH < 9	Optimal range for reductive pathway	0	7.04	0		7.99	0		10.29	-2	> 9 in 2008, 2009, 2010 & 2011, 2013; < 9 in 2012	9.66	-2	7<pH<8 in 2005 thru 2008, >9 in 2009, 2013
		5 > pH > 9	Outside optimal range for reductive pathway	-2												
TOC	mg/l	> 20	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	2	4.1	0		1.8	0		8.2	0		3.6	0	
Temperature	Celc	> 20	At T >20oC biochemical process is accelerated	1	15.32	0		13.49	0		16.57	0		15.68	0	
Alkalinity	mg/l	> 2x background	Results from interaction between CO2 and aquifer minerals	1	110	NA	unknown background	210	NA	unknown background	24 B	NA	unknown background	26	NA	unknown background
Chloride	mg/l	> 2x background	Daughter product of organic chlorine	2	890	NA	unknown background	65	NA	unknown background	140	NA	unknown background	250	NA	unknown background
Tetrachloroethene	ug/l		Material released	0	580	0	source	0.29	0	source	0.54 J	0	source	0.29	0	source
Trichloroethene*	ug/l		Material released	0	1900	0	source	0.31 J	0	source	0.95 J	0	source	0.31 J	0	source
			Daughter product of PCE	2*												
DCE*	ug/l		Material released	0	205	2	1,1-dce = 13, cis-1,2 = 160, trans-1,2 = 32	66.6	2	1,1-dce <0.19, cis-1,2 = 64, trans-1,2 = 2.6	2.8	2	1,1-dce <0.19, cis-1,2 = 2.8, trans-1,2 <0.19	1.79	2	1,1-dce = 0.2 J, cis-1,2 = 1, trans-1,2 = 0.59 J
			Daughter product of PCE. If cis is > 80% of total DCE it is likely a daughter product 1,1-DCE can be chemical reaction product of TCA	2*												
VC*	ug/l		Material released	0	44	2	daughter product	45	2	daughter product	0.22	0	daughter product	1.5	2	daughter product
			Daughter product of PCE	2*												
1,1,2-Trichloroethane*	ug/l		Material released	0	21	0		0.27	0		0.27	0		0.27	0	
DCA	ug/l		Daughter product of TCA under reducing conditions	2	21	0	1,2-DCA	0.22	0	1,2-DCA	0.22	0	1,2-DCA	0.22	0	1,2-DCA
Carbon Tetrachloride	ug/l		Material released	0	1.5	0	source	0.13	0	source	0.13	0	source	0.13	0	source
Ethene/Ethane	ug/l	> 10	Daughter product of VC/ethene	2	53	2	ethane = 6.15, ethene = 35.8	1.76	0	ethane = 0.66, ethene = 1.1	37.2	2	ethane = 33, ethene = 4.2	13.8	2	ethane = 2.8, ethene = 11
		> 100		3												
Carbon Dioxide	mg/l	> 2x background	Ultimate oxidative daughter product	1	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
Hydrogen	nM	> 1	Reductive pathway possible, VC may accumulate	3	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
		< 1	VC oxidized	0												
Volatile Fatty Acids	mg/l	> 0.1	Intermediates resulting from biodegradation of more complex compounds; carbon and energy source	2	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
BTEX*	mg/l	> 0.1	Carbon and energy source; drives dechlorination	2	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
Chloroethane*	ug/l		Daughter product of DCA or VC under reducing conditions	2	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
Chloroform	ug/l		Material released	0	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
			Daughter product of Carbon Tetrachloride	2												
Dichloromethane	ug/l		Material released	0	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
			Daughter product of Chloroform	2												
				Total Points		**19**			**11**			**12**			**14**	

Notes:

* Required analysis. Points awarded only if it can be shown that the compound is a daughter product (i.e., not a constituent of the source NAPL).

NA = not applicable / not accounted for

APPENDIX E
MNA Scoring Details
Evaluation of Biodegradation - 2013 Analytical Results

				Well ID	156D			165D			136E			145E		
Analyte	units	Concentration	Score Interpretation	Value	8/19/13 Concentration	Points	Comments	8/19/13 Concentration	Points	Comments	8/15/13 Concentration	Points	Comments	8/15/13 Concentration	Points	Comments
Oxygen	mg/l	<0.5	Tolerated, suppresses the reductive pathway at higher concentrations	3	0.26	3		0.21	3		0.25	3		0.26	3	
		>5	Not tolerated; however, VC may be oxidized aerobically	-3												
Nitrate	mg/l	<1	At higher concentrations may compete with reductive pathway	2	0.012	2		0.012	2		0.012	2		0.012	2	
Iron (II)	mg/l	>1	Reductive pathway possible; VC may be oxidized under Fe(III)-reducing conditions	3	0.37	0		0.081	0		0.2	0		43	3	
Sulfate	mg/l	<20	At higher concentrations may compete with reductive pathway	2	670	0		12	2		330	0		870	0	
Sulfide	mg/l	>1	Reductive pathway possible	3	22	3		3.2	3		5.0 J	3		0.75 J	0	
Methane	mg/l	<0.5	VC oxidizes	0	0.21	0		0.1	0		0.24	0		1.9	3	
		>0.5	Ultimate reductive daughter product, VC Accumulates	3												
ORP	mV	<50	Reductive pathway possible	1	-460	2		-483	2		-489	2		-348	2	
		<-100	Reductive pathway likely	2												
pH	SU	5 < pH < 9	Optimal range for reductive pathway	0	7.91	0		9.33	-2	7.49 in 2008, 9.05 in 2010, 8.84 in 2011; >9 2009, 2013	8.05	0		7.02	0	
		5 > pH > 9	Outside optimal range for reductive pathway	-2												
TOC	mg/l	> 20	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	2	3.7	0		9.7	0		5.6	0		18	0	
Temperature	Celc	> 20	At T >20oC biochemical process is accelerated	1	13.71	0		14.47	0		13.3	0		12.9	0	
Alkalinity	mg/l	> 2x background	Results from interaction between CO2 and aquifer minerals	1	300	NA	unknown background	44	NA	unknown background	210 J	NA	unknown background	310	NA	unknown background
Chloride	mg/l	> 2x background	Daughter product of organic chlorine	2	200	NA	unknown background	350	NA	unknown background	190	NA	unknown background	4200	NA	unknown background
Tetrachloroethene	ug/l		Material released	0	0.29	0	source	0.29	0	source	0.29	0	source	4.8	0	source
Trichloroethene*	ug/l		Material released	0	0.17	0	source	0.17	0	source	2.8	0	source	2.8	0	source
			Daughter product of PCE	2*												
DCE*	ug/l		Material released	0	0.35	0	1,1-dce <0.19, cis-1,2 = 0.35 J, trans-1,2 <0.19	2.29	2	1,1-dce = 0.31 J, cis-1,2 = 1.5, trans-1,2 = 0.48 J	8.7	2	1,1-dce <0.19, cis-1,2 <0.17, trans-1,2 = 8.7	740	2	1,1-dce <3.2, cis-1,2 = 171, trans-1,2 = 630
			Daughter product of PCE. If cis is > 80% of total DCE it is likely a daughter product 1,1-DCE can be chemical reaction product of TCA	2*												
VC*	ug/l		Material released	0	0.75 J	2	daughter product	3.3	2	daughter product	4.2	2	daughter product	2100	2	daughter product
			Daughter product of PCE	2*												
1,1,2-Trichloroethane*	ug/l		Material released	0	0.27	0		0.27	0		0.27	0		4.5	0	
DCA	ug/l		Daughter product of TCA under reducing conditions	2	0.22	0	1,2-DCA	2	2	1,2-DCA	12	2	1,2-DCA	3.7	2	1,2-DCA
Carbon Tetrachloride	ug/l		Material released	0	0.13	0	source	0.13	0	source	0.13	0	source	2.2	0	source
Ethene/Ethane	ug/l	> 10	Daughter product of VC/ethene	2	1.28	0	ethane = 1.1, ethene = 0.18	87	2	ethane = 2, ethene = 85	355.4	3	ethane = 5.8, ethene = 370	1054	3	ethane = 74, ethene = 980
		> 100		3												
Carbon Dioxide	mg/l	> 2x background	Ultimate oxidative daughter product	1	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
Hydrogen	nM	> 1	Reductive pathway possible, VC may accumulate	3	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
		< 1	VC oxidized	0												
Volatile Fatty Acids	mg/l	> 0.1	Intermediates resulting from biodegradation of more complex compounds; carbon and energy source	2	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
BTEX*	mg/l	> 0.1	Carbon and energy source; drives dechlorination	2	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
Chloroethane*	ug/l		Daughter product of DCA or VC under reducing conditions	2	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
Chloroform	ug/l		Material released	0	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
			Daughter product of Carbon Tetrachloride	2												
Dichloromethane	ug/l		Material released	0	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
			Daughter product of Chloroform	2												
				Total Points		12			18			19			22	

Notes:

* Required analysis. Points awarded only if it can be shown that the compound is a daughter product (i.e., not a constituent of the source NAPL).

NA = not applicable / not accounted for

APPENDIX E
MNA Scoring Details
Evaluation of Biodegradation - 2013 Analytical Results

				Well ID	146E			156E			146F			150F		
Analyte	**units**	**Concentration**	**Score Interpretation**	**Value**	**8/12/13 Concentration**	**Points**	**Comments**	**8/19/13 Concentration**	**Points**	**Comments**	**8/14/13 Concentration**	**Points**	**Comments**	**8/20/13 Concentration**	**Points**	**Comments**
Oxygen	mg/l	<0.5	Tolerated, suppresses the reductive pathway at higher concentrations	3	0.28	3		0.34	3		0.25	3		0.22	3	
		>5	Not tolerated; however, VC may be oxidized aerobically	-3												
Nitrate	mg/l	<1	At higher concentrations may compete with reductive pathway	2	0.012	2		0.012	2		0.012	2		0.012	2	
Iron (II)	mg/l	>1	Reductive pathway possible; VC may be oxidized under Fe(III)-reducing conditions	3	0.081	0		0.081	0		0.22	0		340	3	
Sulfate	mg/l	<20	At higher concentrations may compete with reductive pathway	2	1400	0		310	0		1100	0		1300	0	
Sulfide	mg/l	>1	Reductive pathway possible	3	73	3		3.6	3		220	3		1.8	3	
Methane	mg/l	<0.5	VC oxidizes	0	1.8	3	not analyzed in 2009, using June 2008 results	0.094	0	not analyzed in 2009, using June 2008 results	1.9	3		2.2	3	
		>0.5	Ultimate reductive daughter product, VC Accumulates	3												
ORP	mV	<50	Reductive pathway possible	1	-555	2		-312	2		-421	2		-34	1	likely a transcription error with missing digit (typically <250)
		<-100	Reductive pathway likely	2												
pH	SU	5 < pH < 9	Optimal range for reductive pathway	0	7.22	0		9.34	-2	2013 anomalous pH at 9.34	7.43	0		6.7	0	
		5 > pH > 9	Outside optimal range for reductive pathway	-2												
TOC	mg/l	> 20	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	2	18	0		1.4	0		67	2		190	2	
Temperature	Celc	> 20	At T >20oC biochemical process is accelerated	1	15.1	0		16.34	0		12.66	0		15.94	0	
Alkalinity	mg/l	> 2x background	Results from interaction between CO2 and aquifer minerals	1	290	NA	unknown background	38	NA	unknown background	540	NA	unknown background	50	NA	unknown background
Chloride	mg/l	> 2x background	Daughter product of organic chlorine	2	500	NA	unknown background	210	NA	unknown background	4100	NA	unknown background	9800	NA	unknown background
Tetrachloroethene	ug/l		Material released	0	1.9	0	source	0.29	0	source	15	0	source	0.97	0	source
Trichloroethene*	ug/l		Material released	0	420	0	source	0.17	0	source	280	0	source	0.57	0	source
			Daughter product of PCE	2*												
DCE*	ug/l		Material released	0	2490	2	1,1-dce = 230, cis-1,2 = 2100, trans-1,2 = 160	0	0	1,1-dce <0.19, cis-1,2 <0.17, trans-1,2 <0.19	5110	2	1,1-dce = 230, cis-1,2 = 4500, trans-1,2 = 380	50.78	2	1,1-dce = 0.68 J, cis-1,2 = 439, trans-1,2 = 1.1 J
			Daughter product of PCE. If cis is > 80% of total DCE it is likely a daughter product 1,1-DCE can be chemical reaction product of TCA	2*												
VC*	ug/l		Material released	0	2600	2	daughter product	0.22	2	daughter product	4100	2	daughter product	490	2	daughter product
			Daughter product of PCE	2*												
1,1,2-Trichloroethane*	ug/l		Material released	0	4.4 J	0		0.27	0	1,1,2-TCA <34	97	0		0.9	0	
DCA	ug/l		Daughter product of TCA under reducing conditions	2	1.5	2	1,2-DCA	0.22	2	1,2-DCA	13 J	2	1,2-DCA	0.73	0	1,2-DCA
Carbon Tetrachloride	ug/l		Material released	0	0.87	0	source	0.13	0	source	6.5	0	source	0.43	0	source
Ethene/Ethane	ug/l	> 10	Daughter product of VC/ethene	2	949.4	3	ethane = 9.4, ethene = 940	1.07	0	ethane = 0.89, ethene = 0.18	217	3	ethane = 47, ethene 170	162	3	ethane = 100, ethene = 62
		> 100		3												
Carbon Dioxide	mg/l	> 2x background	Ultimate oxidative daughter product	1	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
Hydrogen	nM	> 1	Reductive pathway possible, VC may accumulate	3	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
		< 1	VC oxidized	0												
Volatile Fatty Acids	mg/l	> 0.1	Intermediates resulting from biodegradation of more complex compounds; carbon and energy source	2	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
BTEX*	mg/l	> 0.1	Carbon and energy source; drives dechlorination	2	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
Chloroethane*	ug/l		Daughter product of DCA or VC under reducing conditions	2	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
Chloroform	ug/l		Material released	0	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
			Daughter product of Carbon Tetrachloride	2												
Dichloromethane	ug/l		Material released	0	not analyzed	0		not analyzed	0		not analyzed	0		not analyzed	0	
			Daughter product of Chloroform	2												
				Total Points		**22**			**12**			**24**			**24**	

Notes:

* Required analysis. Points awarded only if it can be shown that the compound is a daughter product (i.e., not a constituent of the source NAPL).

NA = not applicable / not accounted for

APPENDIX F

DATA VALIDATION SUMMARY LABORATORY REPORTS (CD ONLY)

APPENDIX G

LANDFILL CAP INSPECTION RESULTS (NOVEMBER 2013)

EXHIBIT A
CAP AND SURFACE WATER DRAINAGE
INSPECTION CHECKLIST
NECCO PARK

DATE: 11-25-13
INSPECTOR: Gerald Shepard
WITNESSES: Not Required

EMERGENCY CONTACT: Timothy Pezzino
Phone # (716) 278-5170

CONDITION: (Check) (Not Acceptable or Not Present require comments below)

	Acceptable	Not Acceptable	Present	Not Present	Remarks
1) Vegetative Cover, Ditches, Culverts	X				
a) Sediment Build-Up/Debris	X				
b) Pooling or Ponding	X				
c) Slope Integrity	X				
d) Overall Adequacy	X				
e) Culvert Condition	X				
2) Access Roads	X				
3) Landfill Cover System					
a) Erosion Damage	X				
b) Leachate Seeps				X	
c) Settlement				X	
d) Stone Aprons	X				
e) Vegetation	X				
f) Animal Burrows	X				
4) Slope Stability					
a) Landfill Top Soil	X				
b) Landfill Side Slope	X				
5) Gas Vents	X				
6) Monitoring Wells	X				

COMMENTS:
DESCRIPTION OF CONDITION:

3B - No Leachate Seeps Present.
3C - No Settling on Landfill or Side Slopes
3-F - Very Small Mice + Mole Burrows on LandFill + Side Slopes

DESCRIPTION OF CONCERN:

DESCRIPTION OF REMEDY:

EXHIBIT B
CAP AND SURFACE WATER DRAINAGE
MAINTENANCE CHECKLIST
NECCO PARK

DATE: 11-25-13
INSPECTOR: Gerald Shepard
WITNESSES: Not Required

EMERGENCY CONTACT: Timothy Pezzino
Phone # (716)278-5170

Maintenance Performed (Check)	Item	Performed by:	Remarks
	1) Vegetative Cover:		
	a) Seeding		
	b) Fertilizing		
	c) Topsoil Replaced		
	d) Removal of Undesirable Vegetation		
	2) Drainage Ditches		
	a) Sediment Removal		
	b) Fill		
	c) Regrading		
	d) Stone Apron Repair		
	e) Vegetative Cover Placement		
	f) Liner Replacement		
	3) Access Road		
	a) Excavation		
	b) Fill		
	c) Grading		
	d) Stone Paving		
	4) Landfill Cap		
	a) Excavation		
	b) Cover Materials		
	- topsoil		
	- barrier protection layer		
	- drainage composite		
	- geomembrane		
	- geotextile		
	c) Testing		
	d) Barrier Protection Layer		
X	e) Vegetative Cover	Mowcon/Contractor	
	5) Gas Vents		
	- Pipes		
	- Bedding and Adjacent Media		
	6) Other		

DESCRIPTION OF MAINTENANCE ACTIVITIES: Brush Hogged + Line trimmed entire Land Fill + Perimeter ditch. October 29, 2013