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Young Chang
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Dear Young Chang:

NECCO PARK 2019 ANNUAL REPORT

This document is the *Remedial Action Post-Construction Monitoring 2019 Annual Report* for the Chemours Necco Park Hydraulic Controls System (HCS), Groundwater Treatment Facility (GWTF), and landfill cap.

This fourteenth 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 2019 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). HCS operation uptime for 2019 was 88.7%. Excluding scheduled downtime for planned maintenance, HCS uptime for 2019 was 92.4%. The groundwater elevations, geochemical results, and DNAPL monitoring indicate HCS continues to be effective at controlling source area groundwater at the Chemours Necco Park site. Furthermore, the results indicated monitored natural attenuation remains actively degrading the site compounds.

Please call me at (716) 221-4723 if you have any questions or comments regarding this submittal.

Sincerely,

Chemours

Paul F. Mazierski
Project Director

Enc. 2019 Annual Report

cc: Stanley Radon/NYSDEC
Mary McIntosh/NYSDEC
E. Felter/Parsons

Remedial Action Post-Construction Monitoring
2019 Annual Report
NECCO Park
Niagara Falls, New York

Prepared for:

THE CHEMOURS COMPANY FC LLC
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March 2020

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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 2019 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 fifteenth such report and describes hydraulic and chemistry monitoring conducted in 2019 at the 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), and subsequent agency approved revisions (USEPA, 2011, 2015, and 2016).

The Necco Park Remedial Action consists of an upgraded cap over the landfill and an enhanced groundwater hydraulic control system (HCS) from the previous pumping system which first began operation in the early 1980's. 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). HCS operation uptime for 2019 was 88.7%. Excluding scheduled downtime for planned maintenance, HCS uptime for 2019 was 92.4%. Summaries of system operations and hydraulic head data were previously provided to the USEPA and the NYSDEC in the 2019 Quarterly Data Packages (Parsons 2019a, 2019b, 2019c, and 2020). This Annual Report provides a detailed evaluation of system effectiveness with respect to the performance standards presented in the Necco Park Statement of Work (SOW).

Hydraulic monitoring data from 2019 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.

Two recovery well rehabilitation events were completed in B/C-Zone recovery wells during 2019 using high pressure jetting and vacuum technique developed with National Vacuum, Inc. during 2012-2013. The spring well rehabilitation occurred April 9 through 11 and the fall event occurred October 8 through 10. Both events had a typical modest removal of sediments and maintenance of flow rate. The flow at RW-5 remains at an increased rate (approximately 3 – 6 gpm), when compared with the 2005 – 2015 average as the result of more thorough well cleaning in the Fall 2015, thereby demonstrating that the significant improvement on well yield has been maintained.

In accordance with the LTGMP (DuPont CRG 2005a), annual groundwater sampling began in 2008 after three years of biannual sampling had been conducted. In 2010, a revised sampling program was accepted by USEPA to focus on key locations on an annual basis and intermittently (every 5 years) sample the original 2005 program. In 2012, USEPA agreed to removal of AT wells from the program, sampling VOCs only in the treatment process, and other minor program changes (such as the elimination of drawdown maps in annual reports). In 2015, USEPA approved reductions in the DNAPL monitoring program. In 2016, the USEPA approved a request by Chemours CRG to end the requirement of 10% independent data validation of the groundwater data while QA/QC continues to include in-house data review. In 2019, prior to the 2019 annual groundwater sampling event, USEPA approved minor changes to the groundwater sampling methods, specifically the use of peristaltic pump for purging and sample for well allowable depth to water. The original LTGMP and MNA programs were last completed in 2018 and are scheduled to be completed next in 2023, on the five-year schedule.

The 2019 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 2019 results indicate:

- Four of the five A-Zone wells sampled were less than 2 micrograms per liter TVOCs and the other well (137A) was 152.7 micrograms per liter.
- TVOC concentrations at key source area limit wells in the B and C zones, such as 137B, 150B, 172B, and 145C 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. One of the three E-zone wells (146E) sampled in 2019 resulted in the lowest TVOC concentration observed at the well locations.
- Overall, the TVOC concentrations are decreasing for all groundwater flow zones at the outer portions of the source area and in the downgradient far-field. In the few cases where there were increasing TVOC trends, the concentrations were within historical range, near the source area / a recovery well, or represented increases in degradation products.

Based on the 2019 analytical results obtained using the USEPA-approved new sampling methods, analytical results compare favorably with the many previous years of existing data. If the new sampling methods has any bias compared to the previous methods, it is for the results to be slightly biased higher. Future groundwater sampling is planned using the same methods employed in 2019.

DNAPL was monitored every month throughout 2019. As approved by the USEPA, a reduced list of wells was monitored monthly and semi-annually beginning in June 2015 with the full list of wells to be monitored once every two years (USEPA June 11, 2015 and USEPA August 12, 2015). Measurable DNAPL was observed in RW-4 (0.2 feet) and RW-11 (3.0 feet) in March and RW-11 (4.0 feet) in December 2019. DNAPL was removed from RW-4 (0.8 gallons) and RW-11 (12.0 gallons) in April 2019 and RW-11 (18.0 gallons) in January 2020. A total of 8,849 gallons of DNAPL has been removed since initiation of the recovery program in 1989.

The 2019 groundwater elevations, geochemical results and DNAPL monitoring indicated the HCS continues to be effective at controlling source area groundwater at the Chemours Necco Park site through 2019. 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 approved by the USEPA in 2011 and 2016.

Data on chlorinated ethenes in Necco Park groundwater is consistent with lines of evidence required for natural attenuation of contaminants (USEPA, Monitored Natural Attenuation Directive, 1999). Analytical results from 2019, 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 2023 and another full MNA analysis will be completed then.

1.0 INTRODUCTION

1.1 Site Location

The 24-acre Chemours 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 2019 Annual Report presents hydraulic and chemical monitoring results from the fifteenth year of operation of the hydraulic controls. In addition, this 2019 Annual Report includes historical groundwater chemistry results for assessment of groundwater quality trends.

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 2019 HCS operations.

2.1 Operational Summary

Operational information for the HCS is provided in the 2019 Quarterly Data Packages (Parsons 2019a, 2019b, 2019c, and 2020) and summarized in the table below.

Period	HCS Uptime (%)	HCS Uptime [excluding scheduled maintenance downtime] (%)	Groundwater Treated (Gallons)	DNAPL[1] Removed (Gallons)
1Q19	85.7	85.7	3,136,446	12.8
2Q19	85.2	100.0	3,538,214	0
3Q19	93.1	93.1	2,824,848	0
4Q19	90.6	90.6	3,054,064	18.0
2019 Total	**88.7**	**92.4**	**12,553,572**	**30.8**

[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 operational throughout 2019, averaging 88.7% total system uptime through December 31, 2019 with one scheduled maintenance outage and two unscheduled outages described below. Excluding scheduled downtime for planned maintenance, HCS uptime for 2019 was 92.4%. GWTF downtime was minimized by continuously monitoring operating conditions and implementing mechanical and procedural changes to the process equipment and the Honeywell Experion® PKS (Process Knowledge System) process control system.

There was one reportable scheduled maintenance activity in 2019. Between June 17 and July 1 all pumping wells were shut down for the annual stack inspection, tank cleaning and inspection, and cleaning the treatment system pipeline. All wells, except for RW-5, were down for 340 hours during this scheduled maintenance event. RW-5, which was restarted July 2, had a total downtime of 362 hours for this same event. There were two reportable unscheduled down time events in 2019, both resulting from a float switch malfunction. All recovery wells were off between July 1 and July 15 except for RW-5 which was restarted July 16. The second event had all wells off between November 29 and December 2, except RW-5 which was restarted December 3.

Individual pumping wells were down for greater than 48 hours on only three (3) occasions in 2019. Each of the shutdowns were unscheduled. The unscheduled individual downtimes were as follows:

- RW-5 was down January 6 to 23 for 392 hours due to a failed variable frequency drive (VFD).
- RW-11 was down January 6 to 22 for 374 hours due to a failed VFD.
- RW-9 was down from July 26 through July 29 for 58.5 hours due to a flow meter malfunction.

The following table summarizes HCS reportable downtime in 2019 by component malfunction and scheduled maintenance:

Reason	Contributing Downtime %	Comments
Process component malfunction	7.4%	Unexpected process-related downtime because of alarms and interlocks.
Scheduled maintenance shutdowns and system upgrades/inspections	4.3%	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. Semi-volatile organic compound (SVOC) monitoring will be conducted as needed if significant changes occur to the hydraulic or chemical load observed during routine process monitoring or if there is a change in an operations condition (e.g. change in pump intake elevation). A summary of results for the process sampling conducted in 2019 is provided in Table 2-2.

2.3 Sewer Sampling Summary

Significant Industrial User (SIU) permit #76 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 There were no exceedances of the permit limits in 2019.

2.4 Recovery Well Rehabilitations and Maintenance

Two rehabilitation events were completed in B/C-Zone recovery wells during 2019 using high pressure jetting and vacuum technique developed with National Vacuum Environmental Services Corp. during 2012-2013. This technique allows for safer removal of the sediments, improved pressure control, and allows larger quantities of water to be withdrawn at a high pumping rate (i.e. over-pumping). The spring well rehabilitation occurred April 9 through 11 and the fall event occurred October 8 through 10. Both events had a typical modest removal of sediments and maintenance of flow rate. The flow at RW-5 remains at an increased rate (approximately 3 – 6 gpm), when compared with the 2005 – 2015 average as the result of more thorough well cleaning in the Fall 2015, thereby demonstrating that the significant improvement on well yield has been maintained.

Well painting, labeling and protective casing repairs were performed in 2019 as part of continual site monitoring well maintenance. Five concrete pads around wells were replaced or repaired, 31 well casings were painted and/or re-labeled, three J-plugs were replaced, and a Furnco fitting was used to cover a hole in an above ground casing.

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 discusses the groundwater chemistry.

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 (Table 3-1). Hydrographs and 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 2019 Quarterly Data Packages.

3.2 Hydraulic Control Assessment

Assessment of hydraulic control is described for each relevant bedrock zone in the following sections.

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. Decreases in water elevations from pre-startup 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 compared to pre-startup. In a few cases, there is an increasing trend from the 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 2019 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 (2019 average gradients) and shown in Figure 3-9 (December 7, 2019 gradients). These gradients demonstrate that the predominant flow potential is downward; therefore, 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 2019 (Figure 3-10). Hydraulic controls in the B-Zone and C-Zone were maintained throughout 2019, 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 hybrid recovery well RW-11 which includes a screened interval within a BFBT in the B-Zone and an open bedrock hole for the C-Zone. Increases in yield at RW-5 during the Fall of 2015 have been maintained as well as the increased capture zone due to continued semiannual rehabilitation events.

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.

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. As mentioned in the well rehabilitation section above, the Fall 2015 rehabilitation at RW-5 created significant improvements in flow and mass removal and semiannual rehabilitation events continue to maintain these improvements.

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 Landfills 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. The semiannual rehabilitations of these recovery wells, conducted as a preventative action taken which maintains well performance.

After the Fall 2015 rehabilitation at RW-5, significant improvements in flow and mass removal were observed including with a wider cone of depression in the C-zone. This resulted in a less pronounced depression immediately surrounding RW-5 in the C-zone maps (compared with previous years) because of an improved connection to the aquifer (Figure 3-11). However, connectivity analysis conducted in 2016 (Parsons, 2016) demonstrated that a set point ranging from 563 to 565 in RW-5 resulted in drawdown of greater than 5 feet in the recovery well. Similarly, at 162C (approximately 70 feet east of RW-5) greater than 4 feet of drawdown was observed. This verified the large drawdown in the C-Zone as noted in the past reports.

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 that associated hydraulic gradients were toward the recovery wells throughout 2019, 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 overall 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 2019 report provides an update of groundwater chemistry trends in relation to the long-term remedy for groundwater as well as an update of data relevant to the Source Area Criteria. The Source Area Criteria are provided in Table 3-3, with the 2019 results and comparison to criteria provided in Tables 3-4 and 3-5.

Monitoring completed in 2019 represents the fifteenth year of LTGMP performance monitoring and the twelfth year of annual-only 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 full list of wells was last sampled during the 2018 annual sampling event, and the full well list will again be sampled in 2023. The list of wells used for long-term monitoring is included in Table 3-6. Figure 3-1 provides a well location map.

3.3.2 Sample Collection and Analysis

The annual sampling event was completed between September 23 and October 3, 2019. Parsons of Buffalo, New York, completed sampling. 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 either a peristaltic pump (approved by USEPA, 2019) or using an air-driven bladder pumps equipped with disposable Teflon© bladders. In several cases where wells were unable to maintain low flow yields a low-flow impeller pump such as the Grundfos Rediflow2 was used to purge the well dry and was then sampled with a bladder pump within 24 hours. The pumps were fitted with dedicated HDPE tubing.

Samples were collected at 26 monitoring well locations during the 2019 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 2019 are provided as Appendix A. 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.

3.3.3 Source Areas Delineation

The 2019 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 2019 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.

Calculated solubility criteria for DNAPL compounds evaluated during this study are presented in Table 3-3. A comparison of 2005 through 2019 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 through 2012 in Table 3-4.

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 5 year cycle and are not sampled annually.

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 2019 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.

Semi-annual DNAPL observations conducted at A-Zone well location 131A in 2019 indicated that no DNAPL was present. 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 2019 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. The results indicated no exceedances of the effective solubility criteria. However, the refined sampling program reduced the frequency of some of the wells that typically exceed the criteria. One B-Zone well (171B) that did exceed the criteria in the past, was part of the sampling program in 2019. This well did not exceed the effective solubility criteria in 2019. No C-Zone wells were sampled in 2019 that exceeded the effective solubility criteria and no C-Zone wells were sampled in 2019 that had previously exceeded the criteria.

Two wells in the B/C-Zone exceeded the more conservative one percent criteria in 2019 (171B and 172B). At 171B hexachlorobutadiene (HCBD) concentration was 55 µg/L which is above the 20 µg/L criteria. At 172B, the reported HCBD concentration was 43 µg/L which is above the 20 µg/L criteria. Exceedances of the one percent solubility criteria at well locations 171B and 172B for HCBD represent the spatial limit of the B-Zone source area. As discussed in Section 3.5, TVOC concentrations have significantly decreased since 2002 at locations 171B and 172B. While well 136B had exceeded the one percent solubility criteria from 2012 to 2014, the concentrations in 2015 through 2019 were below the criteria. Historic exceedance of the one percent solubility criteria at well location 136B for PCE represents the western edge of the limit of the B-Zone source area. TVOC concentrations have steadily declined to below 1,000 micrograms per liter (µg/l) from near 3,000 µg/l in 2012.

The frequency of observed DNAPL in B/C-Zone wells has decreased over the course of the monitoring program. In 2019, measurable DNAPL was observed during monthly or semi-annual DNAPL monitoring in RW-4 and RW-11 in March and in RW-4 in December. No DNAPL was observed in 2017 or 2018.

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

None of the 10 wells sampled in 2019 exceeded the effective solubility criteria in the D/E/F wells. One of the 10 wells exceeded the more conservative one percent pure-phase criteria. Well 165E is within the limit of the D/E/F-Zone source area and had exceeded the one percent pure-phase criteria (20 µg/l) for hexachlorobutadiene since 2007, except for 2016. In 2019, Hexachlorobutadiene was detected at an estimated 38 µg/L.

Source zone criteria comparison analysis conducted during 2019 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 2019 chemistry results and trends has been completed to assess the effectiveness of the HCS and previous groundwater pumping system in reducing organic compound concentrations in groundwater. TVOC concentrations versus time plots for A-Zone overburden and B- through F-Zone bedrock monitoring wells are presented in Appendix B.

In general, operation of the HCS and the previous 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. 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 four LTGMP A-Zone wells indicate TVOC concentrations are all 2 μg/l or less, except for well 137A. Sampling results for well 137A (152.7 μg/l) represents the location of the highest reported A-Zone TVOCs. Other well locations were significantly lower: 145A (0.27 μg/L), 146AR (1.66 μg/L), and 150A (0.55 μg/L). The 2019 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 (<5 μg/l) TVOC concentrations with no true discernable trend. These three wells have been less than 5 μg/l since 2007 or earlier.

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.

B-Zone

Results from the eight LTGMP B-Zone wells indicate TVOC concentrations were consistent with previous years with decreases in TVOC over time, thereby demonstrating effective groundwater capture by the recovery wells (Appendix B). Results were below 2,000 μg/l in four of the wells sampled in 2019. Six of the eight wells exhibit large decreases in TVOC over time, thereby demonstrating effective groundwater capture by the recovery wells.

Source area limit wells 171B and 172B show a continued overall TVOC declining trend. Well 171B has decreased 3 orders of magnitude between 2002 and 2018 from over 100,000 μg/l to 141.47 μg/l but exhibited an increase in 2019 (9,730 μg/l). Well 172B has decreased two orders of magnitude to 2,147 μg/l during a similar timeframe. Additionally, the concentrations suggest that there is an active natural attenuation component to the VOCs, as 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 2019 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 less than 10,000 since 2010 and as low as 3.12 μg/l in 2018. In 2019 the concentrations were to 4,644 μg/l similar to the range of the past 10 years.

Far-field wells 146B and 150B also demonstrate the effectiveness of the groundwater control system. Concentrations have decreased by one order of magnitude at both wells since 2000. In 2019, the TVOC concentration at 146B was 33.1 μg/l and at 150B the TVOC concentration was 161.9 μg/l.

Three B-Zone wells (136B, 137B, and 168B) have no apparent well-defined decreasing trend but remain within historical ranges. At location 136B, which is at the southwestern edge of the source area, there is a slight overall declining trend in the data and a more robust declining trend in the data between 2012 and 2019. The 2019 result at 136B (804.5 μg/l) is the lowest since 2005. At well 168B (southern edge of the source area), the TVOC concentrations are within the 2000 through 2012 range, but appeared to be increasing between 2005 and 2012, then decreasing between 2012 and 2019. Since 2012 (59,248 μg/l) TVOC concentrations have decreased to 25,020 μg/l, in 2019. At well 137B, along the southern source area boundary, there appears to be a slight overall decreasing trend in the data, with the early data to 2010 slightly unstable then from 2011 to 2019 the data is stable with a strong decreasing trend during this time period. TVOC concentrations at 137B have ranged from 271.1 μg/l to 2,112 μg/l and were 333.5 μg/l in 2019.

C-Zone

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

Wells 145C and 168C are used to delineate the C-Zone source area limit. These wells had TVOC concentrations in 2019 between 260.4 μg/l (145C) and 4,412 μg/l (168C). At 145C concentrations were lowest in the record for the six years in a row between 2013 and 2018, and a decreasing trend is evident, even with a slight TVOC concentration uptick in 2019 to 260.4 μg/l, the decreasing trend with time remains evident. 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 the 10,000 to 15,000 μg/l range. The concentrations have been slightly decreasing again since 2010. In 2018, a significant decline was observed to 216.9 μg/l, the lowest observed TVOC concentration at 168C to date. However, in 2019 TVOCs increased to 4,412 μg/l which remains a significant decrease in TVOC concentrations from the TVOC concentrations found between 2007 and 2017.

Wells 146C and 150C 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 between 2006 and 2013 to below 15 μg/l. Concentrations between 2014 and 2017 increased to between 58 μg/l and 76 μg/l. In 2018 TVOC concentration dropped to 50.9 μg/l and fell further in 2019 (25.26 μg/l), the lowest in six years. 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 results for 2013 and 2014 show a marked increase to 463.3 μg/l and 2,352 μg/l. Since 2014, TVOC concentrations have decreased each year, with the concentration in 2018 the lowest observed to date (3.74 μg/l). In 2019 TVOC concentrations increased slightly to 17.25 μg/l. Most of VOCs at 150C are attributed to DCE and VC. Steep declines in 150C 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 four D-Zone wells indicate TVOC concentrations are generally low and/or declining over time at these monitoring locations.

Well 165D is within the source area. Well 165D had TVOC concentrations of 20.23 μg/l in 2019, which have been declining since the peak of approximately 1,600 μg/l in May 2006. TVOC concentration here have been under 25 μg/l the last four years.

TVOC concentrations at far-field wells (136D, 145D, and 148D) ranged from 4.29 μg/l (148D) to 576 μg/l (145D). At wells 136D and 145D, the concentrations have continued to decline since the historical concentrations as high as approximately 3,000 μg/l. In 2019, the TVOC concentrations in wells 136D and 145D have decreases to 46.74 μg/l and 576 μg/l, respectively. The TVOC concentration at 136D in 2019 was the lowest observed at this location. 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 2016 and a possible declining trend from 2016 to 2019, however, due to the low concentrations (< 5 μg/l) there is little meaning to the trend.

Consistent with previous long-term monitoring results, biogenic degradation compounds including cis-DCE and VC dominate TVOC results for wells 136D, 145D, 148D, 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 three E-Zone wells (146E, 150E, and 165E) indicate TVOC concentrations were between 487.5 μg/l and 15,280 μg/l. Well 165E (15,280 μg/l) is within the E-Zone source area and has shown an increasing TVOC trend between 2006 and 2011 however, more recent TVOC results have indicated the beginning of a declining trend. The TVOC concentrations are high (now typically between 26,580 μg/l and 15,280 μg/l, 2018 and 2019), therefore the significance of any potential trend is difficult to identify. This well is 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. The 2019 TVOC concentration at well 146E (487.5 μg/l) was the lowest observed at this location. 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 3,500 and 6,300 μg/l between 2009 and 2014. In 2015 the TVOC concentration at 146E increased to 11,566 μg/l from 3,531 μg/l in 2014. 2016 TVOC concentrations increased again to 14,169 μg/l. Even with the TVOC increases observed the in the 2015 and 2016 sampling events, the overall trend for TVOCs continues to be declining. 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 388 μg/l (2015) and typically between 500 and 1,500 μg/l in recent years, however in 2019 the TVOC concentration jumped up in 2019 to 7,835 μg/l (highest observed at this location). Future sampling will determine if the 2019 TVOC result is anomalous. 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. As discussed in Section 3.5, the presence of these degradation compounds is indicative of the occurrence of active natural attenuation processes.

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

F-Zone

Results from the three F-Zone wells indicate TVOC concentrations ranged from 9.33 μg/L to 12,249 μg/l, and all three locations showed decreasing trends. Similar to the results from the E-Zone wells TVOC, results for all the F-Zone wells are mostly dominated by biogenic degradation compounds cis-DCE and VC.

In 2019 TVOC concentrations at well 146F, at the edge of the F-Zone source area have decreased from a high of 36,700 μg/l in 2000 to 12,249 μg/l in 2019. TVOC concentrations at near source well 136F have also steadily declined since HCS startup from 8,348 μg/l (2005) to 9.33 μg/l (2019). TVOC concentrations at location 150F have shown a steady trend lower since 1998, with concentrations decreasing from initially over 4,500 μg/l to 569 μg/l in 2019.

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.

3.5 Evaluation of New Groundwater Sampling Methods

As approved by the USEPA, groundwater sampling was completed using a low-flow peristaltic pump in wells with depths to water less than approximately 20 feet to improve field efficiency, reduce decontamination, and reduce waste. Analytical results for the different sampling methods can be seen in the plots of the analytical data included in Appendix B. In the four A-Zone, four C-Zone, and four D-Zone wells that were sampled in 2019, TVOC concentrations were all similar to the more recent sampling events. In the B-Zone wells that were sampled in 2019, TVOC results were generally similar to other recent results with slight increases at 145B, 146B, and 171B. Additionally, of the six wells sampled in the E and F-Zones, results were consistent with other recent results with the exception of well 150E, which significantly increased relative to other recent TVOC concentrations at 150E.

Based on the 2019 analytical results obtained using the USEPA-approved new sampling methods, analytical results compare favorably with the many previous years of existing data. Based on the discussion above, if the new sampling methods has any bias compared to the previous methods, it is for the results to be slightly biased higher. Future groundwater sampling events plan to use the same methods employed in 2019.

3.6 Monitored Natural Attenuation (MNA) Assessment

Based on the 2018 MNA sampling results (discussed in the 2018 Annual Report) and USEPA approval (USEPA July 16, 2010), future MNA sampling is currently scheduled to be completed on a five-year schedule. The next MNA sampling is scheduled to be completed in 2023. However, VOC and field parameter concentrations from 2019 generally indicate that MNA remains an active component in the source area and the far-field plume. For example, downgradient constituents are predominately degradation products (DCE and VC) and source area groundwater has remained anaerobic and likely sulfate reducing and or methanogenic.

3.7 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. An active recovery and monitoring 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 Pre-design Investigations. In 2015, the USEPA agreed to a request from Chemours to reduce the number of wells monitored monthly and semi-annually for DNAPL. However, the USEPA requested that once every two years, the full list of DNAPL wells are checked. The revised monitoring schedule began in June 2015. The 2019 monthly DNAPL monitoring results are summarized in Table 3-12.

In 2019, measurable DNAPL was identified during the March and December monitoring. In March, 0.2 feet of DNAPL was observed in RW-4 and 3.0 feet in RW-11. An estimated 0.8 gallons of DNAPL was removed from RW-4 and 12.0 gallons from RW-11 in April. In December, 4.0 feet of DNAPL was confirmed in RW-11 and in January 2020 an estimated 18.0 gallons of DNAPL was removed. A total of approximately 8,849 gallons of DNAPL have been recovered since the recovery program was put in place in 1989.

3.8 Quality Control/Quality Assurance

The 2019 annual groundwater samples were submitted to TestAmerica Laboratories in North Canton, Ohio, for all chemical analyses. In accordance with the LTGMP and consistent with previous years, QA/QC procedures included in-house data review. In previous years through 2016, 10% independent validation of the data was completed by Environmental Standards, Inc., of Valley Forge, Pennsylvania. On July 30, 2015, Chemours proposed to eliminate the 10% validation based on 10 years of no instances when significant data qualification or rejection of data occurred as a result of findings from the 10% full validation that wasn’t also identified by the 100% CDRP. The USEPA approved the proposed reduction in a letter dated October 19, 2016. All other provisions of the QAPP remain unchanged.

3.8.1 Sample Collection

All 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) and USEPA approved changes agreed to via email May 30, 2019. May 2019 approved changes allowed for the use of a peristaltic pump or a low flow impeller pump such as the Grundfos Rediflow2 to complete low flow groundwater sampling. Samples were submitted in eight delivery groups received at the laboratories between September 24 and October 4, 2019. Based on laboratory receipt records, all samples were received in satisfactory condition, properly preserved, and within USEPA holding time and temperature requirements. Field QC samples collected during the sampling round included two field duplicate pairs, three daily equipment blank samples, and eight trip blanks (volatile organics).

In-House Data Collection

The quality of the data set was evaluated by the AECOM 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 Chemours Data Review [DVM] 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 Chemours, referred to as the DVM, 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 DVM 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.

Qualifier	Definition
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. All organic parameters were reported to the current laboratory method detection limit (MDL). Target compounds detected between the MDL and the reporting limit (PQL/RL) were J qualified as estimated concentrations.

A number of samples required dilutions for analysis of volatiles and semi-volatiles due to the levels of target compounds and/or non-target interferences. As a result, the reporting limits for the affected samples are elevated, and in some cases, the sample surrogate recoveries could not be determined (diluted out) or were recovered outside of the laboratory control window.

Chloroform was detected in the laboratory method blank analyzed with samples 146F and 168B. The chloroform detections in both samples were in the same range (<10x), and were B qualified during the data review process. The reported concentrations may not be representative of actual well conditions.

The laboratory reported that there was carryover contamination detected in TB4. Only one vial was available for analysis, so the affected analytes (vinyl chloride, trans-1,2-dichloroethene, and cis-1,2-dichlorethene) were not reported in this sample.

The semi-volatiles method blank associated with well samples collected September 27 was inadvertently not surrogated prior to analysis. Rather than re-extract and re-analyze the entire sample group past the holding time, the results of the initial analyses were reported. The surrogates in the field samples, matrix spikes, and laboratory control spikes were recovered successfully.

The semi-volatile analysis included a target tentatively identified compound reported as TIC 1. All positive results reported for TIC 1 have been J qualified as estimated concentrations.

The laboratory instrumentation cannot separate 3-methylphenol and 4-methylphenol under the chromatographic conditions used for sample analysis. The results reported represent the combined total of both semi-volatile compounds.

Except as noted above, all analyses for organics were completed within the 14-day USEPA holding time guidance for preserved volatiles. The semi-volatiles analyses met the USEPA holding time guidance of 7 days from collection for extraction, and 40 days of collection for analysis for aqueous samples.

All inorganics were reported to the current laboratory MDLs. Detections between the MDL and the PQL/RL were J-qualified as estimated concentrations.

A number of samples required dilutions for chloride analysis. As a result, the reporting limits for the affected samples are elevated.

The EPA holding time guidance for chloride (28 days) and barium (180 days) was met for all samples in the program.

There was insufficient sample volume available for the laboratory to include project-specific matrix spikes with all sample prep groups for all analyses. Matrix spikes were prepared and analyzed as available, and laboratory control spikes/spike duplicates were also analyzed with each sample group and used for determining compliance with QC limits.

Evaluation of the Relative Percent Difference (%RPD) between field duplicate pairs is performed via the automated DVM process. The positive analyte detections in the two pairs of blind field duplicates collected for this program compared very well (less than the 30% RPD guideline used for aqueous samples).

All 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 eight delivery groups received at the laboratories between September 24 and October, 2019. Based on laboratory receipt records, all samples were properly preserved, and within USEPA holding time and temperature requirements. Field QC samples collected during the sampling round included two field duplicate pairs, three daily equipment blank samples, and 8 trip blanks (volatile organics). All samples were received in satisfactory condition.

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 26, 2019 are provided in Appendix E. No leachate seeps or settlement was identified, and all aspects of the landfill that were inspected were found acceptable.

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 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 pumping. 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 continues to be an improvement in A-, B-, and C-Zone hydraulic control in the southwestern part of the site. Furthermore, increases in well yield at RW-5 in Fall 2015 increased capture in the A, B and C-Zone around this well.

5.1.2 Recommendations

Based on the site history, years of monitoring, and observations made in 2019, the following procedures are recommended:

- Continue to rehabilitate RW-4, RW-5, RW-11, semi-annually and/or as necessary.

5.2 Groundwater Chemistry Monitoring

5.2.1 Conclusions

The 2019 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 very 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 2019 would not change the A-Zone and B/C-Zone source area limits as delineated in the SAR.
- Analytical results for 2019 (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 2019 sampling results represent the 18th 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, 2011, 2016, and 2019.

5.3 MNA Conclusions and Recommendations

The next sampling event for formal MNA monitoring is scheduled to be completed in 2023. However, the analytical results from 2019, such as concentrations of degradation products and geochemical conditions, continue to support the recommendation that MNA assessments be conducted every five years.

5.4 DNAPL Monitoring and Recovery

5.4.1 Conclusions

Results of the 2019 DNAPL monitoring and historical recovery efforts indicate the following:

- Monitoring for the presence of DNAPL was completed monthly during 2019.
- Measurable DNAPL was identified in March and December 2019. In March, 0.2 feet of DNAPL was found in RW-4 and 3.0 feet in RW-11. DNAPL removal was completed in April with an estimated 0.8 gallons removed from RW-4 and 12.0 gallons from RW-11. In December, 4.0 feet was identified in RW-4 and an estimated 18.0 gallons was removed in January 2020.
- Approximately 8,849 gallons of DNAPL have been recovered since the recovery program was initiated in 1989.
- As approved by the USEPA, a revised list of wells was monitored monthly and semi-annually beginning in June 2015. The full list of well previously checked for DNAPL is monitored once every two years.

5.4.2 Recommendation

Continue DNAPL monitoring as revised and approved by the USEPA in 2015 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 is maintained in accordance with the CMMP. In 2019, no repairs to the landfill cap were necessary and the cap was appropriately maintained. The landfill cap inspection was completed on November 26, 2019.

6.0 REFERENCES

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TABLES

Table 2-1
HCS Recovery Well Performance Summary - 2019
Remedial Action Post-Construction Monitoring - 2019 Annual Report
Chemours 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	25,667	82.18%	106,410	38.12%	122,788	34.92%	325,104	97.30%	284,476	97.27%
February	22,688	85.19%	166,684	86.44%	288,016	87.02%	322,936	95.76%	330,211	95.94%
March	24,279	96.90%	172,369	93.55%	316,929	96.36%	328,072	99.34%	299,817	99.33%
April	31,275	99.24%	208,198	98.57%	332,063	99.42%	389,060	99.99%	449,693	100.00%
May	37,176	98.79%	224,521	97.50%	328,167	98.78%	381,517	98.80%	445,159	98.80%
June	20,079	57.67%	117,810	52.14%	161,989	63.44%	190,659	57.67%	220,848	57.67%
July	14,839	85.77%	158,735	79.03%	254,870	85.78%	220,739	85.86%	193,997	77.82%
August	18,767	100.00%	194,783	100.00%	245,149	97.96%	289,518	100.00%	237,557	86.44%
September	21,692	100.00%	171,153	100.00%	244,725	100.00%	280,676	100.00%	277,648	98.60%
October	18,808	92.43%	174,533	91.06%	229,929	94.50%	310,830	100.00%	335,727	98.52%
November	14,981	89.75%	179,148	79.86%	258,696	88.81%	283,516	97.94%	301,883	96.40%
December	13,338	92.06%	180,308	78.37%	294,628	92.02%	228,877	84.22%	228,862	84.21%
2019 TOTAL / AVG.	263,589	90.0%	2,054,652	82.9%	3,077,949	86.6%	3,551,504	93.1%	3,605,878	90.9%
2018	304,833	88.4%	2,146,956	82.1%	3,140,119	87.6%	3,741,978	89.6%	4,215,450	92.1%
2017	187,283	82.1%	2,408,465	74.8%	2,841,144	85.7%	4,198,265	91.8%	4,192,719	91.8%
2016	233,743	83.7%	2,270,861	74.6%	2,422,531	82.1%	4,508,452	87.6%	3,191,504	87.6%
2015	274,254	77.0%	2,000,841	75.1%	1,668,783	77.4%	4,470,155	82.9%	3,563,902	82.8%
2014	290,476	95.7%	1,889,388	88.4%	2,155,520	91.6%	5,653,830	98.0%	4,301,449	98.1%
2013	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 - 2019
Remedial Acton Post-Construction Monitoring - 2019 Annual Report
Chemours Necco Park, Niagara Falls, New York

General Water Quality Analyte		B/C INFLUENT				D/E/F INFLUENT				COMBINED EFFLUENT			
		3/20/2019	5/20/2019	7/31/2019	11/5/2019	3/20/2019	5/20/2019	7/31/2019	11/5/2019	3/20/2019	5/20/2019	7/31/2019	11/5/2019
Field Parameters													
SPECIFIC CONDUCTANCE	µmhos/cm	3371	6320	6670	6778	4413	4370	4380	4476	3898	4650	505	2798
TEMPERATURE	^{o}C	10.26	14.13	16.78	13.5	11.66	13.89	16.08	12.1	10.11	14.63	19.46	13.7
COLOR	ns	drk grey	clear	cloudy	grey	clear	clear	clear	none	drk grey	cloudy	clear	clear
ODOR	ns	NA	strong	strong	strong	NA	strong	strong	none	NA	slight	none	none
PH	std units	6.58	5.29	5.45	5.7	7.17	6.69	6.97	6.97	8.09	7.44	7.87	7.37
REDOX	mv	-125.5	0	-13	-120.8	-178.5	-227	-247	165	-93	-158	-207	-72.9
TURBIDITY	ntu	1000.0	28.6	51.1	36.9	68.1	28	34	19.3	1000	48.5	33.4	11.2
Volatile Organics													
1,1,2,2-TETRACHLOROETHANE	µg/l	7000	5000	6600	5000	1500	1400	1400	1500	1800	110	230	23
1,1,2-TRICHLOROETHANE	µg/l	3800	3100	3400	3600	2200	2100	2100	2500	700	210	82	7
1,1-DICHLOROETHENE	µg/l	200	460	480 J	450	230	280	310	320 J	0.41 J	0.95	<0.95	<0.19
1,2-DICHLOROETHANE	µg/l	430	420	700 J	600	160 J	130 J	190 J	220 J	41	14	6.1	0.43 J
CARBON TETRACHLORIDE	µg/l	7300	6800	8000	8800	690	750	940	1200	9.6	4.6	1.5 J	<0.26
CHLOROFORM	µg/l	22000	16000	20000	20000	2500	2400	2900	3400	360	120	52	21
CIS-1,2-DICHLOROETHENE	µg/l	4300	8800	9000	9700	9300	9800	11000	12000	190	75	25	1.7
METHYLENE CHLORIDE	µg/l	2300	3100	3600 B	3100	4600	4200	4900 B	5200	190 J	53	22 B	<2.6
TETRACHLOROETHENE	µg/l	11000	10000	8800	12000	710	630	650	780	43	20	15	1.7
TRANS-1,2-DICHLOROETHENE	µg/l	270	460	480 J	470	560	660	720	720	2.2	1.1	<0.95	<0.19
TRICHLOROETHENE	µg/l	16000	14000	15000	17000	3400	3500	3700	4800	130 B	34	13	3.6
VINYL CHLORIDE	µg/l	720	3000	2400	2500	1400	1900	1700	2000	1.5	1.3	<1	<0.2
TOTAL VOLATILES	µg/l	**75,320**	**71,140**	**78,460**	**83,220**	**27,250**	**27,750**	**30,510**	**34,640**	**3,338**	**644**	**447**	**58**

< 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 - 2019 Annual Report
Chemours 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	136G	G
192A	A	141C	C	TRW-6	B/C
193A	A	145C	C	TRW-7	B/C
194A	A	146C	C	PZ-205B	B
D-9	A	149C	C		
D-11	A	150C	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.
4. PZ-205B installed in 2015.

Table 3-2

2019 Average A-Zone to B-Zone Vertical Gradients

Remedial Action Post Construction Monitoring - 2019 Annual report

Chemours Necco Park, Niagara Falls, New York

Well Pair		A	B	C	D	
		2019 Average A-Zone Head	2019 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	572.74	571.26	573.94	561.80	-0.12
119A	119B	574.20	573.08	571.63	556.90	-0.08
129A	129B	574.14	571.60	570.10	557.80	-0.21
137A	137B	571.82	570.77	570.10	561.30	-0.12
145A	145B	571.89	569.32	564.19	546.30	-0.14
150A	150B	571.30	570.29	564.69	553.18	-0.09
159A	159B	577.20	571.74	580.62	562.90	-0.31
163A	163B	573.13	573.05	572.49	564.96	-0.01
168A	168B	571.35	559.99	555.22	544.90	-1.10

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 - 2019 Annual Report
Chemours 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 2019 Annual Sampling
Remedial Action Post-Construction Monitoring - 2019 Annual Report
Chemours Necco Park, Niagara Falls, New York

Well ID	Flow Zone	Analyte	Criteria (ppb)	2005		2006		2007		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
				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	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	< 0.41	< 0.32	< 0.41	0.48 J	BC	<0.39
105C	C	Carbon Tetrachloride	40,000	NS	NS	NS	BC	NS	BC	BC	BC	NS	NS	NS	BC	NS	NS	NS	NS	NS	NS
		Hexachlorobutadiene	1,180	1,700	BC	NS	NS	NS	NS	NS	NS	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	NS	NS	NS	NS	NS	NS
		Tetrachloroethene	4,500	32,000	35,000	NS	36,000	NS	37,000 J	32,000	13,000	NS	NS	NS	24,000	NS	NS	NS	NS	NS	NS
		Trichloroethene	44,000	280,000	190,000	NS	190,000	NS	160,000	140,000	74,000	NS	NS	NS	190,000	NS	NS	NS	NS	NS	NS
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	NS	NS	NS	NS	BC	NS
137C	C	Tetrachloroethene	4,500	8,500	22,000	NS	7,900	NS	BC	BC	BC	NS	NS	NS	BC	NS	NS	NS	NS	BC	NS
105D	D	Carbon Tetrachloride	40,000	150,000	83,000	NS	170,000	NS	190,000	BC	200,000	NS	NS	NS	360,000	NS	NS	NS	NS	45,000	NS
		Chloroform	80,000	98,000	35,000	NS	80,000	NS	90,000	96,000	120,000	NS	NS	NS	160,000	NS	NS	NS	NS	BC	NS
		Tetrachloroethene	4,500	12,000	57,000	NS	11,000	NS	13,000 J	12,000	16,000	NS	NS	NS	22,000	NS	NS	NS	NS	BC	NS
		Trichloroethene	44,000	120,000	51,000	NS	110,000	NS	120,000	130,000	180,000	NS	NS	NS	250,000	NS	NS	NS	NS	BC	NS
137D	D	Tetrachloroethene	4,500	5,100	4,900	NS	BC	NS	7,200	5,300 J	4,700	NS	NS	NS	BC	NS	NS	NS	NS	BC	NS
		Trichloroethene	44,000	64,000	76,000	NS	BC	NS	91,000	70,000	76,000	NS	NS	NS	BC	NS	NS	NS	NS	65,000	NS
		Hexachlorobenzene	0.22	3.0	11.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
139D	D	Hexachlorobenzene	0.22	38 J	11 J	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	5.2 J	NS
		Hexachlorobutadiene	1,180	1,200	BC	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	BC	NS

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

Table 3-5

1% of Pure-Phase Solubility Concentration Exceedances for DNAPL Compounds - 2005 through 2019 Annual Sampling

Remedial Action Post-Construction Monitoring - 2019 Annual Report

Chemours Necco Park, Niagara Falls, New York

Well ID	Flow Zone	Analyte	Criteria (ppb)	2005		2006		2007		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
				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	NS	NS	NS	NS	BC	NS
136B	B	Tetrachloroethene	1,500	BC	BC	BC	BC	BC	BC	1,500	1,600	BC	BC	2,000	1,500	1,500	BC	BC	BC	BC	BC
139B	B	Tetrachloroethene	1,500	NS	NS	NS	2000 J	NS	4,600	3,100	3,200	NS	NS	NS	2,900	NS	NS	NS	NS	BC	NS
		Hexachlorobutadiene	20	78	BC	NS	NS	NS	NS	NS	NS	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	NS	NS	NS	NS	BC	NS
171B	B	Hexachlorobutadiene	20	2,100	130	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	55
		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	<0.41	<0.32	<0.41	<0.45	<0.18	<0.39
172B	B	Hexachlorobutadiene	20	140	89	140 J	110	BC	110	54	170	210	20	130	45	120	53	48	79	63	43
		Tetrachloroethene	1,500	1,800	BC	BC	BC	BC	BC	BC	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	NS	NS	NS	NS	NS	NS
		Carbon Tetrachloride	8,000	25,000	BC	NS	BC	NS	BC	BC	BC	NS	NS	NS	BC	NS	NS	NS	NS	NS	NS
		Chloroform	80,000	250,000	180,000	NS	120,000	NS	90,000	82,000	BC	NS	NS	NS	100,000	NS	NS	NS	NS	NS	NS
		Tetrachloroethene	1,500	32,000	35,000	NS	36,000	NS	37,000 J	32,000 J	13,000	NS	NS	NS	24,000	NS	NS	NS	NS	NS	NS
		Trichloroethene	11,000	280,000	190,000	NS	190,000	NS	160,000	140,000	74,000	NS	NS	NS	190,000	NS	NS	NS	NS	NS	NS
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	NS	NS	NS	NS	4,000	NS
137C	C	Tetrachloroethene	1,500	8,500	22,000	NS	7,900	NS	2,200	2,700	BC	NS	NS	NS	BC	NS	NS	NS	NS	BC	NS
		Trichloroethene	11,000	BC	19,000	NS	16,000	NS	20,000	70,000	BC	NS	NS	NS	BC	NS	NS	NS	NS	BC	NS
168C	C	Hexachlorobutadiene	20	330	64.0	54 J	NS	44 J	BC	BC	NS	<27	21 J	BC	BC	BC	BC	BC	BC	BC	BC
105D	D	Hexachlorobutadiene	20	95.0	BC	NS	NS	NS	NS	NS	N/S	NS	NS	NS	NS	NS	NS	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	NS	NS	NS	NS	45,000	NS
		Chloroform	80,000	98,000	BC	NS	80,000	NS	90,000	96,000	120,000	NS	NS	NS	160,000	NS	NS	NS	NS	BC	NS
		Tetrachloroethene	1,500	12,000	5,700	NS	11,000	NS	13,000 J	12,000 J	16,000	NS	NS	NS	22,000	NS	NS	NS	NS	4,200	NS
		1,1,2,2-Tetrachlorethane	29,000	NS	NS	NS	88,000	NS	79,000	76,000	79,000	NS	NS	NS	100,000	NS	NS	NS	NS	BC	NS
		Trichloroethene	11,000	120,000	51,000	NS	110,000	NS	120,000	130,000	180,000	NS	NS	NS	250,000	NS	NS	NS	NS	33,000	NS
137D	D	Tetrachloroethene	1,500	5,100	4,900	NS	BC	NS	7,200	5,300	4,700	NS	NS	NS	BC	NS	NS	NS	NS	4,400	NS
		Trichloroethene	11,000	64,000	76,000	NS	27,000	NS	91,000	70,000	76,000	NS	NS	NS	BC	NS	NS	NS	NS	65,000	NS
139D	D	Hexachlorobenzene	0.11	38.0	11.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	5.2 J	NS
		Tetrachloroethene	1,500	1,900	BC	NS	BC	NS	BC	BC	BC	NS	NS	NS	BC	NS	NS	NS	NS	BC	NS
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	130 J	34 J	<5.1	140 J	150 J	38 J
		Tetrachloroethene	1,500	BC	BC	BC	BC	BC	BC	BC	BC	2,000	BC	BC	BC	BC	BC	BC	BC	BC	BC
		Trichloroethene	11,000	BC	BC	BC	BC	BC	BC	BC	BC	11,000	12,000	12,000	BC	BC	BC	BC	BC	BC	BC

BC: Below Criteria

NS: Not

"<" = compound not identified above the detection limit.

Table 3-6

Chemical Monitoring List, Long-Term Groundwater Monitoring

Remedial Action Post Construction Monitoring - 2019 Annual Report

Chemours Necco Park, Niagara Falls, New York

MONITORING WELL	ZONE	MONITORING WELL	ZONE
137A	A	136D	D
145A	A	145D	D
146AR	A	148D	D
150A	A	165D	D
136B	B	146E	E
137B	B	150E	E
145B*	B	165E	E
146B	B	136F	F
150B	B	146F	F
168B	B	150F*	F
171B	B		
172B	B		
145C*	C		
146C*	C		
150C*	C		
168C	C		

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

Table 3-7
Indicator Parameter List, Long-Term Groundwater Monitoring
Remedial Action Post Construction Monitoring - 2019 Annual Report
Chemours Necco Park, Niagara Falls, New York

Inorganic and General Water Quality 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
2019 DNAPL Recovery Summary
Remedial Action Post-Construction Monitoring - 2019 Annual Report
Chemours Necco Park, Niagara Falls, New York

Well ID	Frequency	29-Jan		27-Feb		28-Mar		15-Apr		30-May		27-Jun		31-Jul		23-Aug		30-Sep		16-Oct		27-Nov		31-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
RW-4	Monthly	0.0		0.0		0.2	0.8	0.0		0.0		0.0		0.0		0.0		trace		0.0		0.0		4.0	18.0
RW-5	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	
RW-11	Monthly	0.0		0.0		3.0	12.0	0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
204C	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	Semi-annually	na		na		na		0.0		na		na		na		na		na		0.0		na		na	
VH-131A	Semi-annually	na		na		na		na		na		na		na		na		na		0.0		na		na	
VH-139C	Semi-annually	na		na		na		na		na		na		na		na		na		0.0		na		na	
VH-161B	Semi-annually	na		na		na		0.0		na		na		na		na		na		0.0		na		na	
VH-161C	Semi-annually	na		na		na		0.0		na		na		na		na		na		0.0		na		na	
VH-171B	Semi-annually	na		na		na		0.0		na		na		na		na		na		0.0		na		na	
RW-6	Biennial	na		na		na		0.0		na		na		na		na		na		na		na		na	
RW-7	Biennial	na		na		na		0.0		na		na		na		na		na		na		na		na	
PZ-A	Biennial	na		na		na		0.0		na		na		na		na		na		na		na		na	
VH-117A	Biennial	na		na		na		0.0		na		na		na		na		na		na		na		na	
VH-123A	Biennial	na		na		na		trace		na		na		na		na		na		na		na		na	
VH-129A	Biennial	na		na		na		trace		na		na		na		na		na		na		na		na	
VH-190A	Biennial	na		na		na		0.0		na		na		na		na		na		na		na		na	
D-23	Biennial	na		na		na		0.0		na		na		na		na		na		na		na		na	
PZ-B	Biennial	na		na		na		0.0		na		na		na		na		na		na		na		na	
VH-160B	Biennial	na		na		na		0.0		na		na		na		na		na		na		na		na	
VH-167B	Biennial	na		na		na		0.0		na		na		na		na		na		na		na		na	
VH-168B	Biennial	na		na		na		0.0		na		na		na		na		na		na		na		na	
VH-169B	Biennial	na		na		na		0.0		na		na		na		na		na		na		na		na	
VH-170B	Biennial	na		na		na		0.0		na		na		na		na		na		na		na		na	
VH-172B	Biennial	na		na		na		0.0		na		na		na		na		na		na		na		na	
VH-160C	Biennial	na		na		na		0.0		na		na		na		na		na		na		na		na	
VH-162C	Biennial	na		na		na		0.0		na		na		na		na		na		na		na		na	
VH-168C	Biennial	na		na		na		0.0		na		na		na		na		na		na		na		na	
VH-139A	Biennial	na		na		na		na		na		na		na		na		na		na		na		na	
CECOS52SR	Biennial	na		na		na		na		na		na		na		na		na		0.0		na		na	
CECOS18SR	Biennial	na		na		na		na		na		na		na		na		na		0.0		na		na	
CECOS-53	Biennial	na		na		na		na		na		na		na		na		na		0.0		na		na	

na - not applicable/not taken due to reduction in scope, approved by USEPA (June 11, 2015 and August 12, 2015)
GALS - gallons purged

FIGURES

PARSONS 40 La Riviere Dr, Suite 350 Buffalo, NY 14202 (716) 541-0730	Created by: JWS	Date: 03-29-11	**FIGURE 1-1** **SITE LOCATION MAP** **NECCO PARK** **NIAGARA FALLS, NY**
	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		

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

PARSONS

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

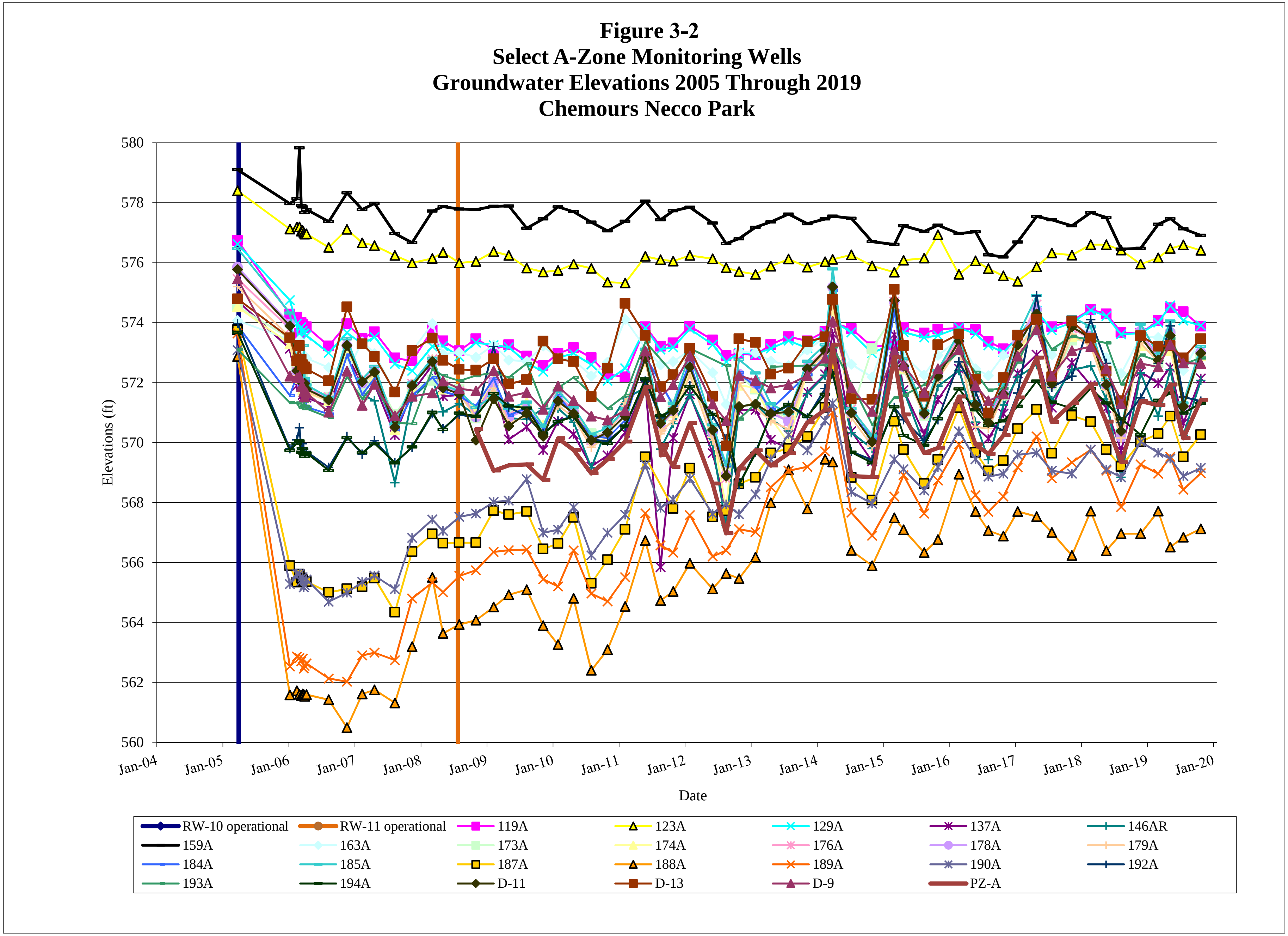
Created by: EFG	Date: 02-12-2018
Checked by: RBP	Date: 02-12-2018
Project Manager: Eric Felter	Date: 02-12-2018
Project Number: 450860.02023	

LEGEND

- RECOVERY WELLS
- ANNUAL SAMPLING WELLS
- 5 YEAR SAMPLING WELLS
- MONITORING WELL
- RAIL ROADS
- GROUT CURTAIN

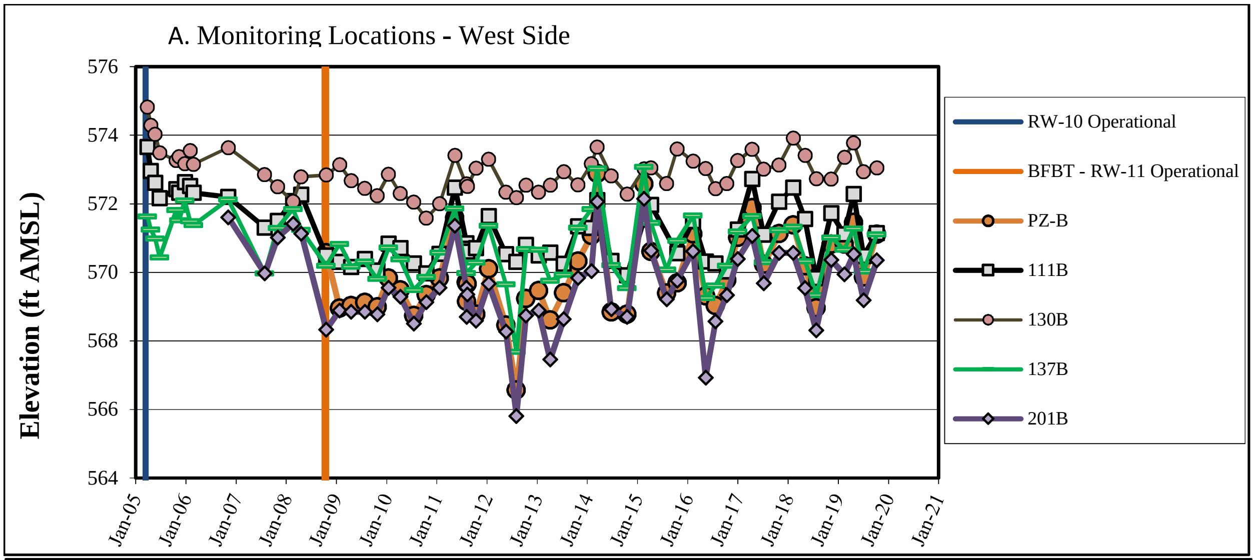
FIGURE 3-1
WELL AND PIEZOMETER LOCATIONS
CHEMOURS NECCO PARK SITE
NIAGARA FALLS, NY

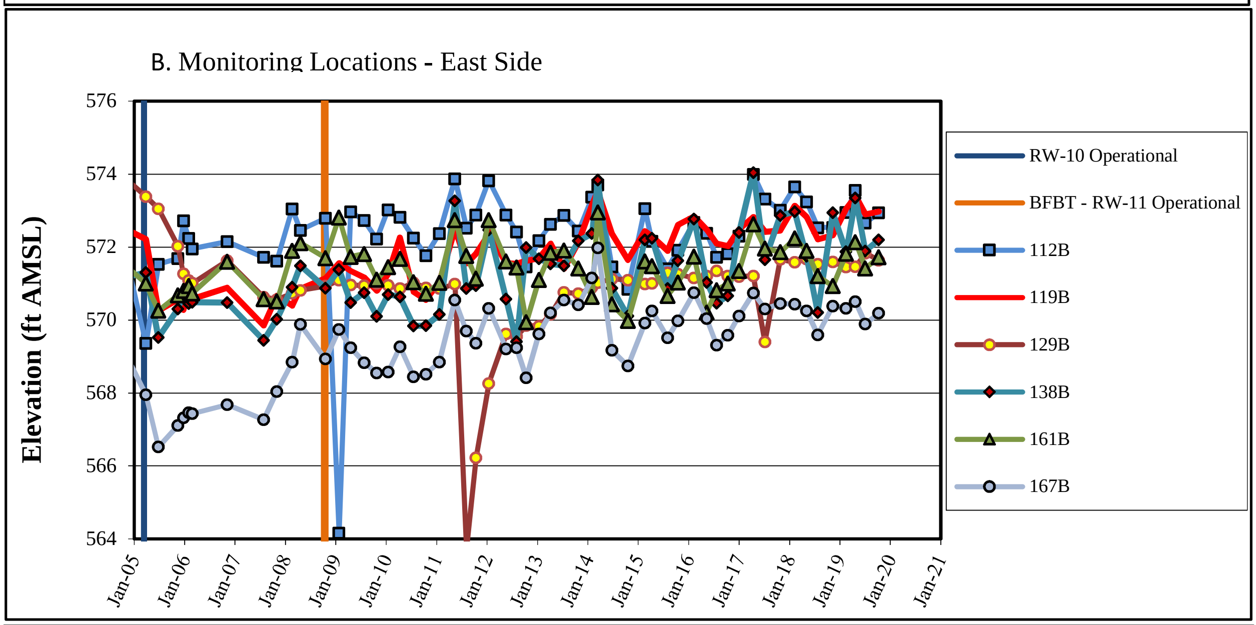
U:\Necco\hydrogeo\Maps\gis\Abandoned_Wells_TVOC.mxd



Necco 2019 A Zone Water Elev Trends.xlsx

Figure 3-3
Select B-Zone Monitoring Wells
Groundwater Elevations 2005 through 2019
Chemours Necco Park





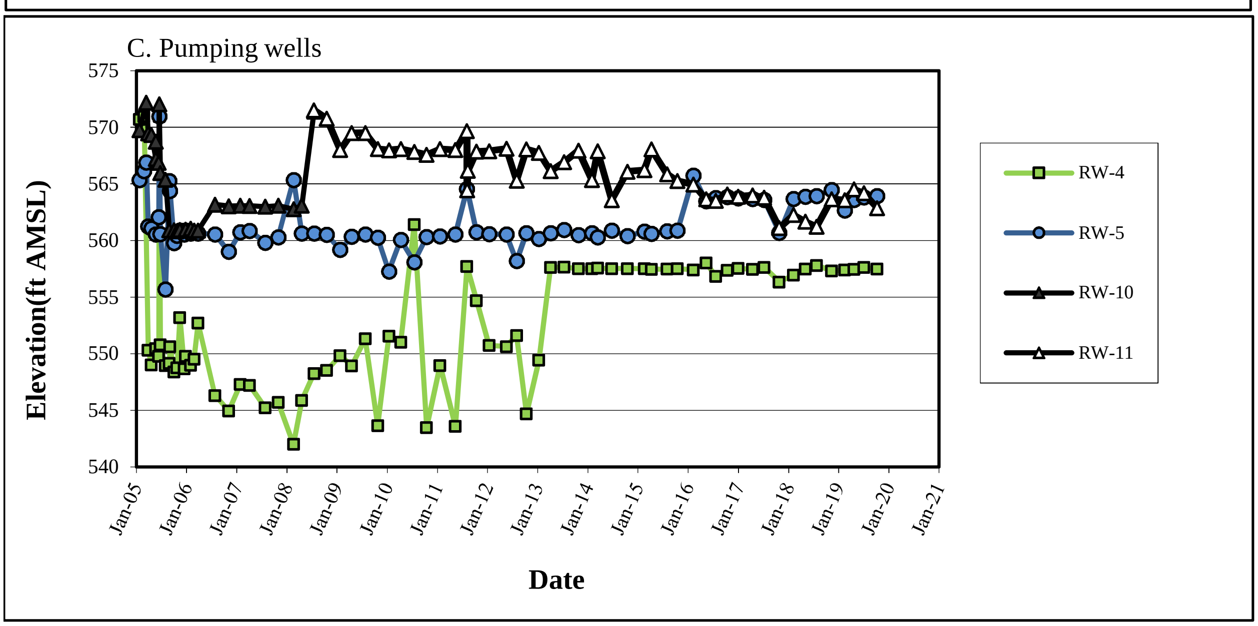
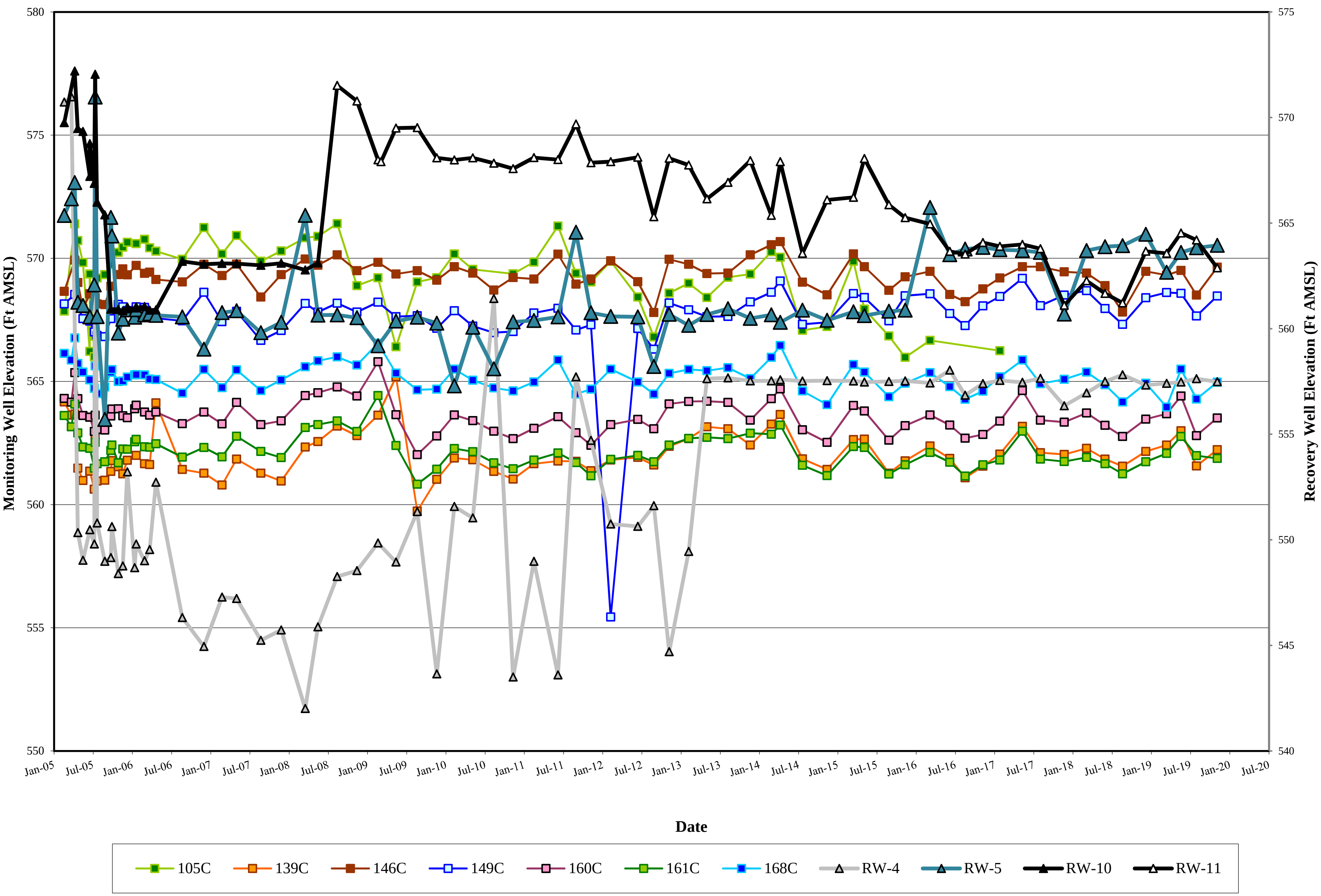
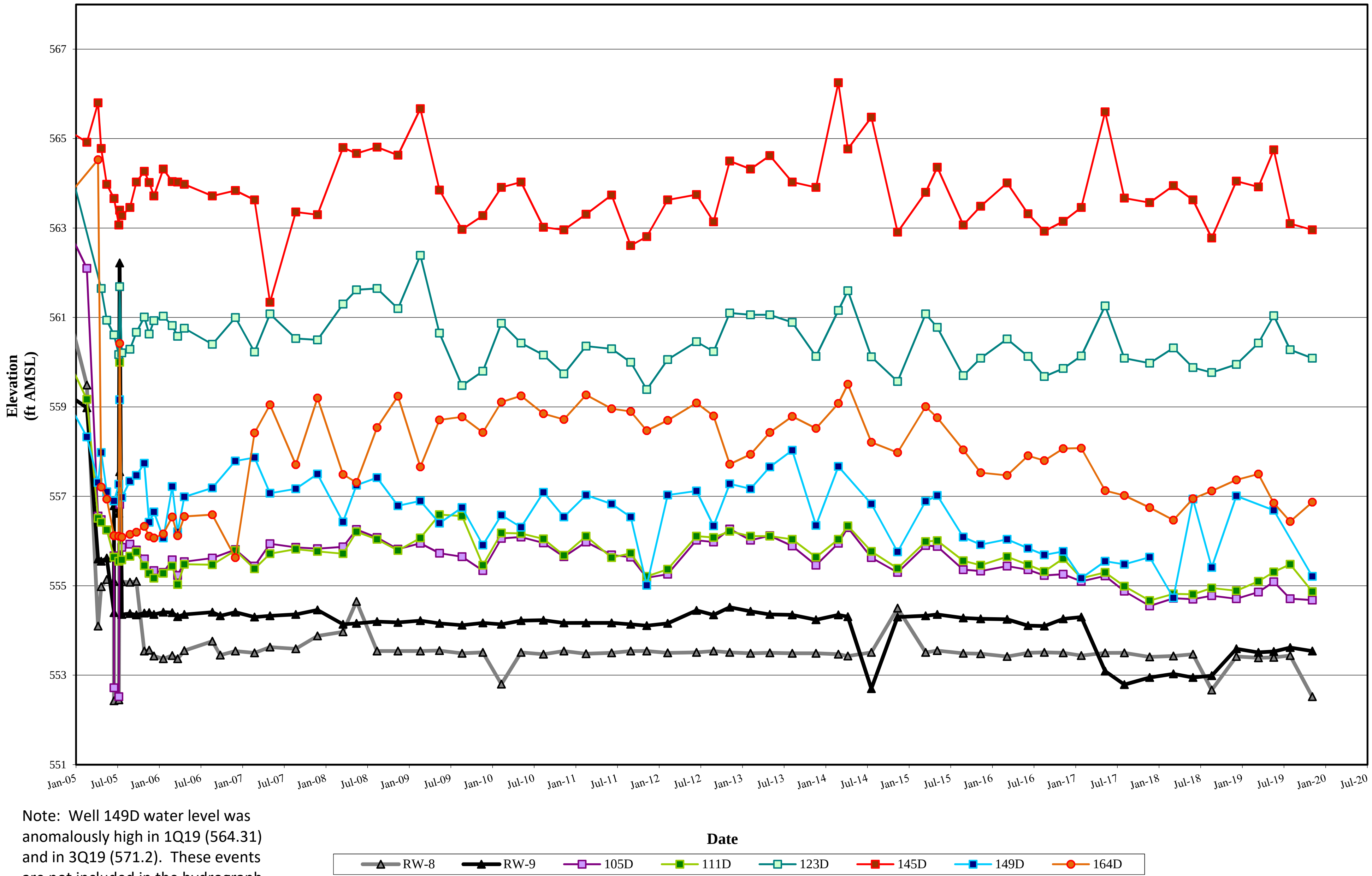


Figure 3-4
Select C-Zone Monitoring Wells
Groundwater Elevations 2005 Through 2019
Chemours Necco Park



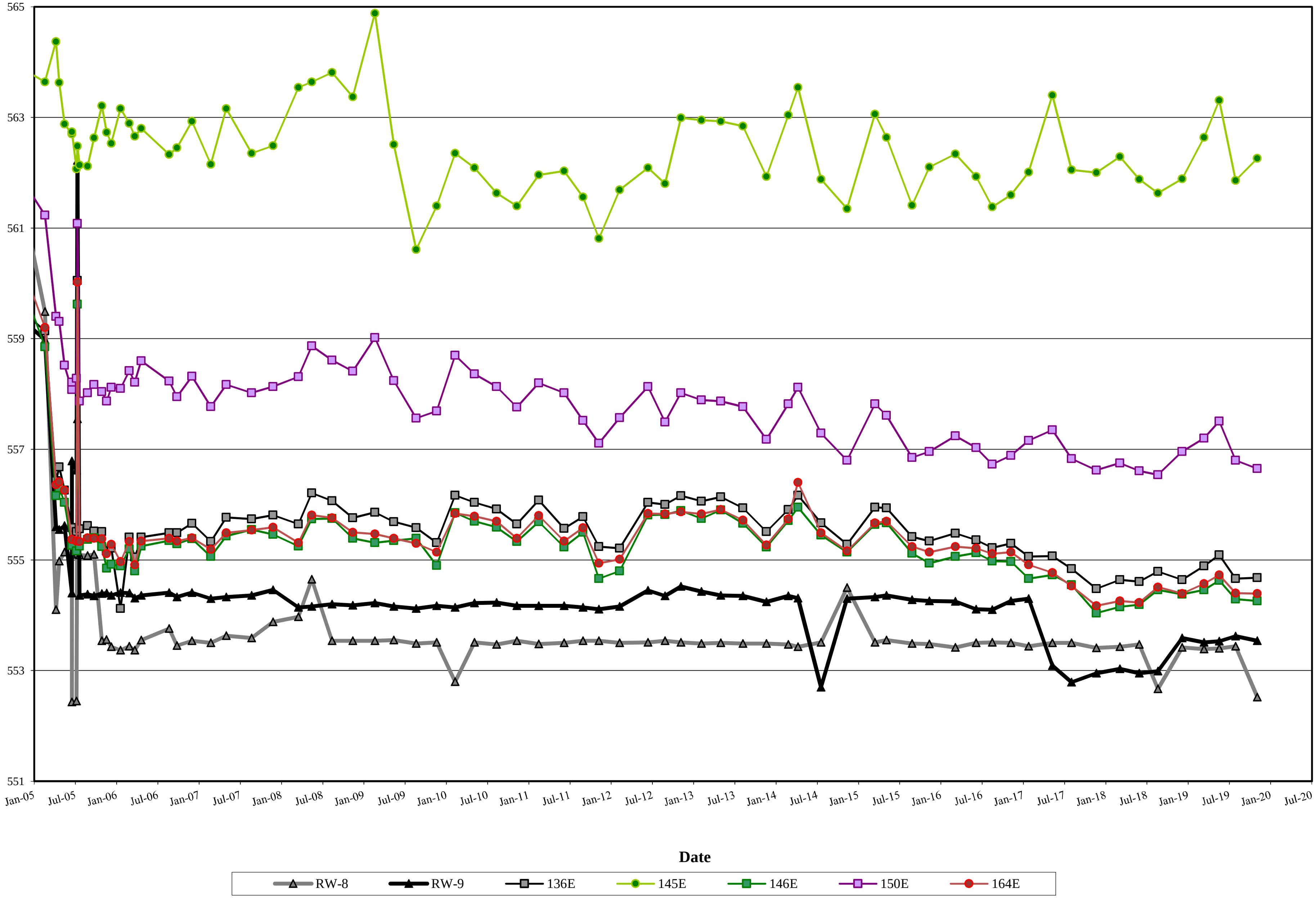
Necco 2019 C Zone Water Elev Trends.xlsx

Figure 3-5
Select D-Zone Monitoring Wells
Groundwater Elevations 2005 through 2019
Chemours Necco Park



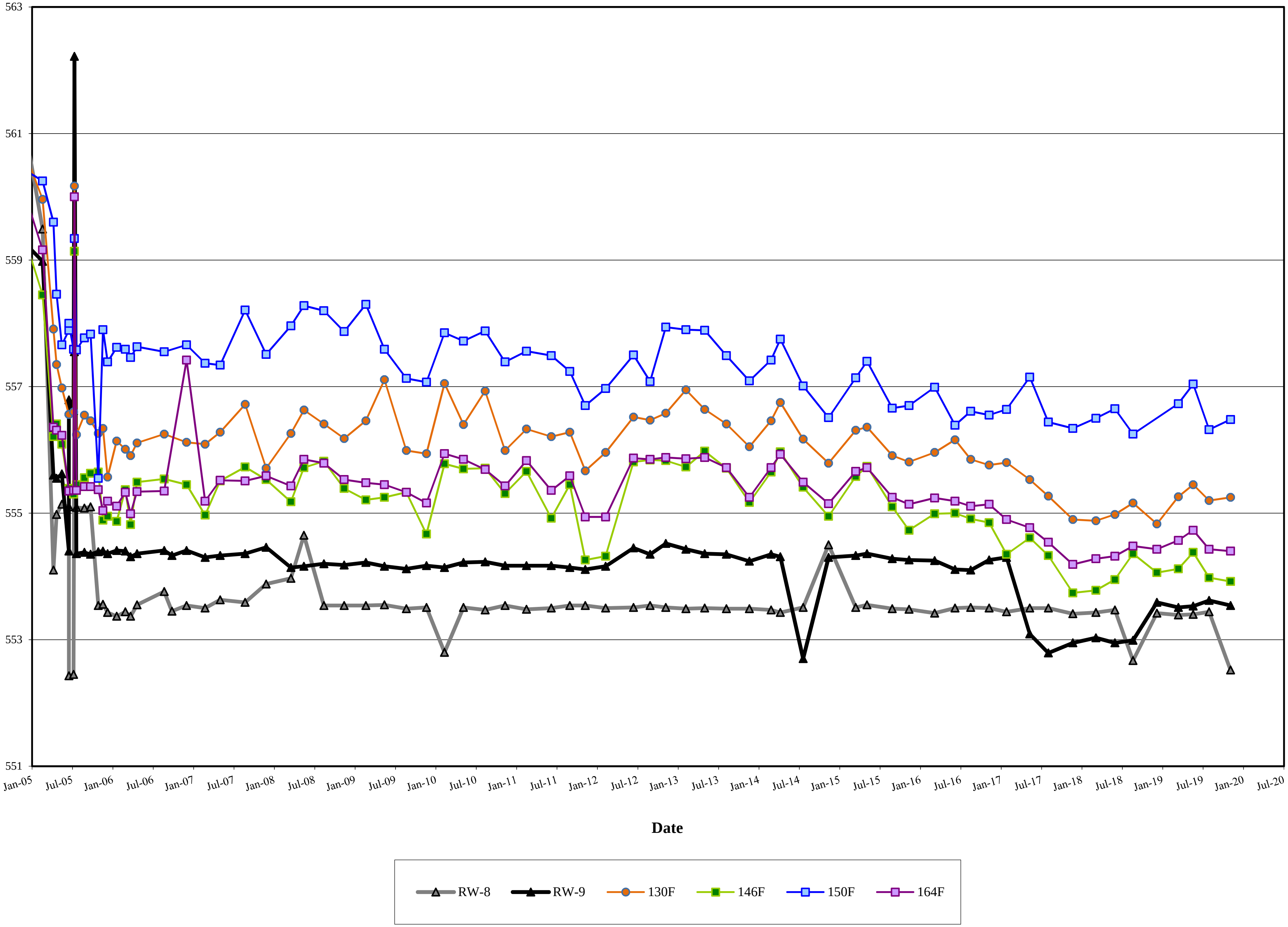
Note: Well 149D water level was anomalously high in 1Q19 (564.31) and in 3Q19 (571.2). These events are not included in the hydrograph .

Figure 3-6
Select E-Zone Monitoring Wells
Groundwater Elevations 2005 Through 2019
Chemours Necco Park

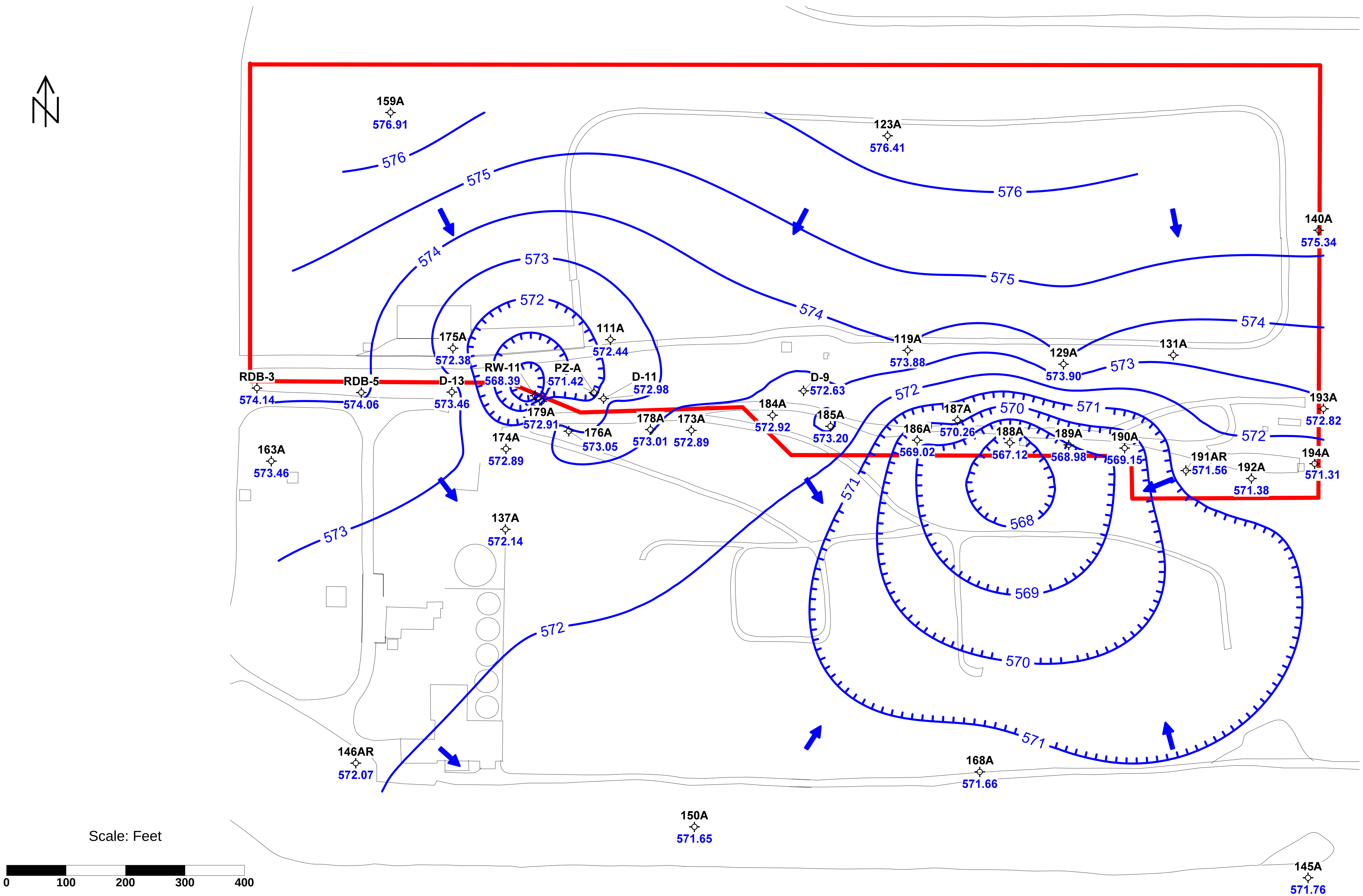


Necco 2019 E Zone Water Elev Trends.xlsx

Figure 3-7
Select F-Zone Monitoring Wells
Groundwater Elevations 2005 Through 2019
Chemours Necco Park



Necco 2019 F Zone Water Elev Trends.xlsx



Contour Interval = 1 foot   Elevation datum feet AMSL

Well 131A water level was anomalously high and was not used in the contouring.

PARSONS

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

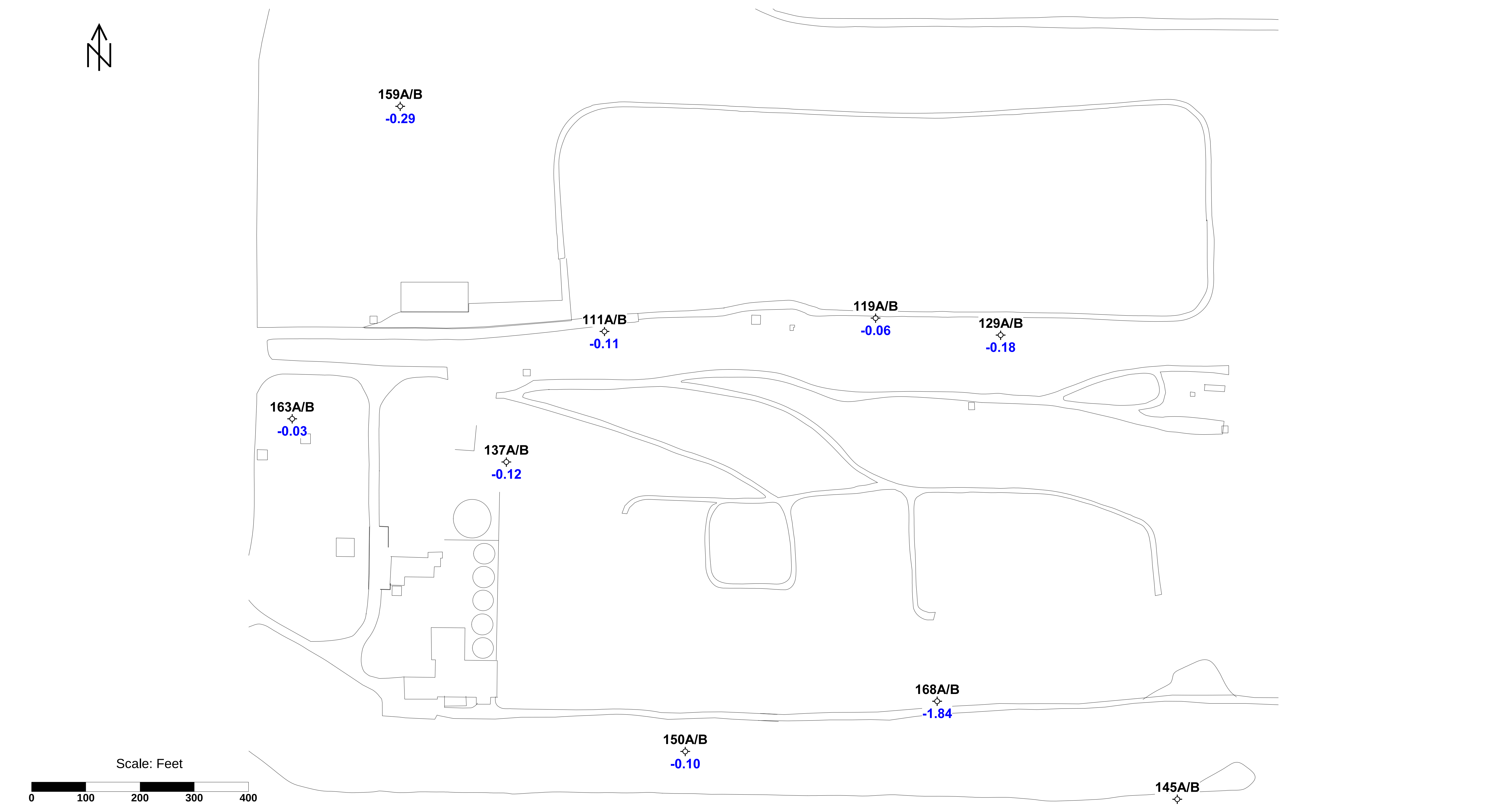
Created by: RBP	Date: 01-06-20
Checked by: JWS	Date: 01-10-20
Project Manager: EAF	Date: 01-10-20
Job number: 451999.03000	

LEGEND

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

Figure 3-8
Potentiometric Surface Map
Chemours Necco Park: A-Zone
November 05, 2019

\\nybuf03fs01\Dupont$\Necco\HydroGeo\Hydro\GW_contours\2019-11-05 NEC Contour Tool\2019-11-05 - A PZ - F2.srf



Negative value indicates downward gradient

Elevation datum feet AMSL

PARSONS
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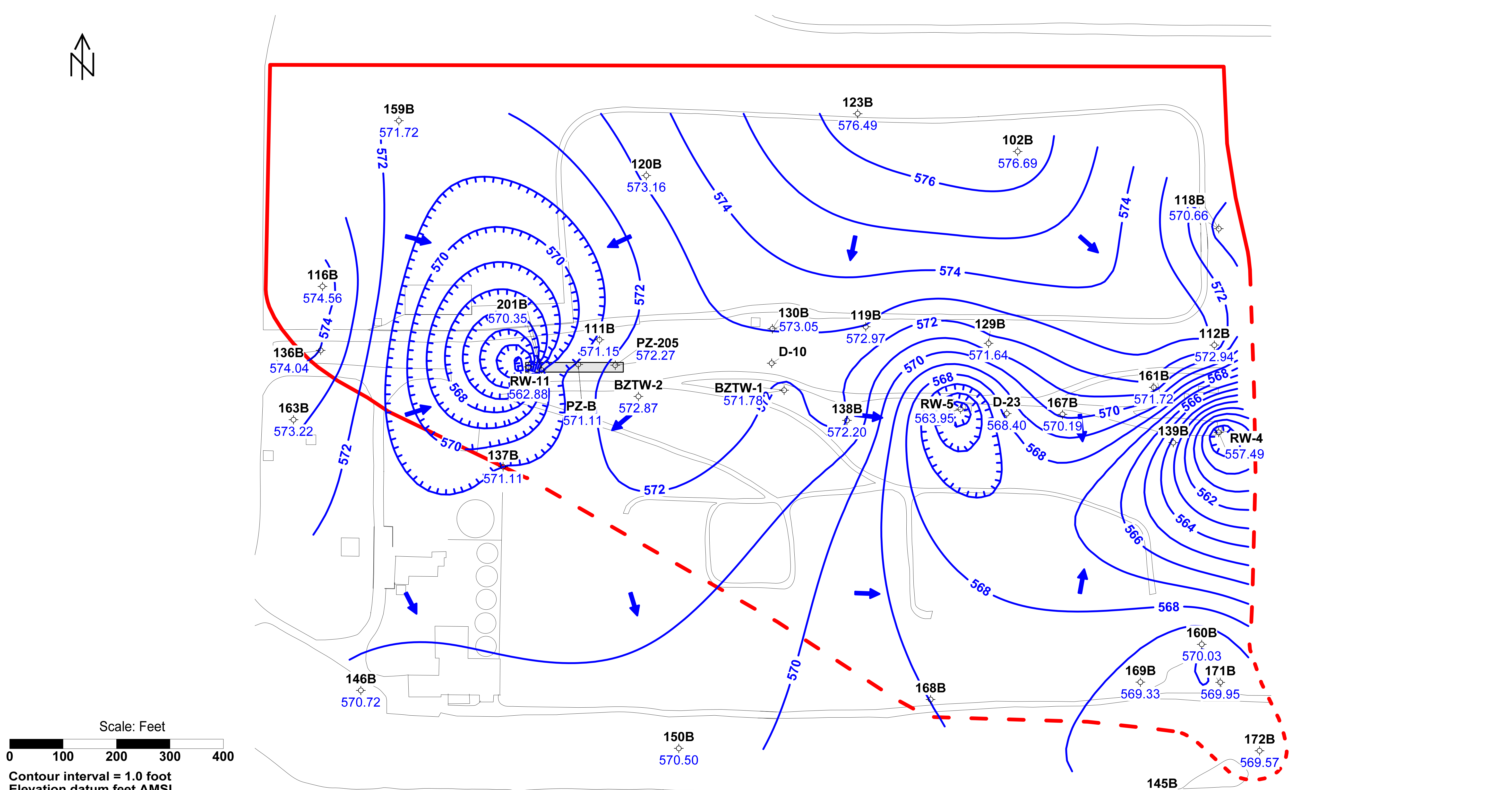
Created by: RBP	Date: 01-06-20
Checked by: JWS	Date: 01-10-20
Project Manager: EAF	Date: 01-10-20
Job number: 451999.03000	

LEGEND

150A/B	Well ID
✧	Monitoring Well
✦	Pumping Well
	Structure
	Road
-0.16	Vertical Hydraulic Gradient

Figure 3-9
Vertical Gradient: A-Zone to B-Zone
Chemours Necco Park
November 05, 2019

\\nybuf03fs01/Dupont$/Necco/HydroGeo/Hydro/GW_contours/2019-11-05 NEC Contour Tool/2019-11-05 - ABvgrad - F3.srf



Wells 149B and 151B are outside the area shown, but were used in the contouring.
Wells 139B, 168B, 170B, D-10, TRW-6, and TRW-7 were not used in the contouring.
Water level elevation for RW-11 was the hourly average from November 5, 2019 at noon from Experion® Process Knowledge System water level probe measurements.

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Buffalo, NY 14202
(716) 541-0730

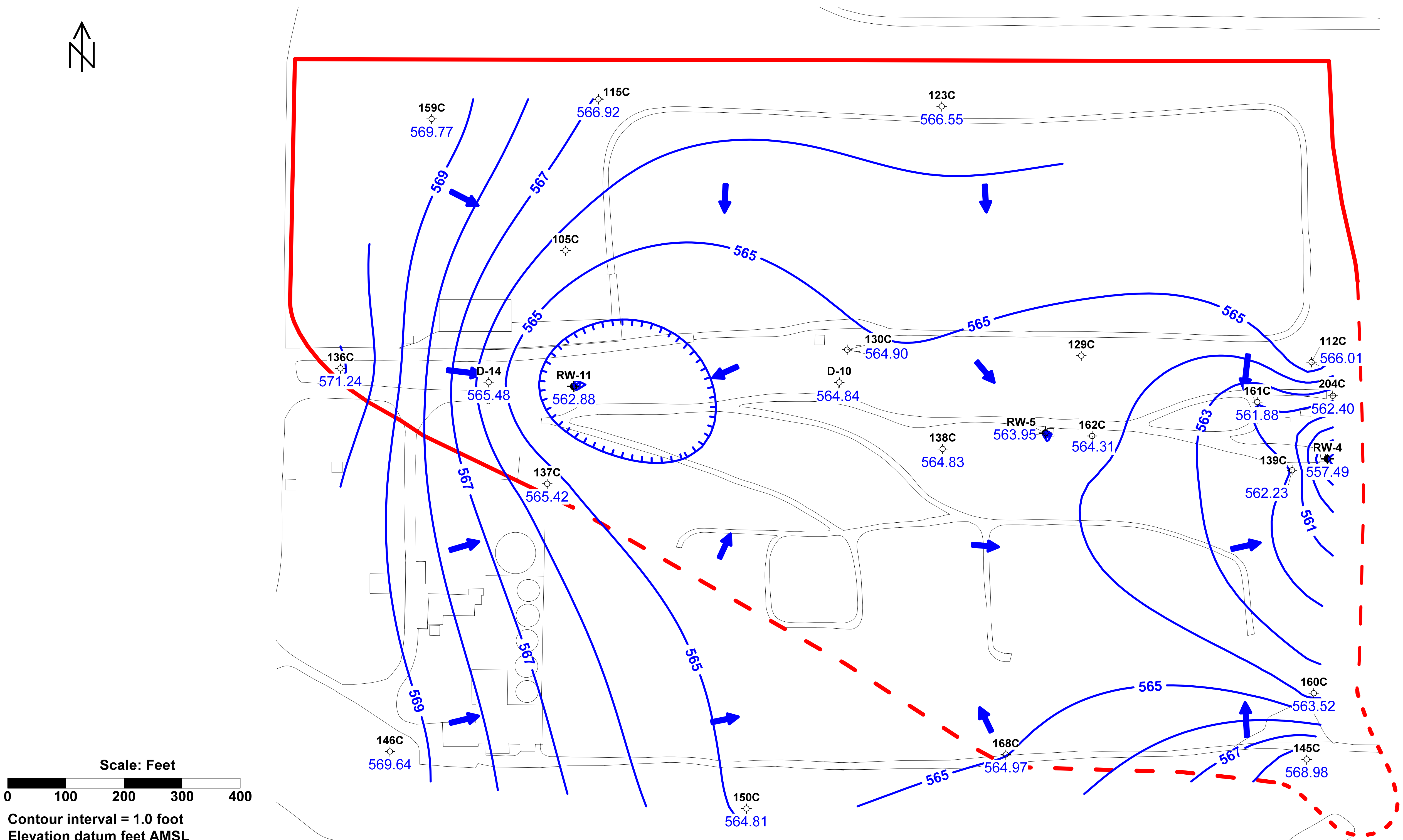
Created by: RBP	Date: 01-06-20
Checked by: JWS	Date: 01-10-20
Project Manager: EAF	Date: 01-10-20
Job number: 451999.03000	

LEGEND

3B	Well ID	Potentiometric Contour	Source Area Extent
	Monitoring Well	Structure	Approximate Location of Bedrock Fractured Blast Trench
	Pumping Well	Road	

Figure 3-10
Potentiometric Surface Map
Chemours Necco Park: B-Zone
November 05, 2019

//nybuf03fs01/DupontS/Necco/HydroGeo/Hydro/GW_contours/2019-11-05 NEC Contour Tool/2019-11-05 - PZ B - F5.srf



Contour interval = 1.0 foot
Elevation datum feet AMSL
Wells 149C and 151C are outside the area shown, but were used in the contouring.
The water level for 129C was erroneously high and was not used in the contouring.
Well 105C was dry.
Water level elevation for RW-11 was the hourly average for November 5, 2019 at noon from Experion® Process Knowledge System water level probe measurements.

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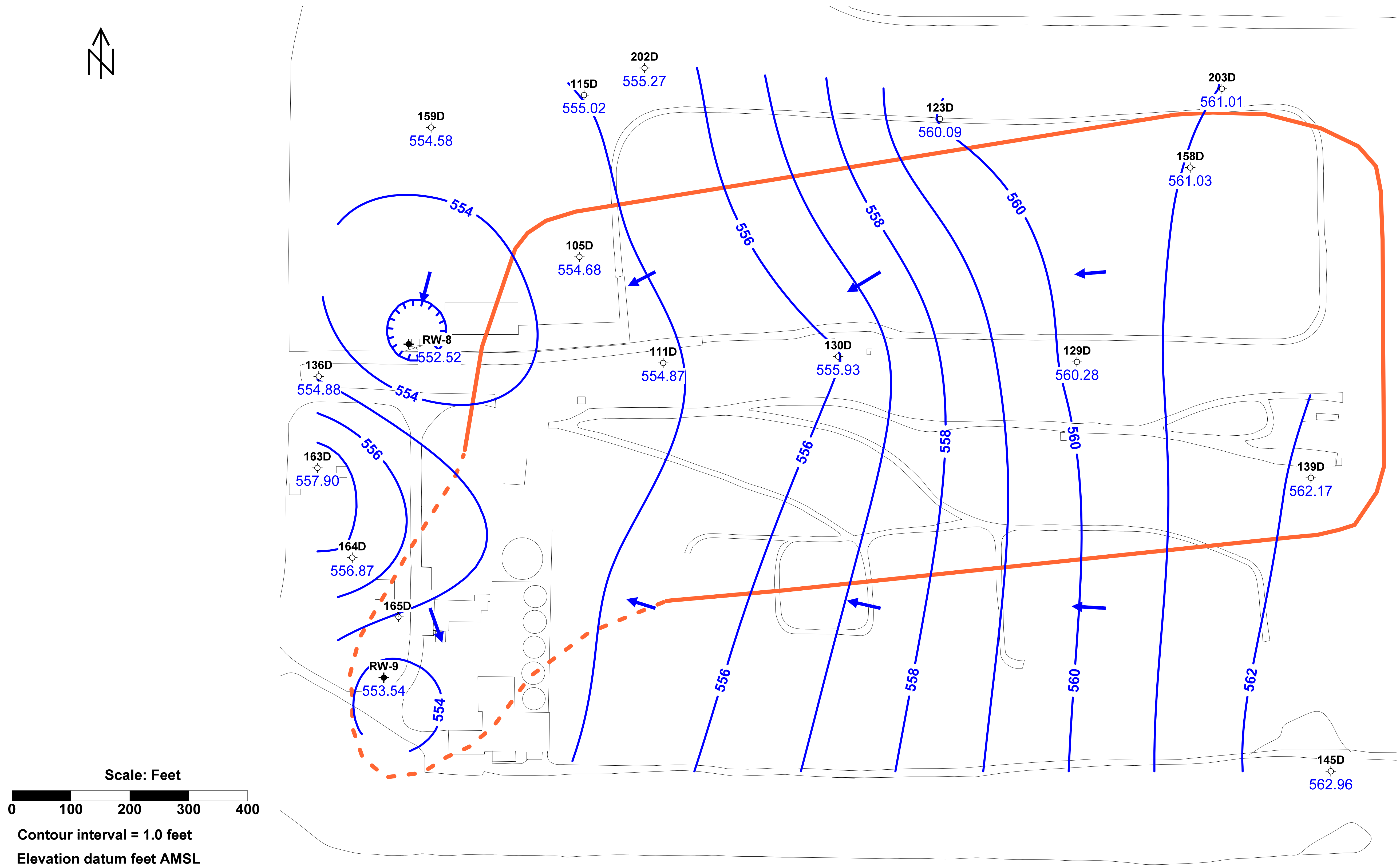
Created by: RBP	Date: 01-06-20
Checked by: JWS	Date: 01-10-20
Project Manager: EAF	Date: 01-10-20
Job number: 451999.03000	

LEGEND

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

Figure 3-11
Potentiometric Surface Map
Chemours Necco Park: C-Zone
November 05, 2019

\\nybuf03fs01\Dupont$\Necco\HydroGeo\Hydro\GW_contours\2019-11-05 NEC Contour Tool\2019-11-05 - PZ C - F7.srf



Contour interval = 1.0 feet

Elevation datum feet AMSL

Well 148D located downgradient was not used in the interpolation.

Wells 149D and 165D were not used in the contour interpolation.

Water level elevation for RW-8 was the hourly average for November 5, 2019 at noon from Experion ® Process Knowledge System water level probe measurements.

PARSONS
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Buffalo, NY 14202
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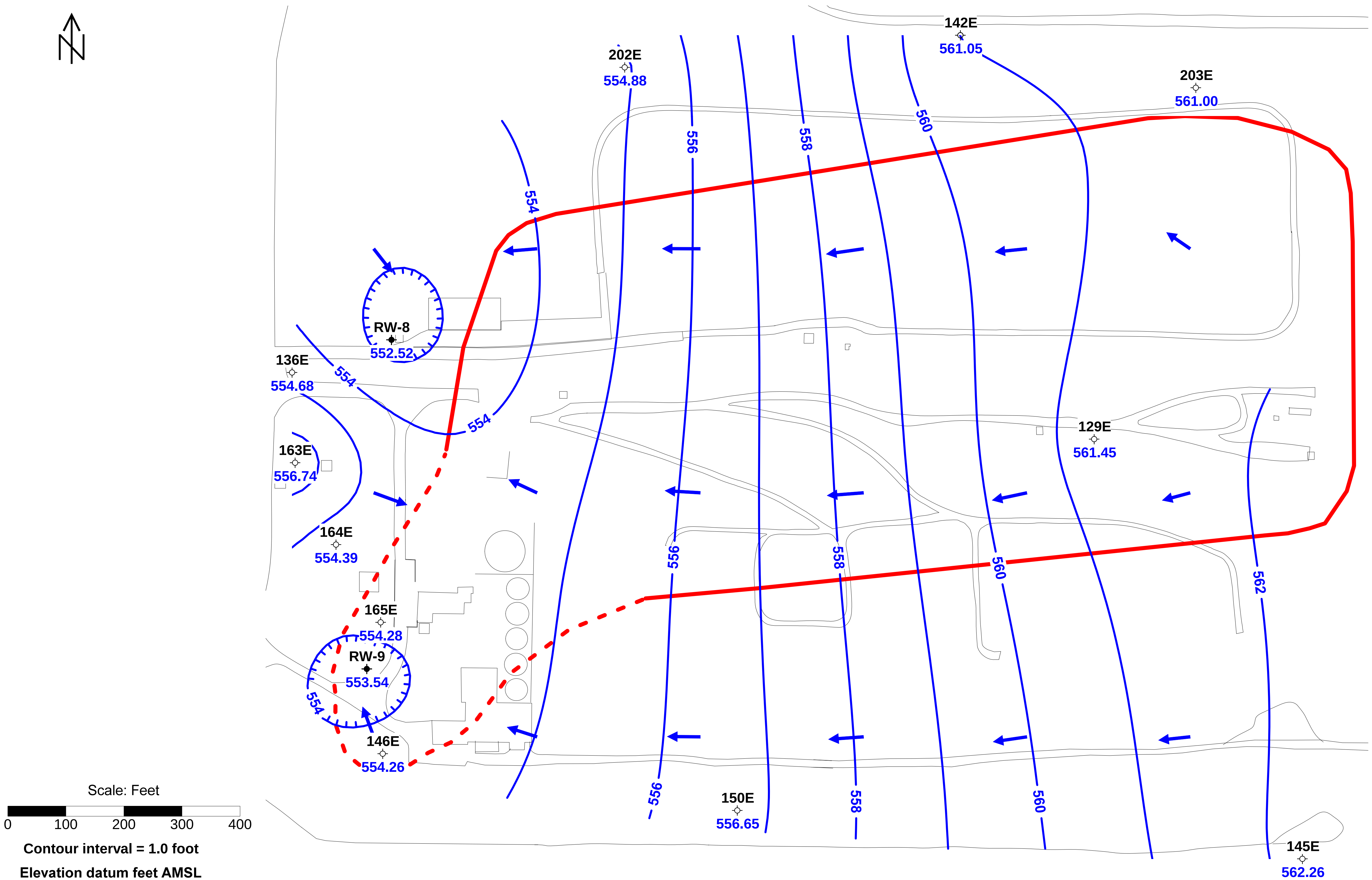
Created by: RBP	Date: 01-06-20
Checked by: JWS	Date: 01-10-20
Project Manager: EAF	Date: 01-10-20
Job number: 451999.03000	

LEGEND

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

Figure 3-12
Potentiometric Surface Map
Chemours Necco Park: D-Zone
November 05, 2019

\\nybuf03fs01\Dupont$\Necco\HydroGeo\Hydro\GW_contours\2019-11-05 NEC Contour Tool\2019-11-05 - PZ D - F9.srf



Contour interval = 1.0 foot

Elevation datum feet AMSL

Water level elevation for RW-8 was the hourly average for November 5, 2019 at noon from Experion® Process Knowledge System water level probe measurements.

PARSONS

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

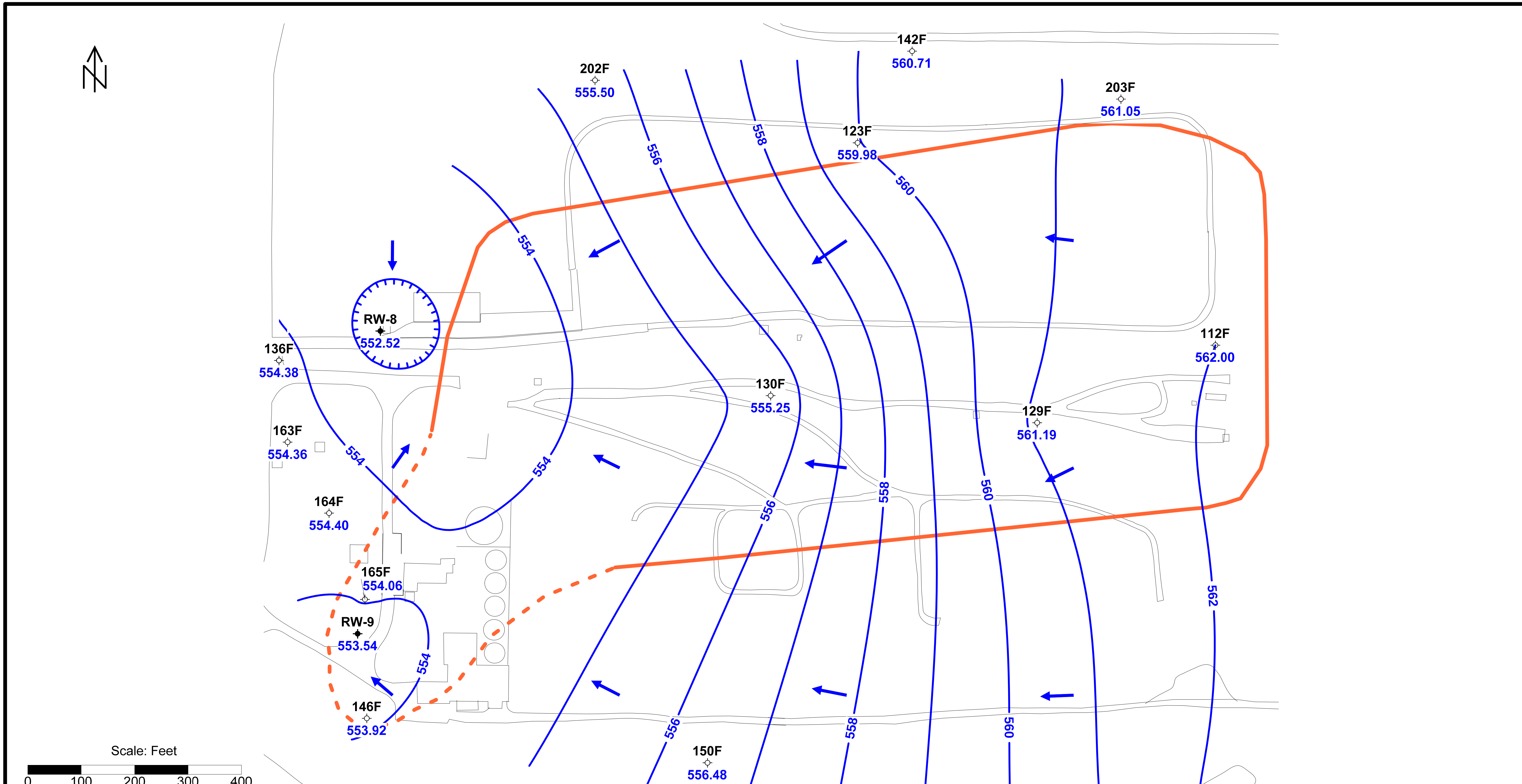
Created by: RBP	Date: 01-06-20
Checked by: JWS	Date: 01-10-20
Project Manager: EAF	Date: 01-10-20
Job number: 451999.03000	

LEGEND

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

Figure 3-13
Potentiometric Surface Map
Chemours Necco Park: E-Zone
November 05, 2019

\\nybuf03fs01\Dupont$\Necco\HydroGeo\Hydro\GW_contours\2019-11-05 NEC Contour Tool\2019-11-05 - PZ E - F11.srf



Contour interval = 1.0 foot
Elevation datum feet AMSL
148F located downgradient was not used in the interpolation.
Water level elevation for RW-8 was the hourly average for November 5, 2019 at noon from Experion® Process Knowledge System water level probe measurements.

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

Created by: RBP	Date: 01-06-20
Checked by: JWS	Date: 01-10-20
Project Manager: EAF	Date: 01-10-20
Job number: 451999.03000	

LEGEND

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

Figure 3-14
Potentiometric Surface Map
Chemours Necco Park: F-Zone
November 05, 2019

//nybuf03fs01/Dupont$/Necco/HydroGeo/Hydro/GW_contours/2019-11-05 NEC Contour Tool/2019-11-05 - PZ F - F13.srf

APPENDIX A
2019 ANNUAL GROUNDWATER SAMPLING RESULTS

APPENDIX A
2019 Analytical Results - Monitoring Wells

Parameter Name	Location	136B	136D	136D	136F	137A	137B	145A	145B	145C	145D	146AR	146B	146C
	Date	09/24/2019	09/23/2019	09/23/2019	09/25/2019	09/23/2019	09/27/2019	09/25/2019	09/26/2019	09/27/2019	10/01/2019	09/25/2019	10/02/2019	10/01/2019
	Units	FS	FS	DUP	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS
Field Parameters														
COLOR	NONE	None	Clear/grey	Clear/grey	Grey/brown	None	None	None	--	--	--	--	Clear	--
DEPTH TO WATER	Feet	8.95	26.02	26.02	25.97	7.56	8.18	6.29	--	--	--	--	6.58	--
DISSOLVED OXYGEN	MG/L	3.33	0.56	0.56	0.41	0.24	0.6	0.7	--	--	--	--	O.32	--
ODOR	NONE	None	None	None	None	None	None	None	--	--	--	--	None	--
OXIDATION REDUCTION POTENTIAL	MV	-234	-179	-179	-290	-376	-316	-81	--	--	--	--	-281	--
PH	STD UNITS	8.50	7.33	7.33	7.10	13.01	12.86	6.64	--	--	--	--	10.92	--
SPECIFIC CONDUCTANCE	UMHOS/CM	2230	892	892	1070	4530	18.1	1790	--	--	--	--	656	--
TEMPERATURE	DEGREES C	16.91	15.15	15.15	14.15	18.03	17.18	19.67	--	--	--	--	17.81	--
TURBIDITY QUANTITATIVE	NTU	8.36	11.48	11.48	7.87	1.53	4.10	4.13	--	--	--	--	0.00	--
Volatile Organics														
1,1,2,2-Tetrachloroethane	UG/L	<1.3	<0.13	<0.13	<0.13	<0.26	<0.52	<0.13	26 J	1.7 J	<1.6	<0.13	<0.13	<0.13
1,1,2-Trichloroethane	UG/L	<0.9	0.33 J	0.24 J	<0.09	<0.18	<0.36	<0.09	13 J	10	20	<0.09	<0.09	<0.09
1,1-Dichloroethene	UG/L	2.4 J	0.58 J	0.5 J	<0.19	7.2	12	<0.19	<19	1.4 J	9.7 J	<0.19	5.2	0.32 J
1,2-Dichloroethane	UG/L	<2.1	0.88 J	0.91 J	5.7	1.7 J	2.9 J	<0.21	<21	1.4 J	<2.6	<0.21	<0.21	<0.21
Carbon Tetrachloride	UG/L	<2.6	<0.26	<0.26	<0.26	<0.52	<1	<0.26	<26	<1	<3.3	<0.26	<0.26	<0.26
Chloroform	UG/L	<1.3	0.92 J	0.72 J	0.13 J	1.1 J	1.1 J	<0.13	110	2.3 J	54	<0.13	<0.13	<0.13
cis-1,2 Dichloroethene	UG/L	430	17	15	1.2	34	96	0.27 J	3100	72	260	0.36 J	18	5.6
Tetrachloroethene	UG/L	290	<0.15	<0.15	<0.15	36	62	<0.15	<15	<0.6	<1.9	<0.15	<0.15	<0.15
trans-1,2-Dichloroethene	UG/L	4.1 J	1.2	1.1	0.26 J	3.7	7.5	<0.19	430	17	46	<0.19	1.3	0.94 J
Trichloroethene	UG/L	60	3.9	3.2	0.44 J	44	95	<0.1	55 J	4.6	6.3 J	<0.1	2.1	0.4 J
Vinyl Chloride	UG/L	18	25	22	1.6	25	57	<0.2	910	150	180	1.3	6.5	18
Total VOCs	UG/L	804.5	49.81	43.67	9.33	152.7	333.5	0.00	4644	260.4	576	1.66	33.1	25.26
Semi-Volatile Organics														
2,4,5-Trichlorophenol	UG/L	250	<1.9	<1.9	<1.9	2.2 J	9.7	<2	<10	<2	<7.6	<2	14	<2
2,4,6-Trichlorophenol	UG/L	39 J	<1.8	<1.7	<1.7	<1.8	<1.7	<1.9	<9.1	<1.8	<6.9	<1.8	3.1 J	<1.8
3- And 4- Methylphenol	UG/L	<1.9	<0.19	<0.18	<0.18	8 J	9.1 J	<0.2	6.4 J	0.59 J	2.9 J	<0.19	1.7 J	<0.19
Hexachlorobenzene	UG/L	<1.6	<0.16	<0.15	<0.15	<0.16	<0.16	<0.17	<0.81	<0.16	<0.62	<0.16	<0.16	<0.16
Hexachlorobutadiene	UG/L	<5.3	<0.53	<0.52	<0.52	2 J	1.9 J	<0.56	<2.7	<0.54	<2.1	<0.54	<0.53	<0.54
Hexachloroethane	UG/L	<3.9	<0.39	<0.38	<0.38	<0.39	<0.38	<0.41	<2	<0.4	<1.5	<0.39	<0.38	<0.39
Pentachlorophenol	UG/L	780	<3	<3	<3	<3.1	4.4 J	<3.2	<16	<3.1	<12	<3.1	19 J	<3.1
Phenol	UG/L	<1.3	<0.13	<0.12	<0.12	32	25	<0.13	3.8 J	0.68 J	7.5 J	<0.13	<0.12	<0.13
Tentativley Identified Compound	UG/L	--	--	2.1 J	--	19 J	20 J	--	810 J	46 J	450 J	0.86 J	--	--
Inorganics														
Barium, filtered	UG/L	75 J	39 J	37 J	39 J	3000	3000	32 J	34 J	27 J	140 J	5.1 J	15 J	30 J
Chloride, total	UG/L	160000	180000 J	150000 J	140000	320000 J	440000	180000	5600000	550000	9000000	170000	140000	150000

< Non detect at stated reporting limit. J Estimated concentration.

B Not detected substantially above the level reported in the laboratory or field blanks.

UJ Undetected-estimated reporting

APPENDIX A
2019 Analytical Results - Monitoring Wells

Parameter Name	Location Date Units	146E 09/23/2019 FS	146F 10/02/2019 FS	148D 09/24/2019 FS	150A 09/25/2019 FS	150B 09/27/2019 FS	150C 09/27/2019 FS	150E 09/27/2019 FS	150E 09/27/2019 DUP	150F 10/01/2019 FS	165D 09/24/2019 FS	165E 09/24/2019 FS	168B 10/02/2019 FS	168C 10/03/2019 FS
Field Parameters														
COLOR	NONE	--	Gray	--	--	--	--	--	--	--	--	--	--	--
DEPTH TO WATER	Feet	--	21.87	--	--	--	--	--	--	--	--	--	--	--
DISSOLVED OXYGEN	MG/L	--	3.24	--	--	--	--	--	--	--	--	--	--	--
ODOR	NONE	--	Sulfur	--	--	--	--	--	--	--	--	--	--	--
OXIDATION REDUCTION POTENTIAL	MV	--	-370	--	--	--	--	--	--	--	--	--	--	--
PH	STD UNITS	--	6.40	--	--	--	--	--	--	--	--	--	--	--
SPECIFIC CONDUCTANCE	UMHOS/CM	--	11300	--	--	--	--	--	--	--	--	--	--	--
TEMPERATURE	DEGREES C	--	15.24	--	--	--	--	--	--	--	--	--	--	--
TURBIDITY QUANTITATIVE	NTU	--	0.00	--	--	--	--	--	--	--	--	--	--	--
Volatile Organics														
1,1,2,2-Tetrachloroethane	UG/L	18	<26	<0.13	<0.13	<0.52	<0.13	<13	<16	<1	<0.13	270 J	<52	370
1,1,2-Trichloroethane	UG/L	18	29 J	<0.09	<0.09	<0.36	<0.09	<9	<11	<0.72	<0.09	470 J	<36	1500
1,1-Dichloroethene	UG/L	12	440	<0.19	<0.19	4.1	0.36 J	310	310	16	1.6	200 J	170 J	110
1,2-Dichloroethane	UG/L	8.3	<42	<0.21	0.22 J	1.4 J	<0.21	<21	<26	<1.7	1.1	130 J	340 J	82
Carbon Tetrachloride	UG/L	<1	<52	<0.26	<0.26	<1	<0.26	<26	<33	<2.1	<0.26	<130	<100	78
Chloroform	UG/L	49	110 B	<0.13	<0.13	<0.52	<0.13	180	180	14	0.43 J	400 J	60 B	530
cis-1,2 Dichloroethene	UG/L	75	9000	1.8	0.33 J	110	6	3800	3900	430	5.3	11000	14000	380
Tetrachloroethene	UG/L	3.2 J	<30	0.7 J	<0.15	5.5	<0.15	<15	<19	<1.2	<0.15	<75	<60	100
trans-1,2-Dichloroethene	UG/L	78	490	0.39 J	<0.19	4.4	2.9	380	370	27	0.9 J	210 J	220 J	72
Trichloroethene	UG/L	26	190 J	1.4	<0.1	9.5	0.99 J	410	430	10	1	500	230 J	1000
Vinyl Chloride	UG/L	200	2100	<0.2	<0.2	27	7	2700	2700	72	9.9	2100	10000	190
Total VOCs	UG/L	487.5	12249	4.29	0.55	161.9	17.25	7780	7890	569	20.23	15280	25020	4412
Semi-Volatile Organics														
2,4,5-Trichlorophenol	UG/L	<9.8	140	<1.9	<2	15 J	<1.9	<20	<20	<38	7.2 J	1200	<44	<38
2,4,6-Trichlorophenol	UG/L	<8.9	37 J	<1.7	<1.8	<3.5	<1.8	<19	<18	<34	<1.8	<88	<40	<34
3- And 4- Methylphenol	UG/L	7.8 J	26 J	25	<0.19	9.8 J	<0.19	56 J	55 J	15 J	0.87 J	11 J	160 J	<3.6
Hexachlorobenzene	UG/L	<0.8	<0.81	<0.15	<0.16	<0.31	<0.16	<1.7	<1.6	<3.1	<0.16	<7.9	<3.5	<3.1
Hexachlorobutadiene	UG/L	3.8 J	<2.7	<0.52	<0.54	<1	<0.53	<5.6	<5.5	<10	<0.54	38 J	<12	16 J
Hexachloroethane	UG/L	<2	<2	<0.38	<0.4	<0.76	<0.39	<4.1	<4	<7.5	<0.4	<19	<8.7	<7.5
Pentachlorophenol	UG/L	<15	<16	<3	<3.1	10 J	<3	<32	<32	<59	<3.1	<150	<68	<59
Phenol	UG/L	<0.63	68	8.7 J	<0.13	29	<0.13	140	140	65 J	0.26 J	<6.3	93 J	8.2 J
Tentativley Identified Compound	UG/L	68 J	1000 J	--	--	34 J	11 J	5000 J	4900 J	3200 J	--	150 J	11000 J	4800 J
Inorganics														
Barium, filtered	UG/L	54 J	32 J	41 J	55 J	260	18 J	290	270	71 J	27 J	43 J	250	140 J
Chloride, total	UG/L	360000 J	3500000	380000	130000	440000	1100000	8500000	10000000	7200000	250000	460000	12000000	14000000

< Non detect at stated reporting limit. J Estimated concentration.

B Not detected substantially above the level reported in the laboratory or field blanks.

UJ Undetected-estimated reporting

APPENDIX A
2019 Analytical Results - Monitoring Wells

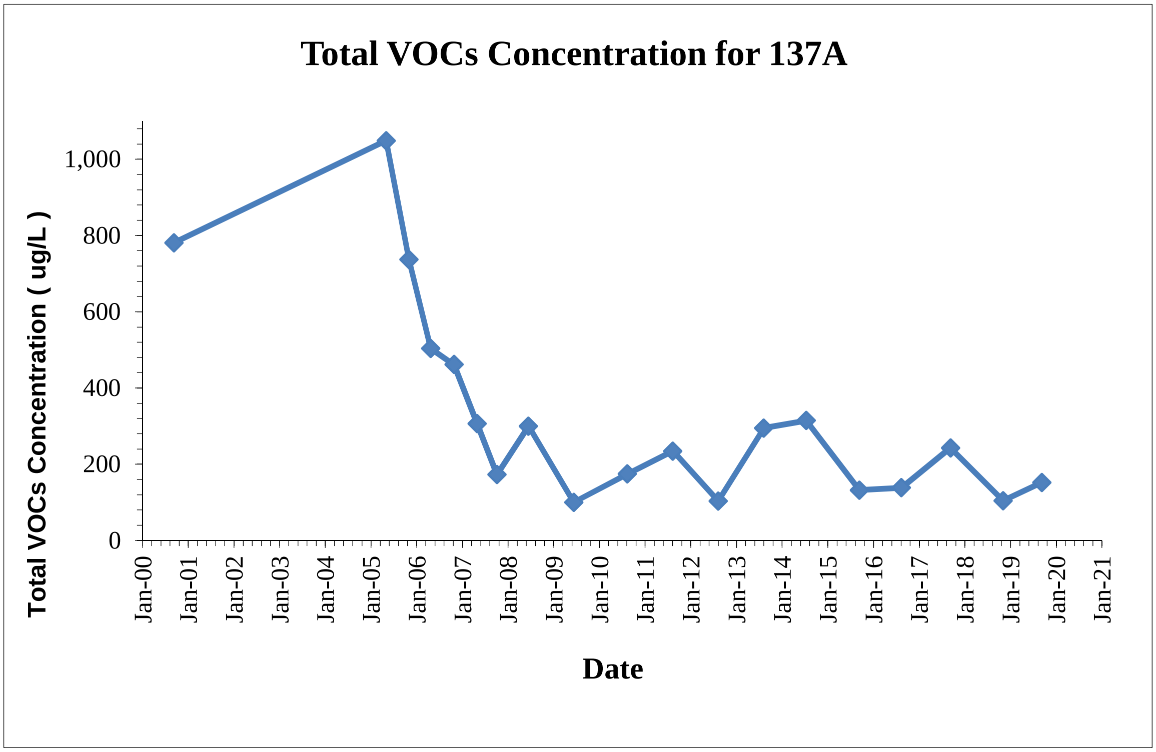
Parameter Name	Location Date Units	171B 10/01/2019 FS	172B 09/25/2019 FS	EB 10/01/2019 EB	EB 10/02/2019 EB	EB 10/03/2019 EB	TB 09/23/2019 TB	TB 09/24/2019 TB	TB 09/25/2019 TB	TB 09/26/2019 FS	TB 09/27/2019 TB	TB 10/01/2019 TB	TB 10/02/2019 TB	TB 10/03/2019 TB
Field Parameters														
COLOR	NONE	--	--	--	--	--	--	--	--	--	--	--	--	--
DEPTH TO WATER	Feet	--	--	--	--	--	--	--	--	--	--	--	--	--
DISSOLVED OXYGEN	MG/L	--	--	--	--	--	--	--	--	--	--	--	--	--
ODOR	NONE	--	--	--	--	--	--	--	--	--	--	--	--	--
OXIDATION REDUCTION POTENTIAL	MV	--	--	--	--	--	--	--	--	--	--	--	--	--
PH	STD UNITS	--	--	--	--	--	--	--	--	--	--	--	--	--
SPECIFIC CONDUCTANCE	UMHOS/CM	--	--	--	--	--	--	--	--	--	--	--	--	--
TEMPERATURE	DEGREES C	--	--	--	--	--	--	--	--	--	--	--	--	--
TURBIDITY QUANTITATIVE	NTU	--	--	--	--	--	--	--	--	--	--	--	--	--
Volatile Organics														
1,1,2,2-Tetrachloroethane	UG/L	3500	540	<0.13	<0.13	0.51 J	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13
1,1,2-Trichloroethane	UG/L	180 J	20 J	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
1,1-Dichloroethene	UG/L	<38	<7.6	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19
1,2-Dichloroethane	UG/L	<42	<8.4	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21
Carbon Tetrachloride	UG/L	<52	27 J	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26
Chloroform	UG/L	570	100	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13
cis-1,2 Dichloroethene	UG/L	3300	770	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	--	<0.16	<0.16	<0.16	<0.16
Tetrachloroethene	UG/L	390	100	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
trans-1,2-Dichloroethene	UG/L	440	150	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	--	<0.19	<0.19	<0.19	<0.19
Trichloroethene	UG/L	930	200	<0.1	<0.1	0.18 J	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vinyl Chloride	UG/L	420	240	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	--	<0.2	<0.2	<0.2	<0.2
Total VOCs	UG/L	9730	2147	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Semi-Volatile Organics														
2,4,5-Trichlorophenol	UG/L	<4.8	<2	<2	<2	<2	--	--	--	--	--	--	--	--
2,4,6-Trichlorophenol	UG/L	<4.4	<1.8	<1.8	<1.8	<1.8	--	--	--	--	--	--	--	--
3- And 4- Methylphenol	UG/L	1.5 J	0.34 J	<0.19	<0.19	<0.19	--	--	--	--	--	--	--	--
Hexachlorobenzene	UG/L	<0.39	<0.16	<0.16	<0.16	<0.16	--	--	--	--	--	--	--	--
Hexachlorobutadiene	UG/L	55	43	<0.54	<0.54	<0.54	--	--	--	--	--	--	--	--
Hexachloroethane	UG/L	<0.96	1.8 J	<0.4	<0.39	<0.39	--	--	--	--	--	--	--	--
Pentachlorophenol	UG/L	<7.5	<3.1	<3.1	<3.1	<3.1	--	--	--	--	--	--	--	--
Phenol	UG/L	<0.31	<0.13	<0.13	<0.13	<0.13	--	--	--	--	--	--	--	--
Tentativley Identified Compound	UG/L	170 J	15 J	--	--	--	--	--	--	--	--	--	--	--
Inorganics														
Barium, filtered	UG/L	24 J	22 J	<1.3	<1.3	<1.3	--	--	--	--	--	--	--	--
Chloride, total	UG/L	4500000	250000	<14	<14	<14	--	--	--	--	--	--	--	--

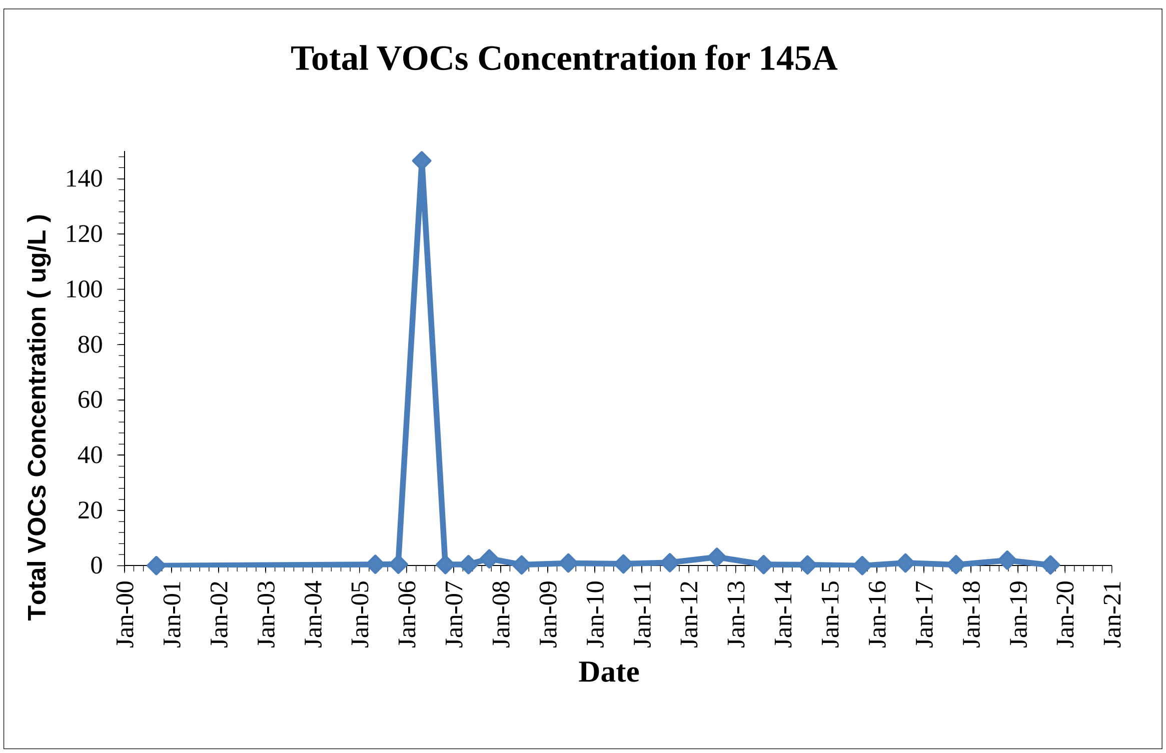
< Non detect at stated reporting limit. J Estimated concentration.

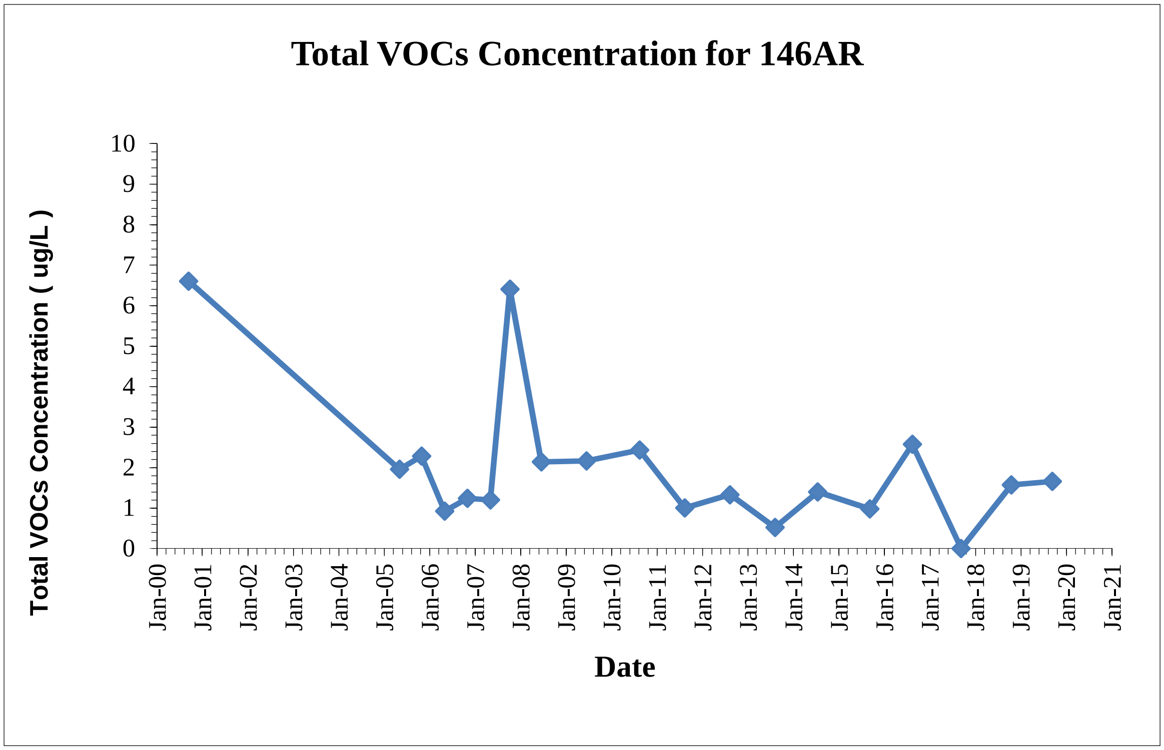
B Not detected substantially above the level reported in the laboratory or field blanks.

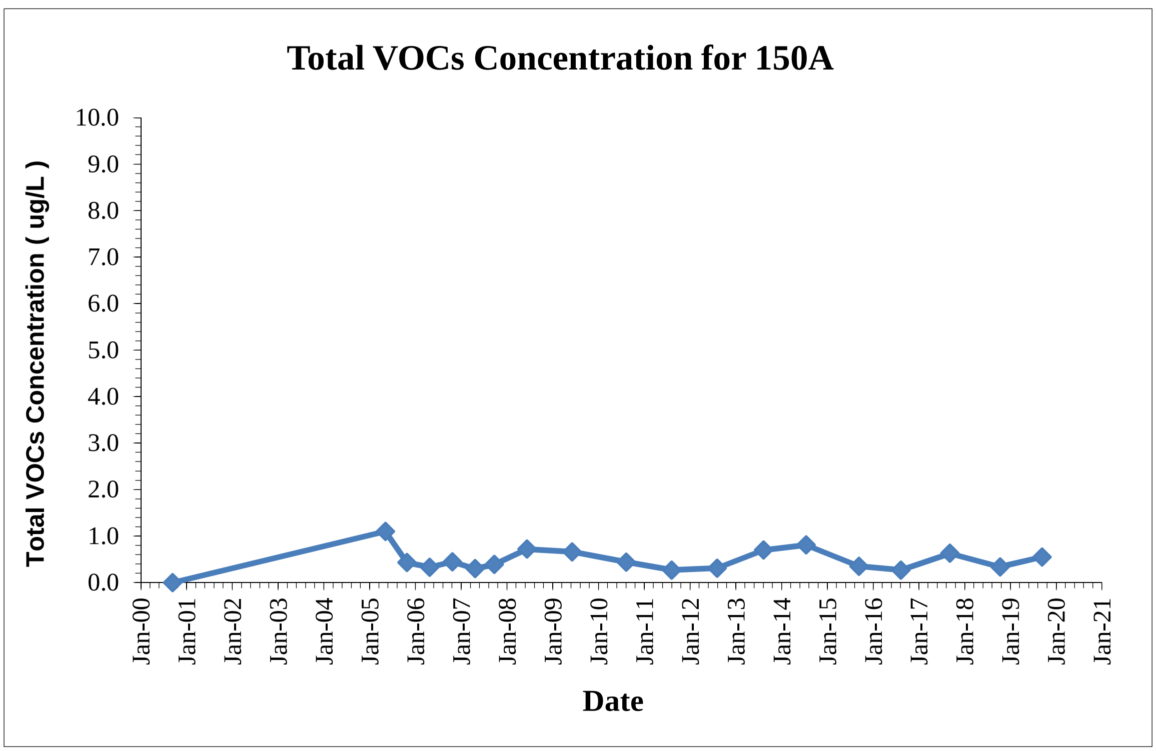
UJ Undetected-estimated reporting

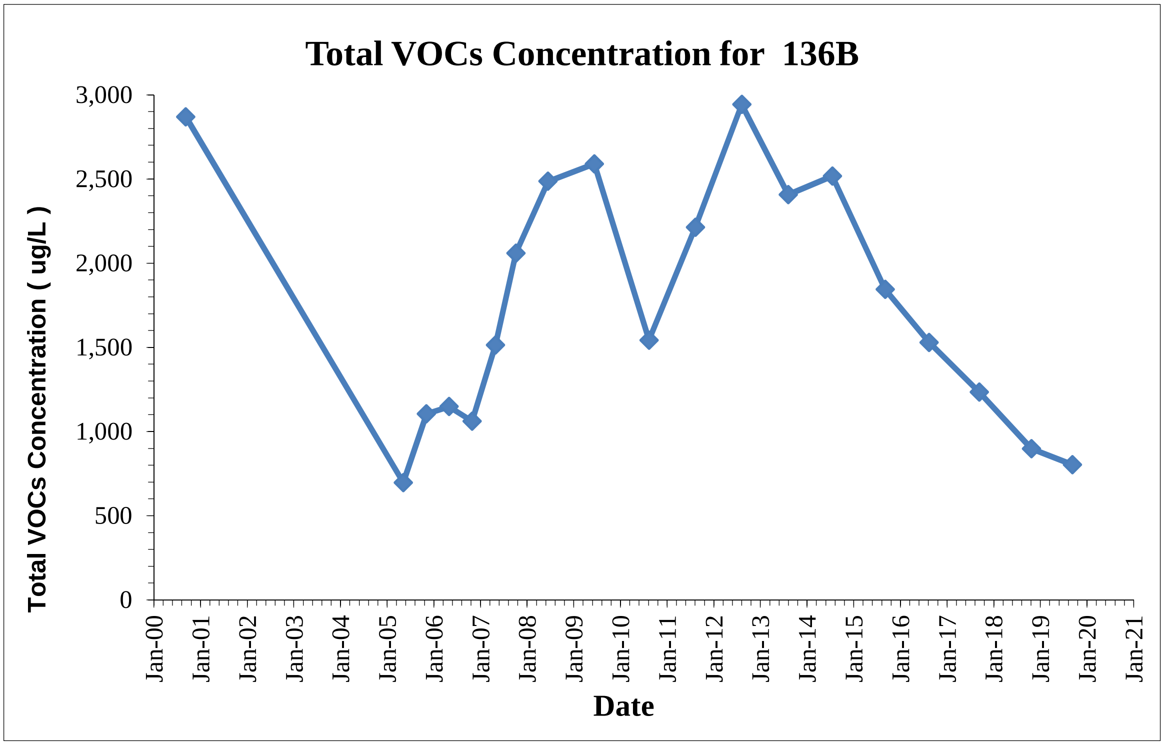
APPENDIX B
TVOC TREND PLOTS

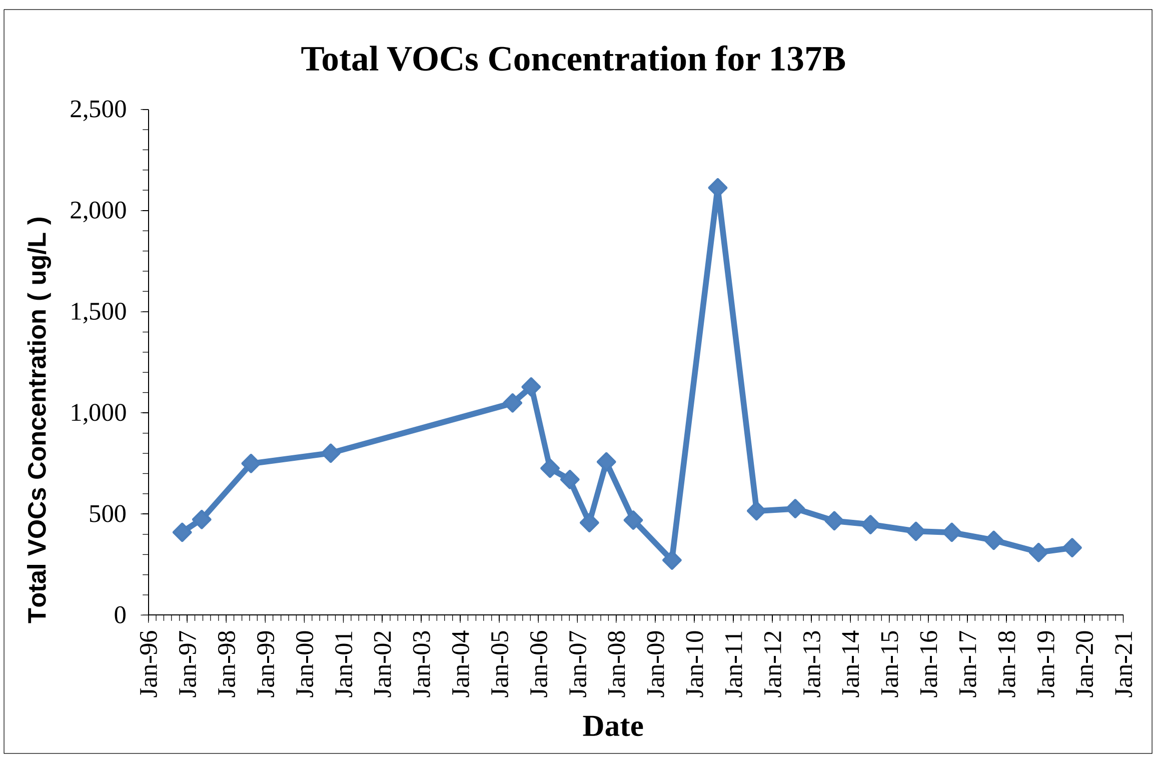

Total VOCs Concentration for 137A
Total VOCs Concentration (ug/L)
1,000
800
600
400
200
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Date

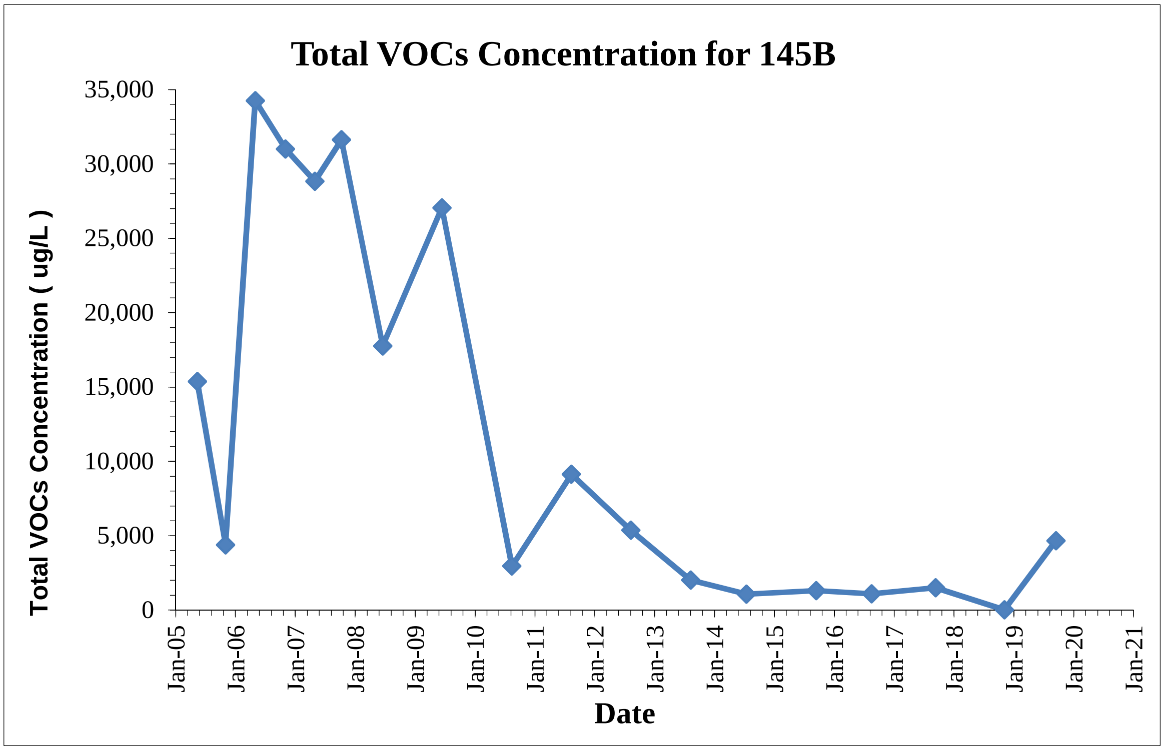

Total VOCs Concentration for 145A
Total VOCs Concentration (ug/L)
140
120
100
80
60
40
20
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Date

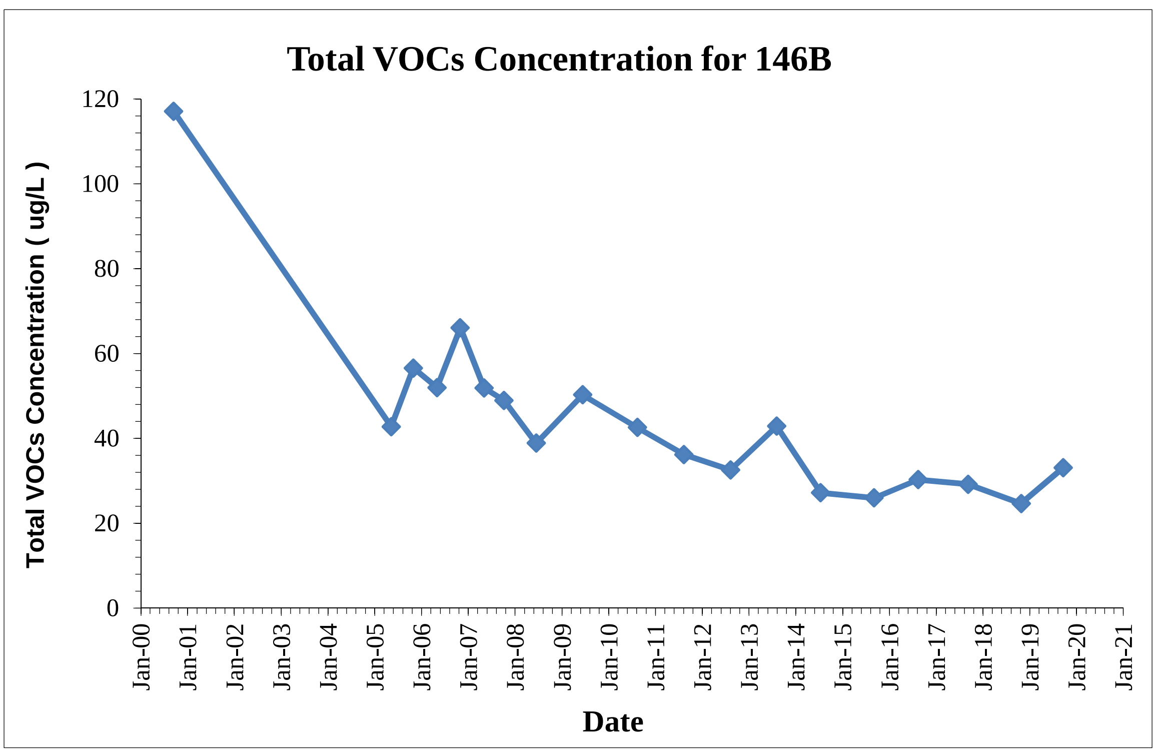

Total VOCs Concentration for 146AR
Total VOCs Concentration (ug/L)
0
1
2
3
4
5
6
7
8
9
10
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Date

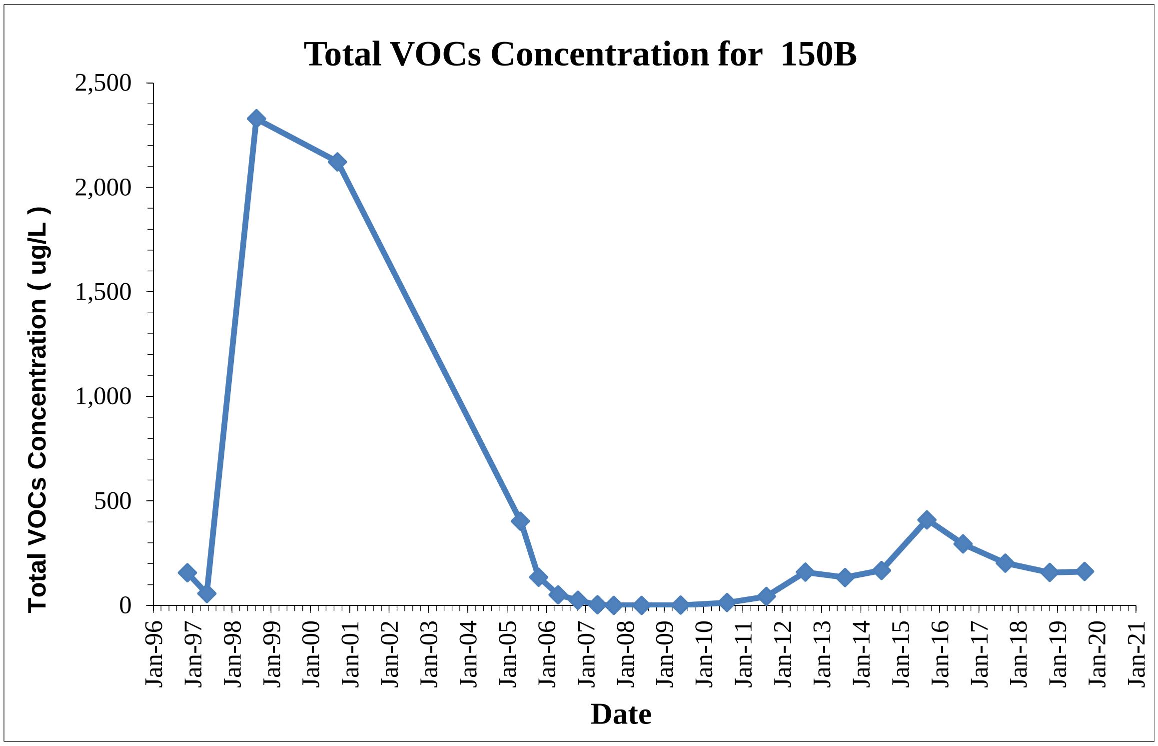

Total VOCs Concentration for 150A
Total VOCs Concentration (ug/L)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Date

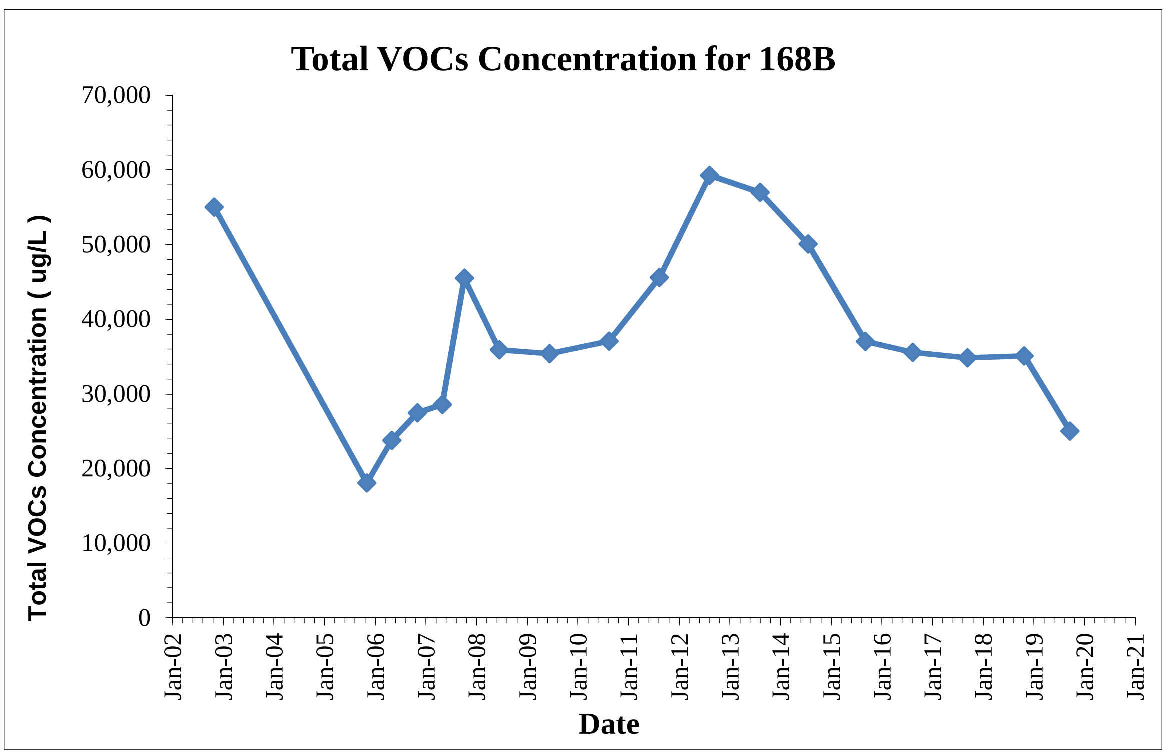

Total VOCs Concentration for 136B
Total VOCs Concentration (ug/L)
3,000
2,500
2,000
1,500
1,000
500
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Date

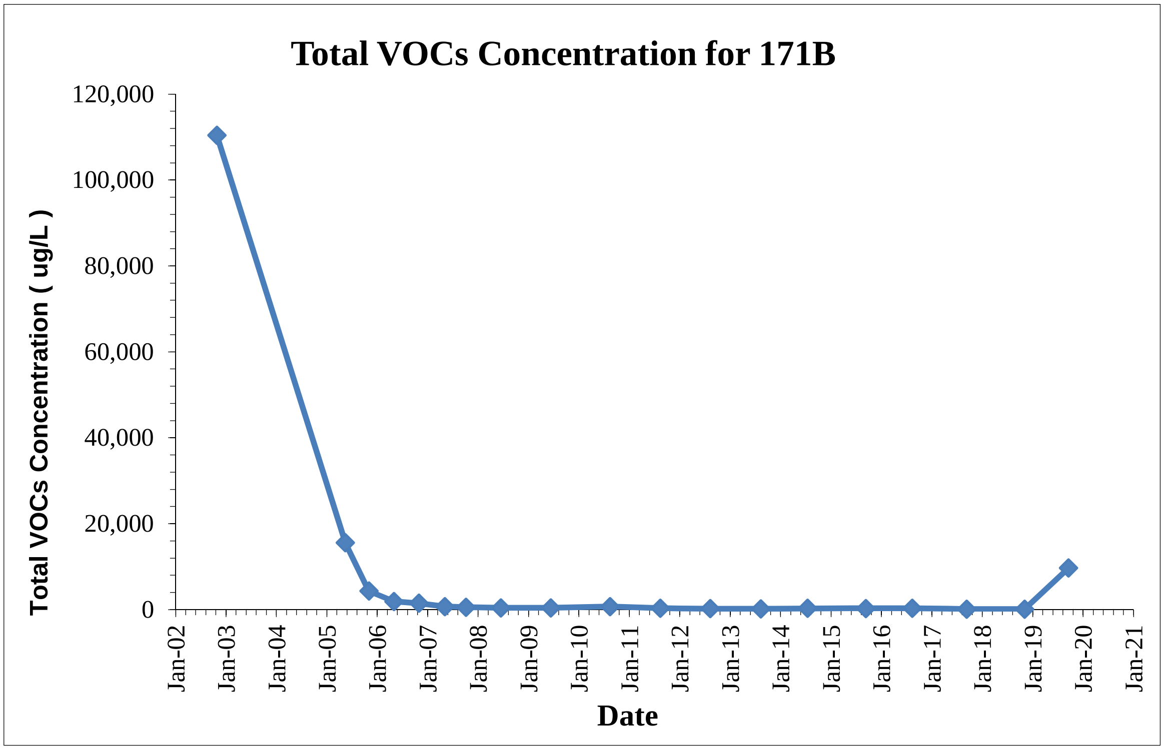

Total VOCs Concentration for 137B
Total VOCs Concentration (ug/L)
2,500
2,000
1,500
1,000
500
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Date

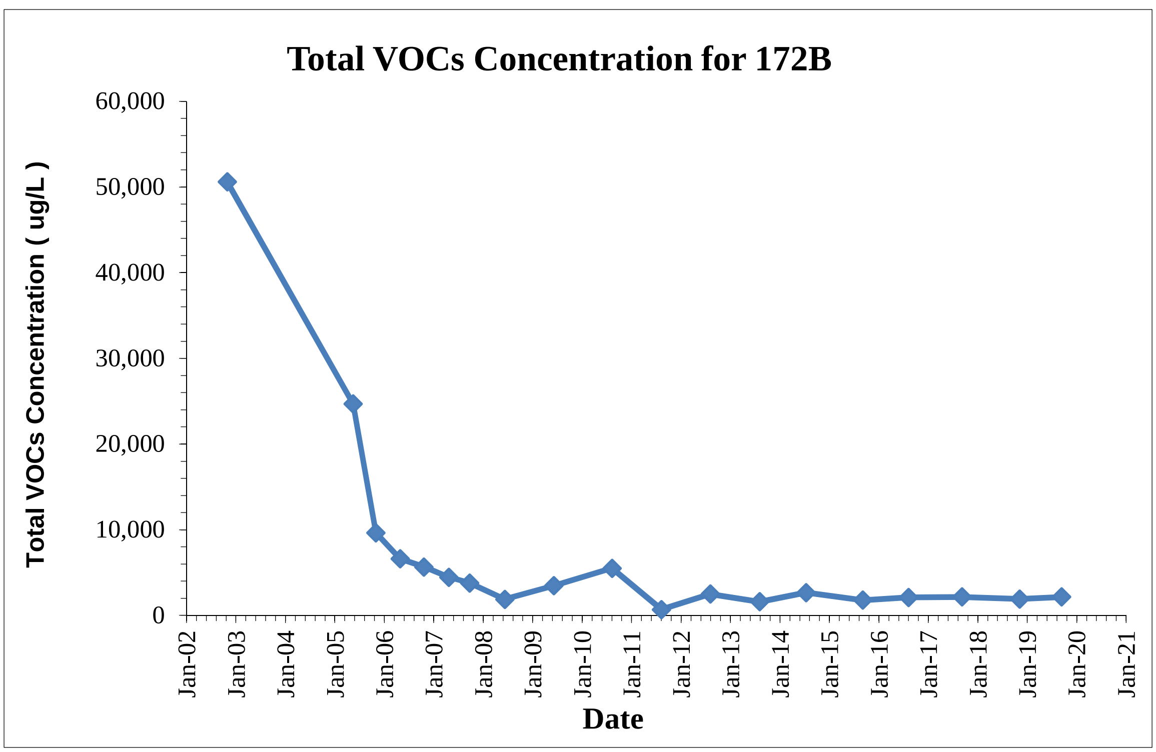

Total VOCs Concentration for 145B
Total VOCs Concentration (ug/L)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Date

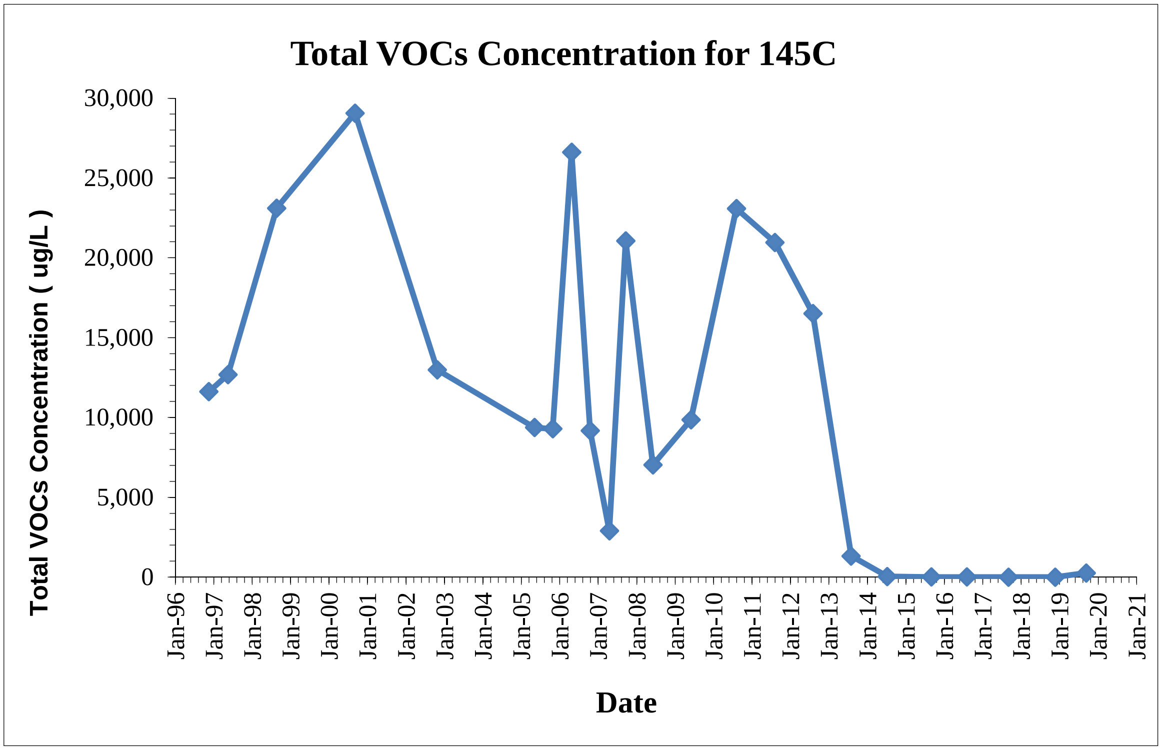

Total VOCs Concentration for 146B
Total VOCs Concentration (ug/L)
120
100
80
60
40
20
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Date

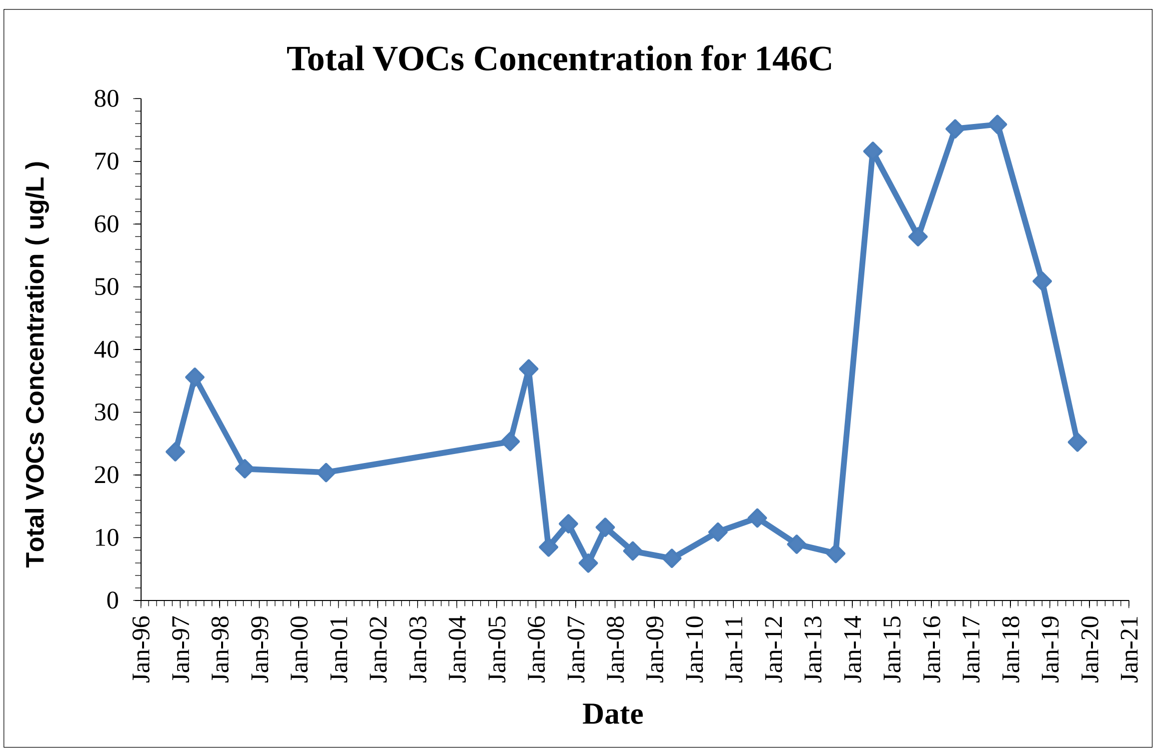

Total VOCs Concentration for 150B
2,500
2,000
1,500
1,000
500
0
Total VOCs Concentration (ug/L)
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Date

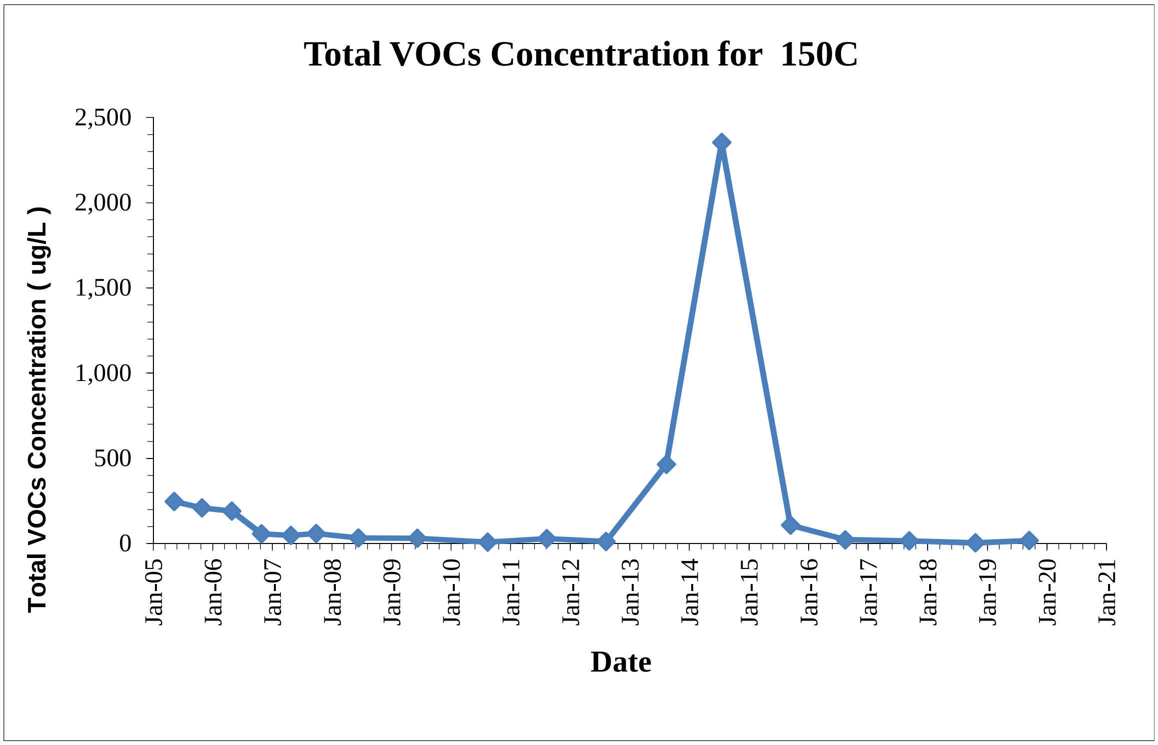

Total VOCs Concentration for 168B
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Total VOCs Concentration (ug/L)
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Date

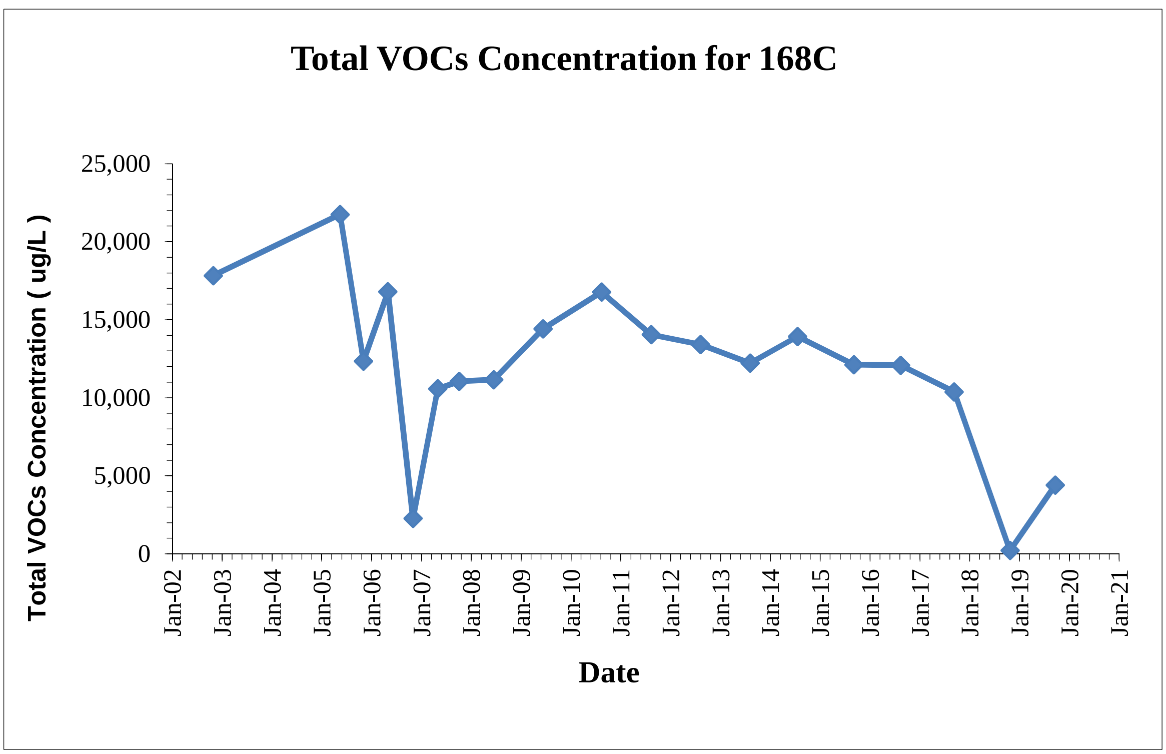

Total VOCs Concentration for 171B
Total VOCs Concentration (ug/L)
120,000
100,000
80,000
60,000
40,000
20,000
0
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Date

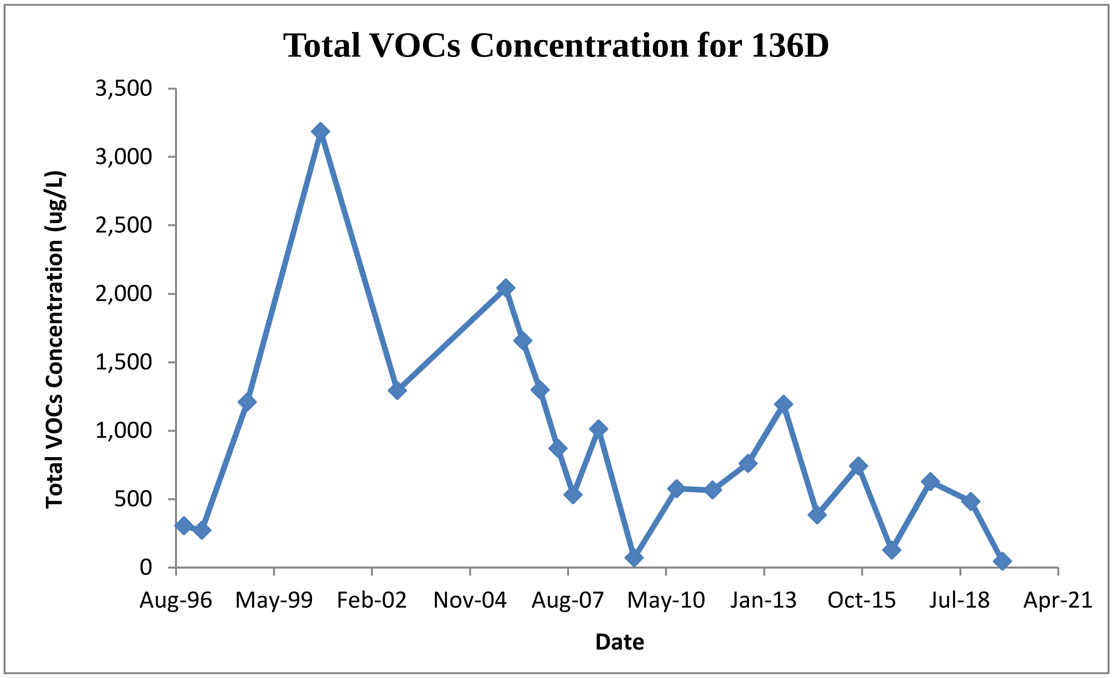

Total VOCs Concentration for 172B
Total VOCs Concentration (ug/L)
60,000
50,000
40,000
30,000
20,000
10,000
0
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Date

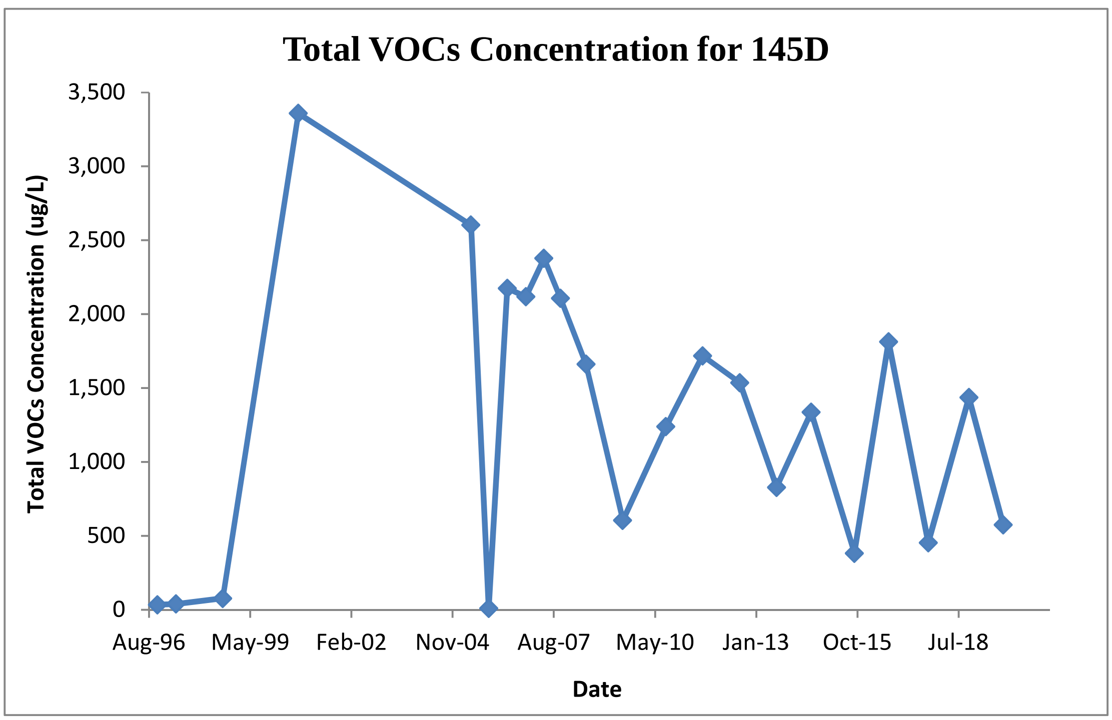

Total VOCs Concentration for 145C
Total VOCs Concentration (ug/L)
30,000
25,000
20,000
15,000
10,000
5,000
0
Jan-96 Jan-97 Jan-98 Jan-99 Jan-00 Jan-01 Jan-02 Jan-03 Jan-04 Jan-05 Jan-06 Jan-07 Jan-08 Jan-09 Jan-10 Jan-11 Jan-12 Jan-13 Jan-14 Jan-15 Jan-16 Jan-17 Jan-18 Jan-19 Jan-20 Jan-21
Date

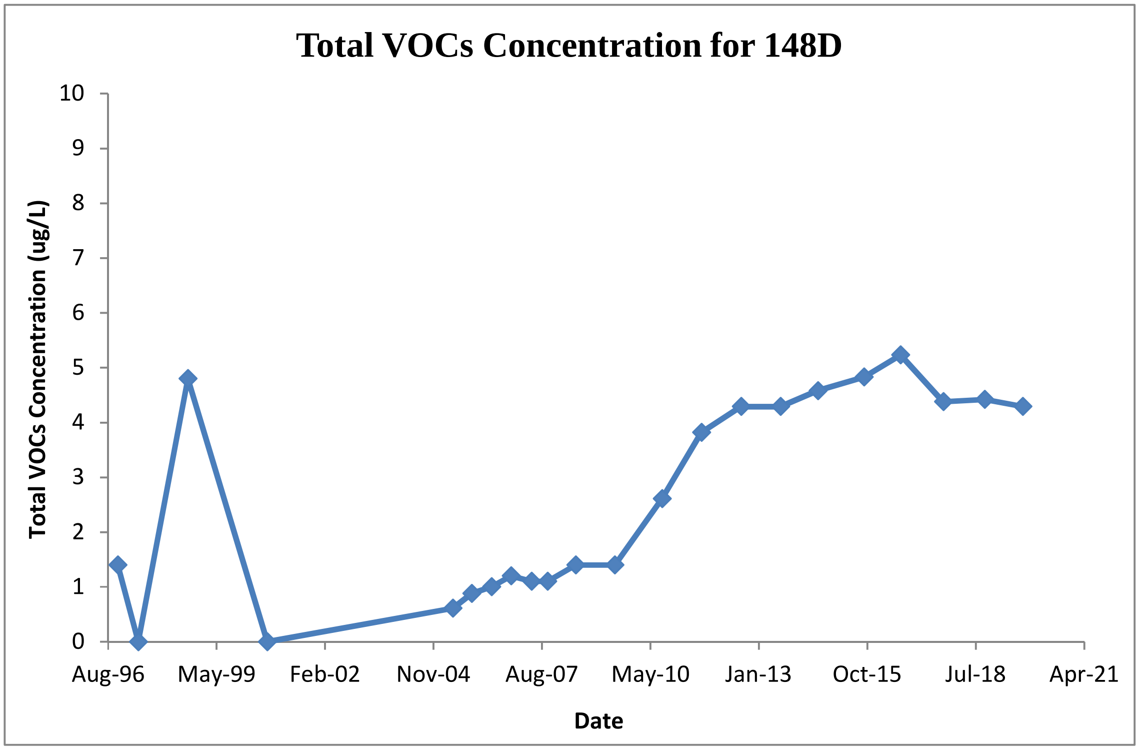

Total VOCs Concentration for 146C
Total VOCs Concentration (ug/L)
80
70
60
50
40
30
20
10
0
Jan-96 Jan-97 Jan-98 Jan-99 Jan-00 Jan-01 Jan-02 Jan-03 Jan-04 Jan-05 Jan-06 Jan-07 Jan-08 Jan-09 Jan-10 Jan-11 Jan-12 Jan-13 Jan-14 Jan-15 Jan-16 Jan-17 Jan-18 Jan-19 Jan-20 Jan-21
Date

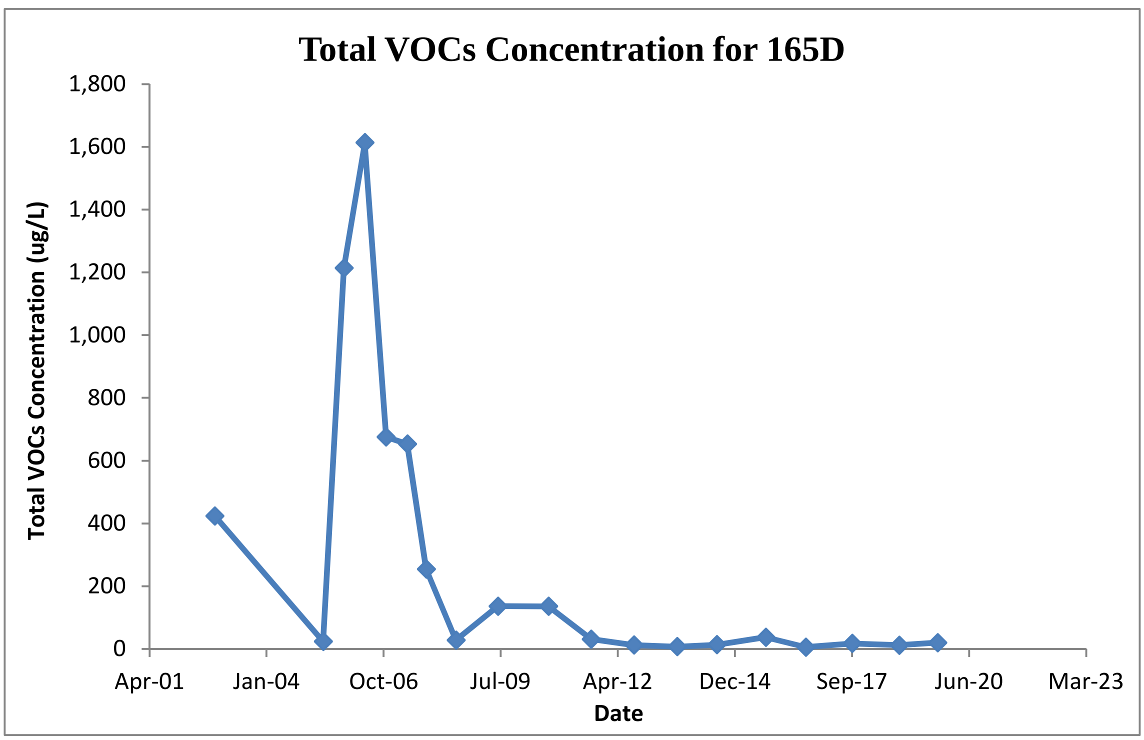

Total VOCs Concentration for 150C
Total VOCs Concentration (ug/L)
2,500
2,000
1,500
1,000
500
0
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Date

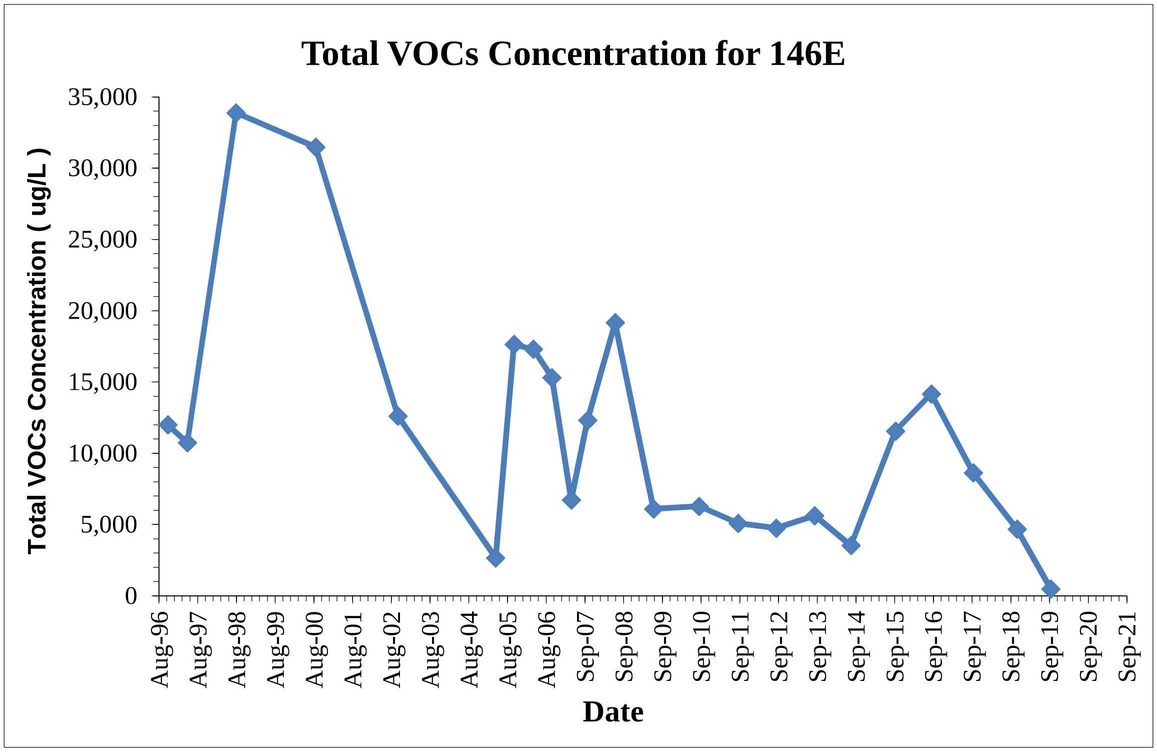

Total VOCs Concentration for 168C
Total VOCs Concentration (ug/L)
25,000
20,000
15,000
10,000
5,000
0
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Date

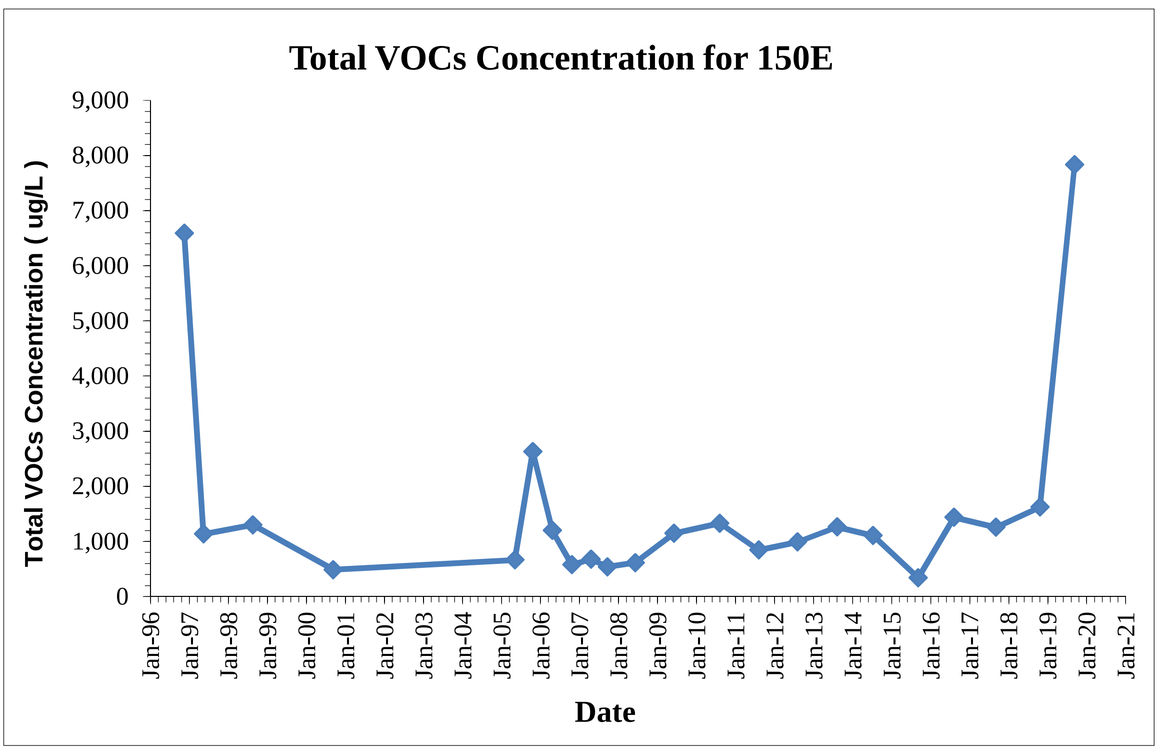

Total VOCs Concentration for 136D
Total VOCs Concentration (ug/L)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Aug-96
May-99
Feb-02
Nov-04
Aug-07
May-10
Jan-13
Oct-15
Jul-18
Apr-21
Date

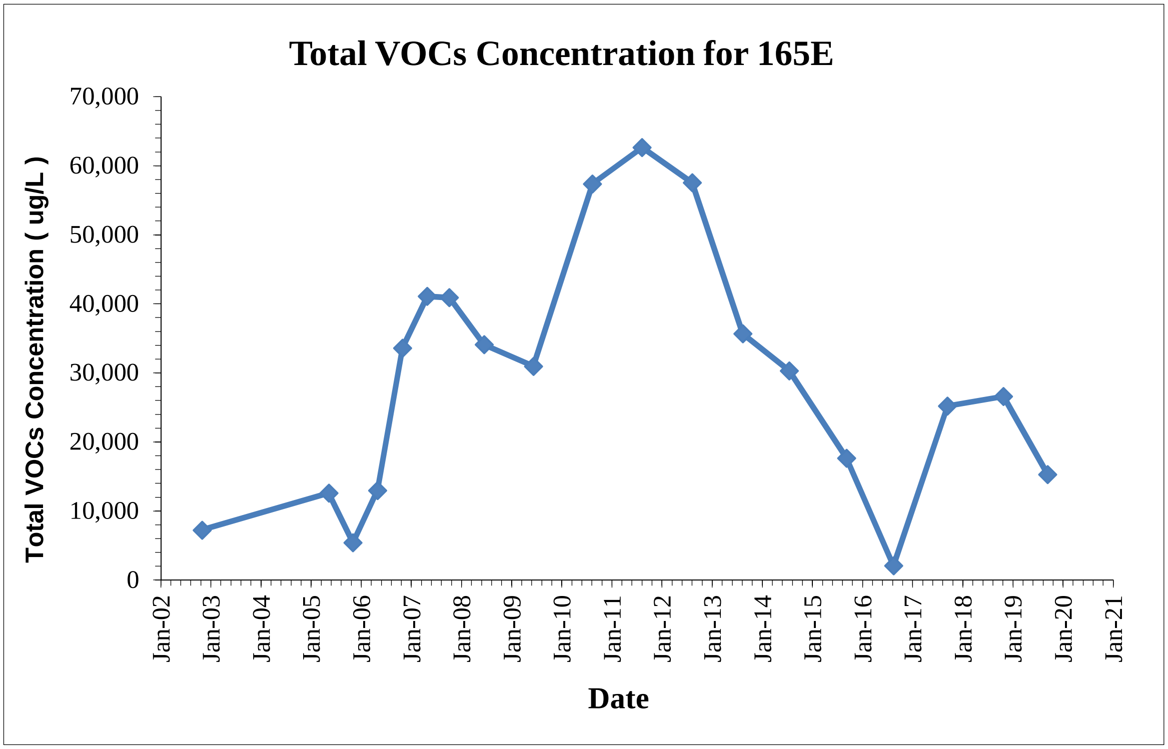

Total VOCs Concentration for 145D
Total VOCs Concentration (ug/L)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Aug-96
May-99
Feb-02
Nov-04
Aug-07
May-10
Jan-13
Oct-15
Jul-18
Date

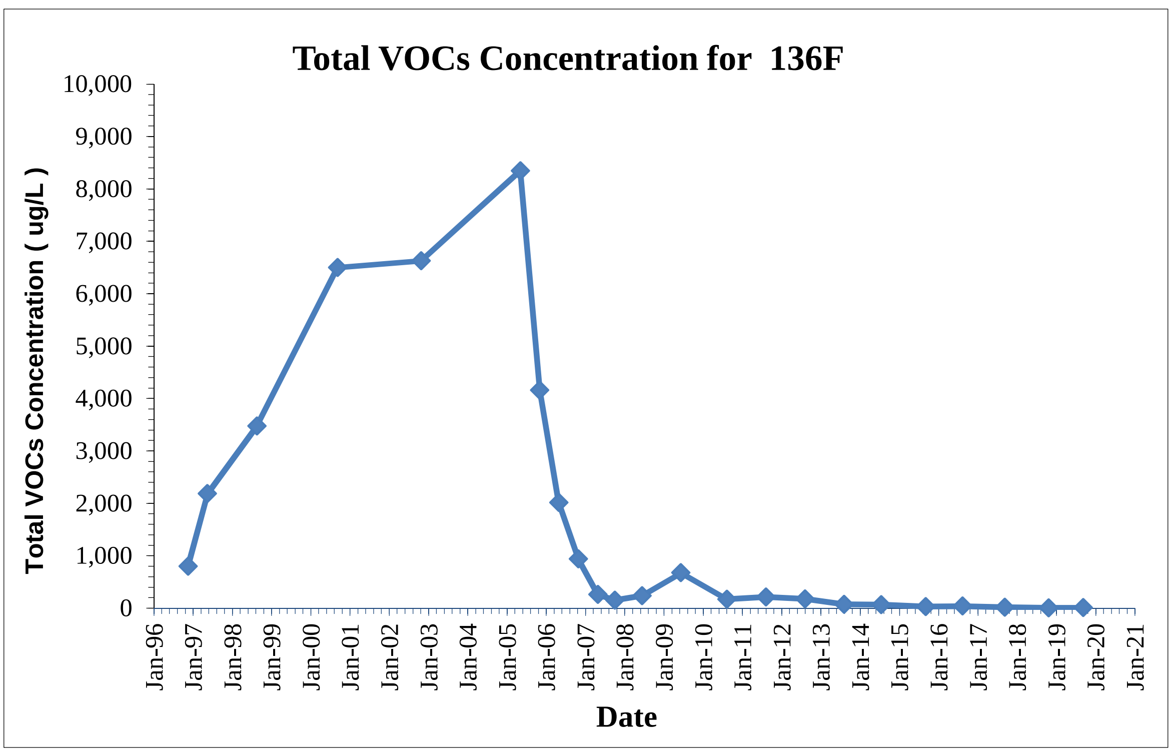

Total VOCs Concentration for 148D
Total VOCs Concentration (ug/L)
10
9
8
7
6
5
4
3
2
1
0
Aug-96
May-99
Feb-02
Nov-04
Aug-07
May-10
Jan-13
Oct-15
Jul-18
Apr-21
Date


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
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Jun-20
Mar-23
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
Aug-96
Aug-97
Aug-98
Aug-99
Aug-00
Aug-01
Aug-02
Aug-03
Aug-04
Aug-05
Aug-06
Sep-07
Sep-08
Sep-09
Sep-10
Sep-11
Sep-12
Sep-13
Sep-14
Sep-15
Sep-16
Sep-17
Sep-18
Sep-19
Sep-20
Sep-21
Date


Total VOCs Concentration for 150E
Total VOCs Concentration (ug/L)
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
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
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
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
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
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Jan-05
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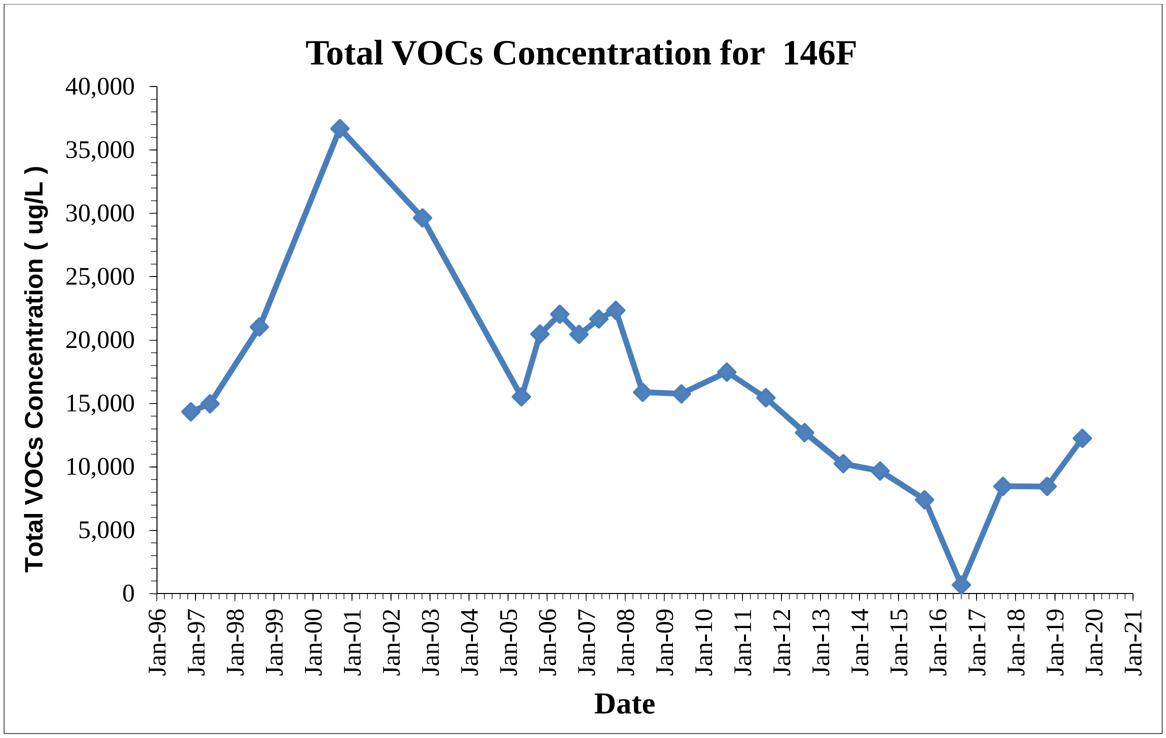
Jan-20
Jan-21
Date


Total VOCs Concentration for 146F
Total VOCs Concentration (ug/L)
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
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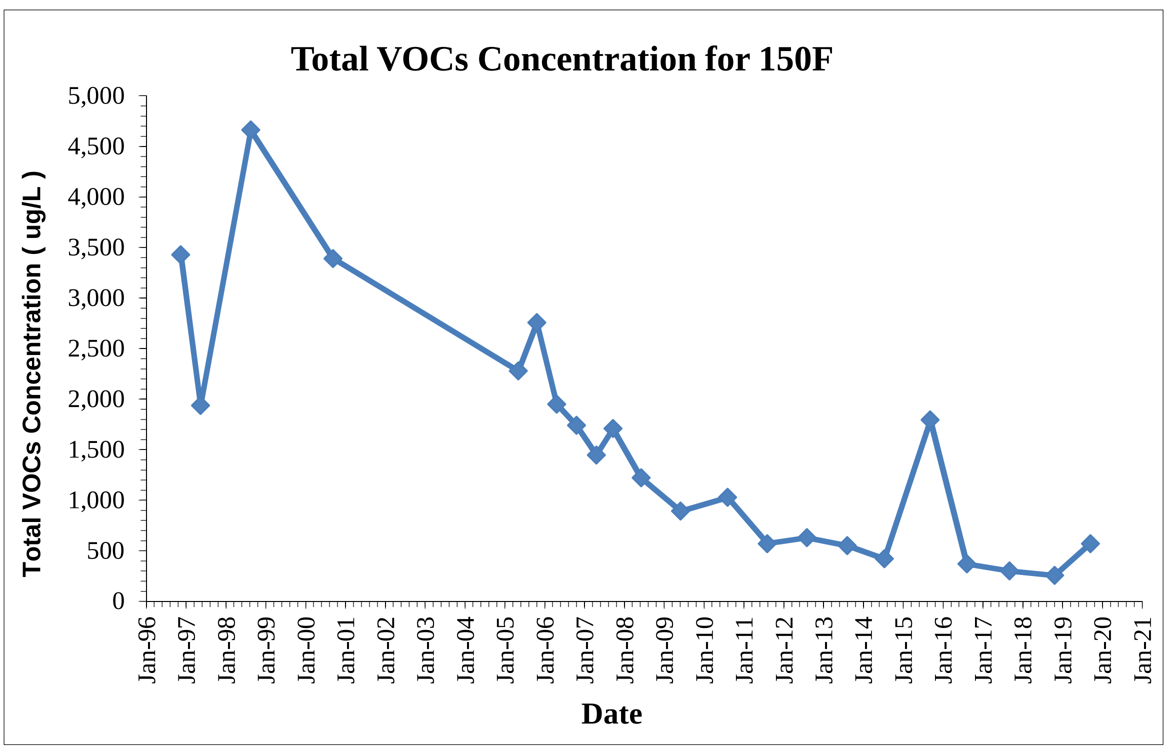
Jan-19
Jan-20
Jan-21
Date


Total VOCs Concentration for 150F
Total VOCs Concentration (ug/L)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
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Jan-19
Jan-20
Jan-21
Date

APPENDIX C

LANDFILL CAP INSPECTION RESULTS (NOVEMBER 2019)

EXHIBIT A
CAP AND SURFACE WATER DRAINAGE
INSPECTION CHECKLIST
NECCO PARK

DATE: 11-26-19
INSPECTOR: Gerald Shepard
WITNESSES: Not Required

EMERGENCY CONTACT: Timothy J. Pezzino
Phone # 716-570-6846

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 Cap or Side Slopes
3F) Very small mice + mole Burrows on Landfill Cap and Side Slopes

DESCRIPTION OF CONCERN:

DESCRIPTION OF REMEDY:

Continued to next page

EXHIBIT B
CAP AND SURFACE WATER DRAINAGE
MAINTENANCE CHECKLIST
NECCO PARK

DATE: 11-26-19
INSPECTOR: Gerald Shepard
WITNESSES: Not Required

EMERGENCY CONTACT Timothy J. Pezzino
Phone# 716-570-6846

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	Contractor-Mowcon	Aug-2019
	5) Gas Vents		
X	- Pipes	John W. Danforth	Aug-2019
	- Bedding and Adjacent Media		
	6) Other		

DESCRIPTION OF MAINTENANCE ACTIVITIES: 4E) Brush hogged And Line Trimmed Landfill Cap, Side Slopes, And Ditch Aug-2019

Continued to next page

EXHIBIT B
CAP AND SURFACE WATER DRAINAGE
MAINTENANCE CHECKLIST
NECCO PARK

DESCRIPTION OF MAINTENANCE ACTIVITIES: 5) All gas vents had minor to major repairs completed.

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