Third Evaluation of Enhanced Attenuation for the Endoline Area Chlorinated Solvent Plume (Revised)

General Motors Tonawanda Engine Plant

Tonawanda, New York

General Motors, LLC

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1. Introduction

On behalf of General Motors, LLC (GM), GHD Services, Inc. (GHD) has completed the third round of groundwater monitoring as part of the Enhanced Attenuation (EA) program to address the Endoline Area chlorinated solvent plume at the GM Tonawanda Engine Plant located in Tonawanda, New York (Site). New York State Department of Environmental Conservation (NYSDEC) Spill Number 9875474 has been assigned to this Site.

1.1 Background

GHD conducted investigation activities to delineate the chlorinated solvent plume and performed a remedial technology evaluation to identify feasible remedial options for the Endoline Area. GHD submitted the "Report of Findings for the Supplemental Phase I and Phase II of the Endoline Area Chlorinated Solvent Subsurface Investigation" to the NYSDEC on July 1, 2008. Based on the results of the investigation and remedial technology evaluation, monitored natural attenuation (MNA) was the recommended remedial alternative. The NYSDEC approved the report and agreed with the selection of MNA as the remedial alternative for the Site in a letter dated July 9, 2008.

The first MNA groundwater monitoring program was completed between October 2008 and April 2010. An evaluation of the effectiveness of the MNA remedy was prepared and submitted to the NYSDEC in October 2010. The evaluation recommended the implementation of an In Situ Enhanced Biodegradation (ISEB) program to promote attenuation consisting of the application of a carbon source and an additional 2 years of monitoring followed by an evaluation.

A work plan for implementation of the ISEB program was submitted to the NYSDEC in February 2011. The NYSDEC approved the work plan in a letter dated March 14, 2011. Baseline sampling was completed in April 2011, and the injection program was completed in September 2011, followed by 2 years of post-injection monitoring. Samples were also collected annually to monitor the concentrations of residual petroleum compounds in monitoring wells MW-2, MW-3, MW-4, and MW-5.

An evaluation of the ISEB program was prepared and submitted to NYSDEC in August 2014. The evaluation report recommended a second round of injections followed by another 2 years of monitoring and evaluation. The NYSDEC approved the injections in an email dated May 15, 2015.

The second round of ISEB injections was completed in November and December 2015. Monitoring events were completed at 90- and 180-days post-injection with the 180-day event being the first semi-annual event. The four semi-annual events were completed in May 2016, November 2016, May 2017, and November 2017. In addition to the second round of post-injection monitoring, samples were also collected in May of 2016 to monitor the concentrations of residual petroleum compounds in monitoring wells MW-2, MW-3, MW-4, and MW-5.

GHD submitted a second evaluation report dated February 2018, which recommended annual sampling for the chlorinated solvent and MNA parameters and elimination of the petroleum monitoring. The NYSDEC approved the annual groundwater monitoring and the elimination of the petroleum monitoring in a letter dated September 30, 2019.

Annual groundwater monitoring was completed in October 2018, October 2019, and October 2020. This report summarizes the groundwater monitoring for these three annual events and evaluates the ISEB program to date.

2. Groundwater Sampling Program

The groundwater sampling program was designed to monitor the attenuation of the chlorinated solvent contamination and monitor migration of the chlorinated solvent plume.

Groundwater monitoring wells MW-2, MW-11, and MW-12, located within the chlorinated solvent plume, were sampled to monitor the progress of attenuation. Monitoring wells MW-1, MW-9, MW-101, MW-102, and MW-103 were sampled to monitor the plume migration. Groundwater monitoring well locations are shown on Figure 1.

The groundwater samples collected from MW-2, MW-11, and MW-12 were analyzed for Target Compound List (TCL) volatile organic compounds (VOCs), and the following natural attenuation parameters:

1. Total organic carbon (TOC)
2. Chemical oxygen demand (COD)
3. Biological oxygen demand (BOD)
4. Sulfate
5. Sulfide
6. Nitrate
7. Nitrite
8. Orthophosphate phosphorus
9. Total heterotrophic microbial count
10. Total 1,1,1-TCA-specific microbial count
11. Alkalinity
12. Methane
13. Ethane
14. Total nitrogen (as ammonia)

Table 1 presents analytical results for the sampling conducted at plume monitoring wells MW-2, MW-11, and MW-12 between April 2011 and October 2020.

The groundwater samples collected from perimeter monitoring wells MW-1, MW-9, MW-101, MW-102, and MW-103 were analyzed for TCL VOCs to monitor plume migration. The analytical results for the plume migration monitoring conducted between April 2011 and October 2020 are presented on Table 2.

The data were validated by GHD. Application of quality assurance criteria was consistent with "National Functional Guidelines for Superfund Organic Methods Data Review," United States Environmental Protection Agency (USEPA)-540-R-2016-002, September 2016, and "National Functional Guidelines for Inorganic Superfund Methods Data Review," USEPA-540-R-2016-001, September 2016. The data were found to exhibit acceptable levels of accuracy and precision with the qualifiers noted on the tables. The data validation reports are included as Appendix A.

3. Monitoring Results

3.1 Chlorinated Volatile Organic Compounds

The data for 1,1,1-trichloroethane (1,1,1-TCA) at monitoring well MW-2 demonstrates a greater than 99% reduction from 12,000 µg/L in April 2011 to 29 µg/L (avg) in October 2020. The 1,1,1-TCA data for well MW-11 show a 66% reduction (730 µg/L to 250 µg/L) at MW-11.

1,1,-Dichlororethane (1,1-DCA) continues to be the only chlorinated solvent detected at well MW-12. The concentration has remained stable during the 2011 to 2020 monitoring period.

The daughter/breakdown product concentrations at wells MW-2 and MW-11 have increased, as expected, and are now exhibiting a downward trend as they convert to ethane.

These data are shown in Table 1 and graphically on Figures 2 through 5 for MW-2, Figures 6 through 9 for MW-11, and Figures 10 through 13 for MW-12.

3.2 Dissolved Gases

The dissolved gases monitored in the groundwater included ethane, which is the final product of the anaerobic biodegradation of 1,1,1-TCA, and methane, which is produced under strictly anaerobic conditions. Methane is an indicator that highly anaerobic conditions have been established.

The ethane and methane concentrations at well MW-2 both remain high.

Methane concentrations have remained stable since 2018 at MW-11. The ethane concentration is low but detectable at MW-11 indicating that biodegradation continues at a low level at this location.

The ethane and methane concentrations increased significantly from after the second injection at MW-12. The ethane concentration has remained stable, while the methane concentration has decreased from an average of 3,550 µg/L in October 2018 to 2,400 µg/L in October 2020.

3.3 Natural Attenuation Parameters

Alkalinity did not change during the monitoring period in any of the monitoring wells. Nitrate and nitrite were not detected above their detection limits in any of the wells either before or after EVO treatment, which indicates that the conditions were anaerobic.

Concentrations of ammonia nitrogen increased after the EVO injection events, particularly in well MW-2, but have decreased in the last 3 years. Ammonia nitrogen is currently present at 4.3 µg/L in well MW-2, 140 µg/L in well MW-11, and 900 µg/L in well MW-12. These levels are sufficient to sustain microbial activity at a low level.

Orthophosphate-phosphorus remained present at low concentrations throughout the monitoring period. Increased concentrations were not observed after injection events. Low levels of orthophosphate are required for microbial activity so the low phosphate may have limited microbial growth.

BOD, COD, and TOC all showed increases in well MW-2 after each injection event and have decreased in the last 3 years. TOC is currently present at 29 mg/L in well MW-2, 6.9 mg/L in well MW-11, and 14 mg/L in well MW-12. These concentrations may sustain a low level of ongoing biodegradation.

The sulfate concentration at well MW-2 was low initially (5.6 mg/L) and decreased further to non-detect levels. Sulfate has continued to fluctuate between low and non-detect levels in well MW-2. Sulfide was detected in well MW-2 during some monitoring events. Sulfate is significantly higher in wells MW-11 and MW-12. Sulfate is reduced to sulfide under anaerobic conditions; therefore, the sulfate/sulfide data suggested that anaerobic conditions were established at well MW-2, more so than at MW-11 and MW-12.

Total aerobic and anaerobic microbial counts increased in well MW-2 after each of the injection events but then stabilized. Microbial counts remain at a similar level through the October 2020 monitoring event. These microbial numbers suggest that biodegradation is ongoing. The 2020 microbial counts were much lower for wells MW-11 and MW-12 and suggest that biodegradation is not proceeding as quickly in these wells.

3.4 Field Parameters

At well MW-2, the pH remained in the neutral range throughout the monitoring periods after both injection events showing that the EVO injection did not cause a drop in pH. Dissolved oxygen (DO) and oxidation-reduction potential (ORP) in well MW-2 were low before the injection events and have remained low throughout the monitoring period indicating that conditions are naturally anaerobic in this well. pH has also been maintained in the neutral range in wells MW-11 and MW-12. More fluctuations in DO and ORP have been observed in these wells than in well MW-2, however, DO has generally been low and ORP in the low negative to low positive range indicating that conditions are fairly anaerobic in these wells.

3.5 Plume Migration

A review of the VOC data for perimeter monitoring wells MW-1, MW-9, MW-101, MW-102, and MW-103 shows that there are no detections of 1,1,1-TCA or associated daughter/breakdown products in any of the perimeter wells. This indicates that the plume is stable and not migrating.

4. Conclusions and Recommendations

4.1 Conclusions

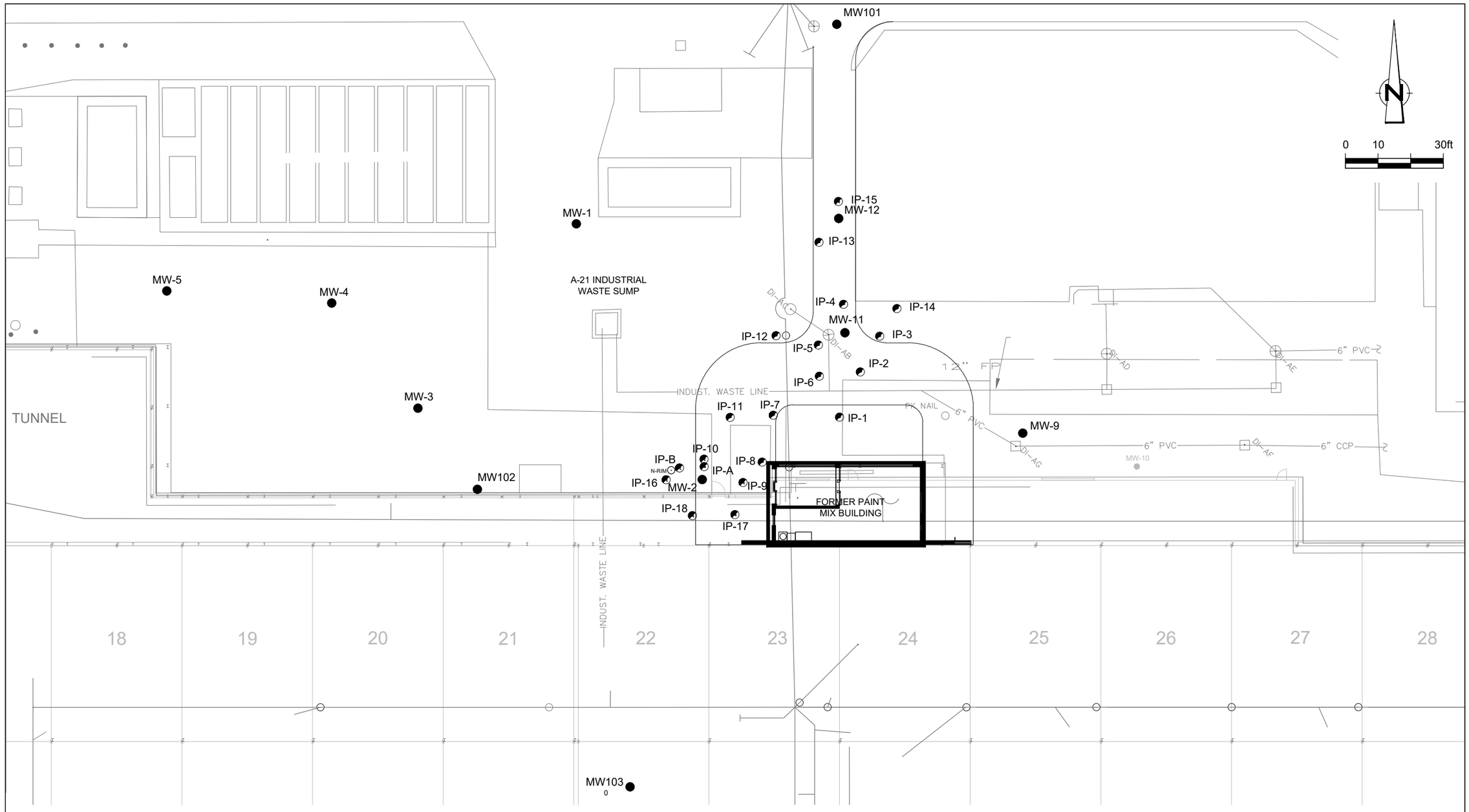
The plume well data continues to show that biodegradation is still occurring at a slow rate, and the soil conditions remain sufficient enough for anaerobic biodegradation to continue. The perimeter well data continues to confirm that the tight clay soils continue to prevent migration of the plume.

4.2 Recommendations

Conditions in the wells appear to be stable and no changes have been observed over the last 3 years, aside from a slow decrease in chlorinated solvents. Since the degradation is continuing slowly, and there is no contaminant migration, GHD is recommending reducing the frequency of monitoring to a triennial basis. Sampling will be completed in October 2023, 2026, and 2029. The monitoring parameters for the plume wells MW-2, MW-11, and MW-12 are presented on Table 3. Samples from the perimeter wells, MW-1, MW-9, MW-101, MW-102, and MW-103 will only be analyzed for the VOC parameters listed on Table 3.

GHD will evaluate the effectiveness of the remedy after each triennial event.

Figures



LEGEND

MW-1 ● MONITORING WELL LOCATION

IP-11 ◐ INJECTION WELL LOCATION

EXTENT OF GROUNDWATER CONTAMINATION

figure 1

WELL LOCATIONS
ENHANCED ATTENUATION AT THE ENDOLINE AREA CHLORINATED SOLVENT PLUME
GENERAL MOTORS COMPANY TONAWANDA ENGINE PLANT
Tonawanda, New York

17390-00(009)GN-BU001 DEC 11/2020

Figure 2. Concentration Versus Time Plot for Well MW-2

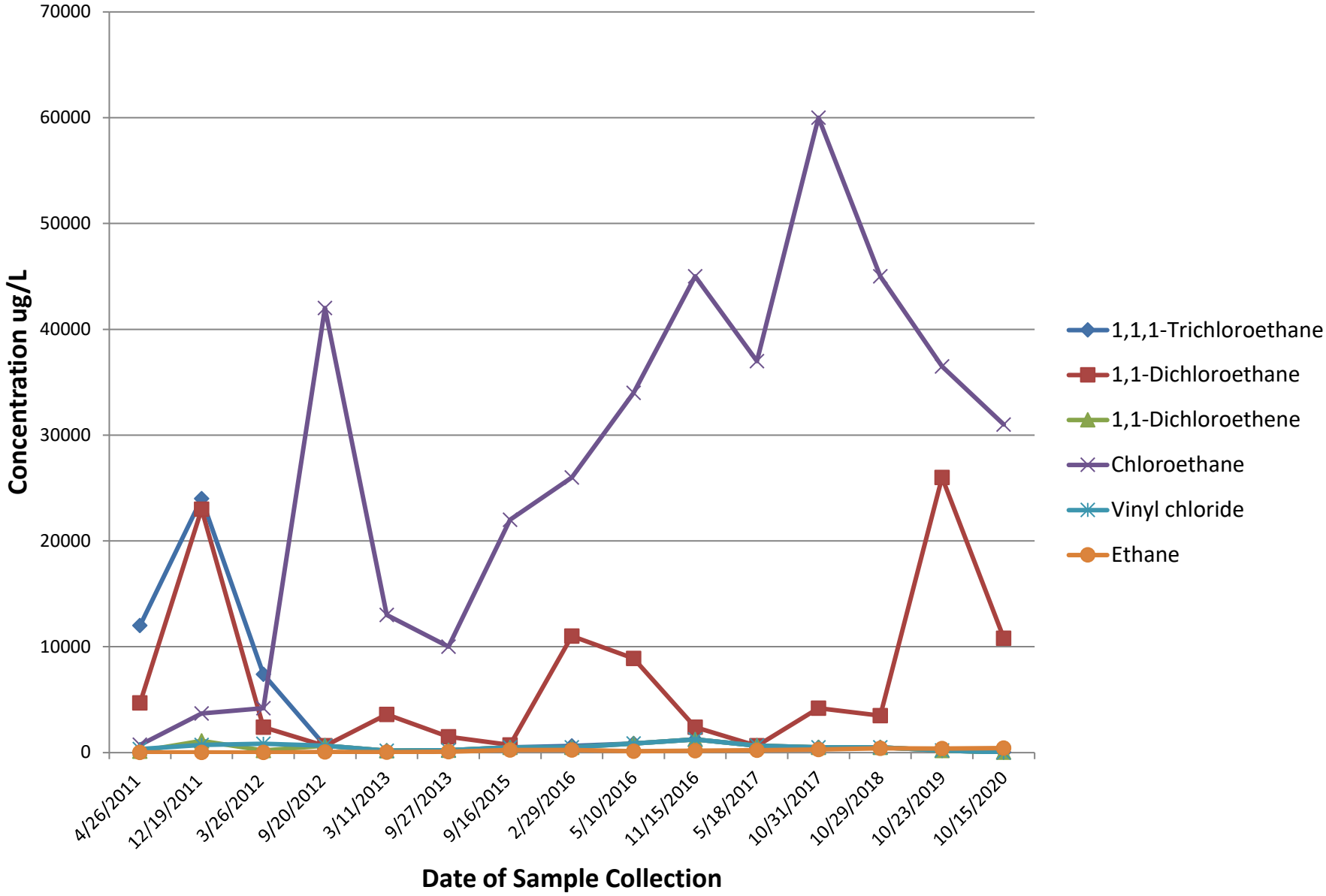


Figure 3. Concentration Versus Time Plot for Well MW-2

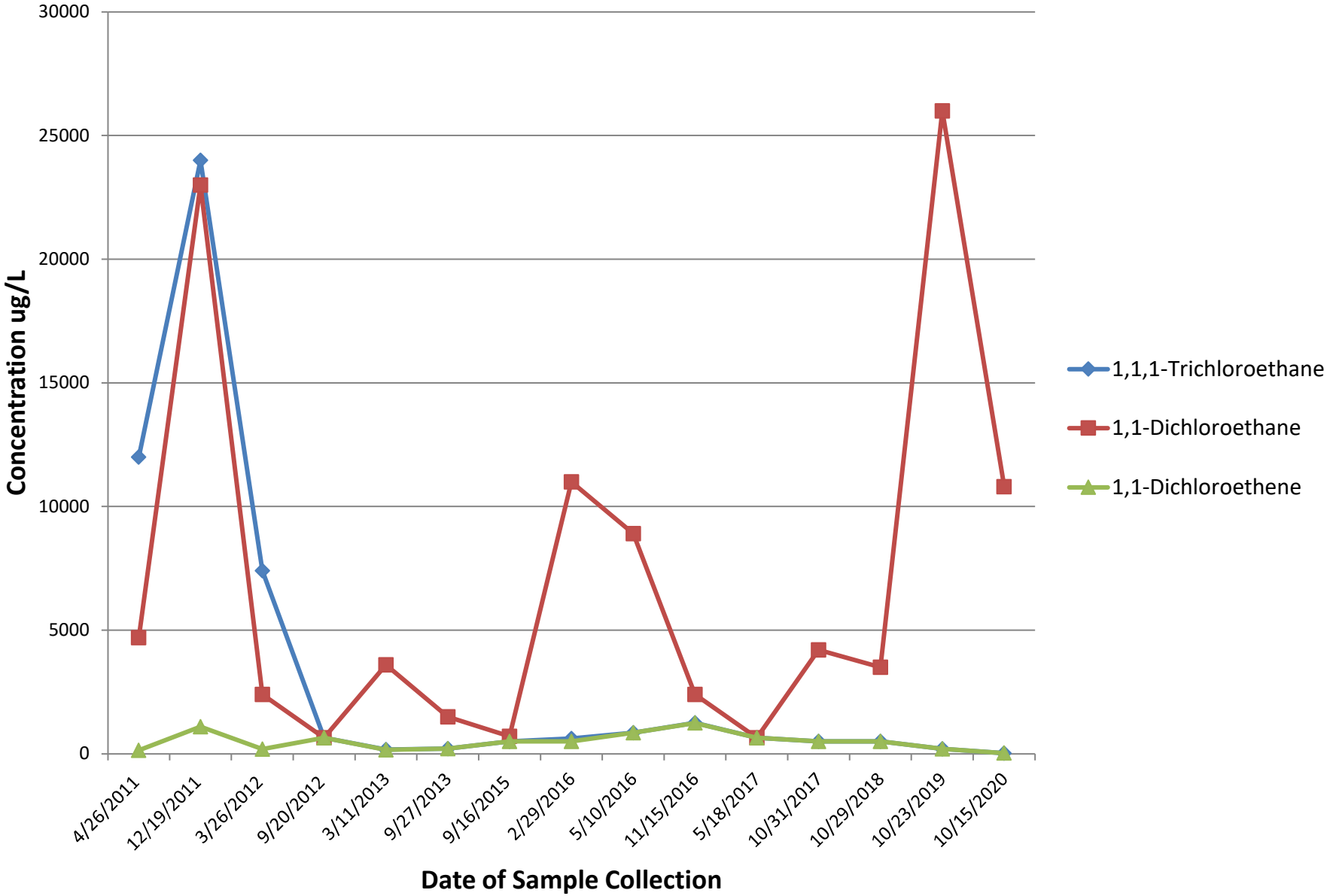


Figure 4. Concentration Versus Time Plot for Well MW-2

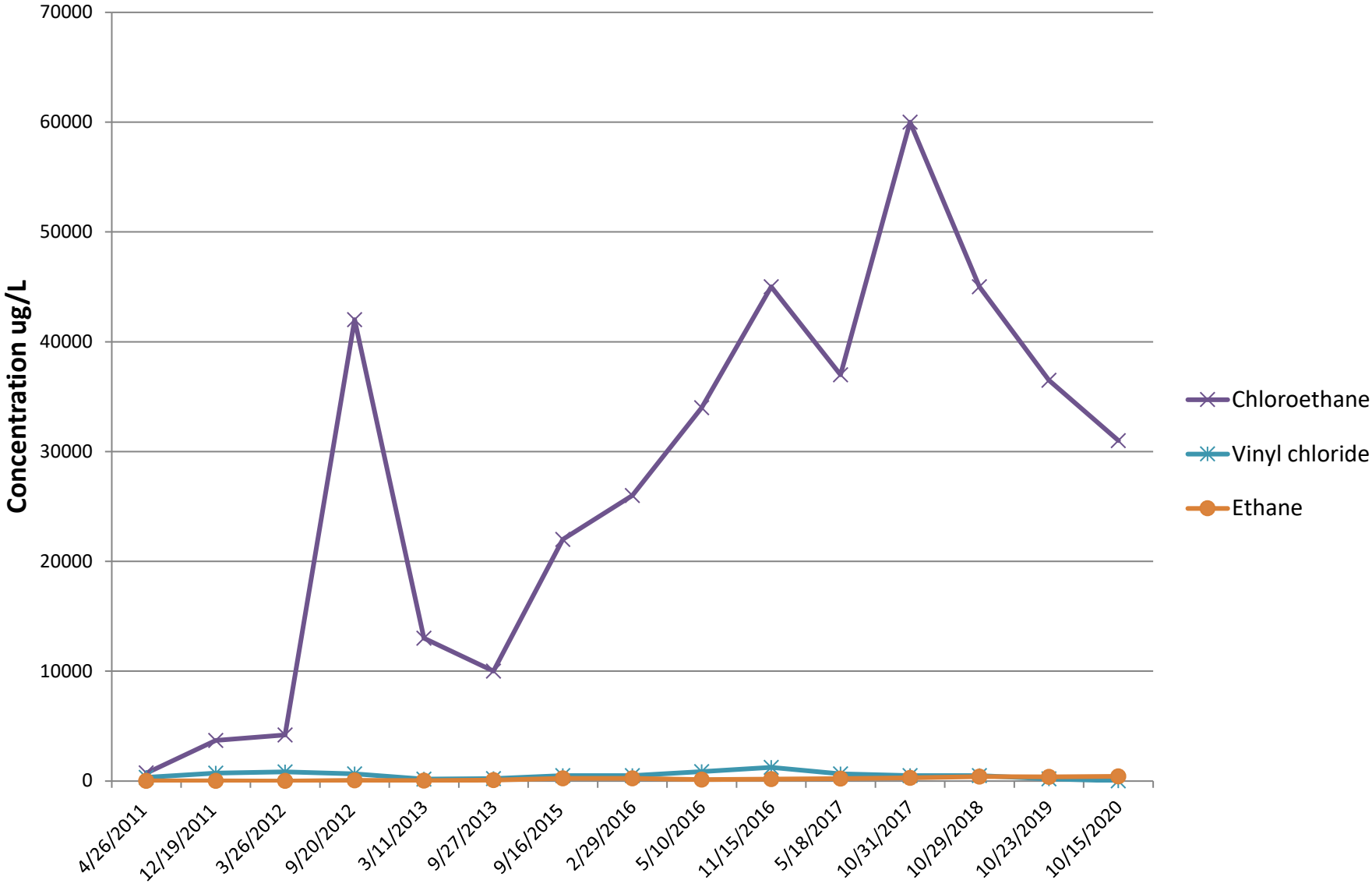


Figure 5. Concentration Versus Time Plot for Well MW-2

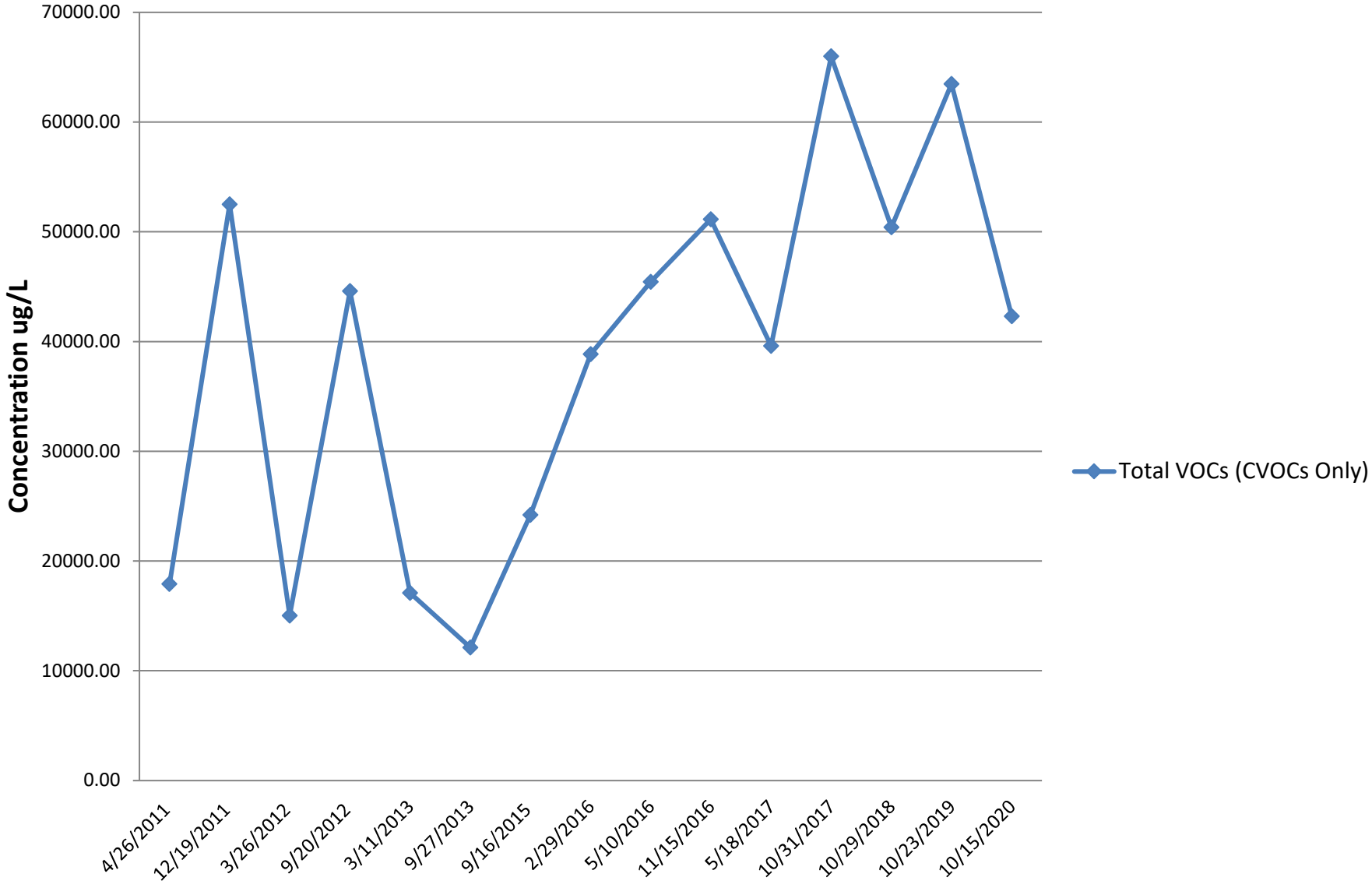


Figure6. Concentration Versus Time Plot for Well MW-11

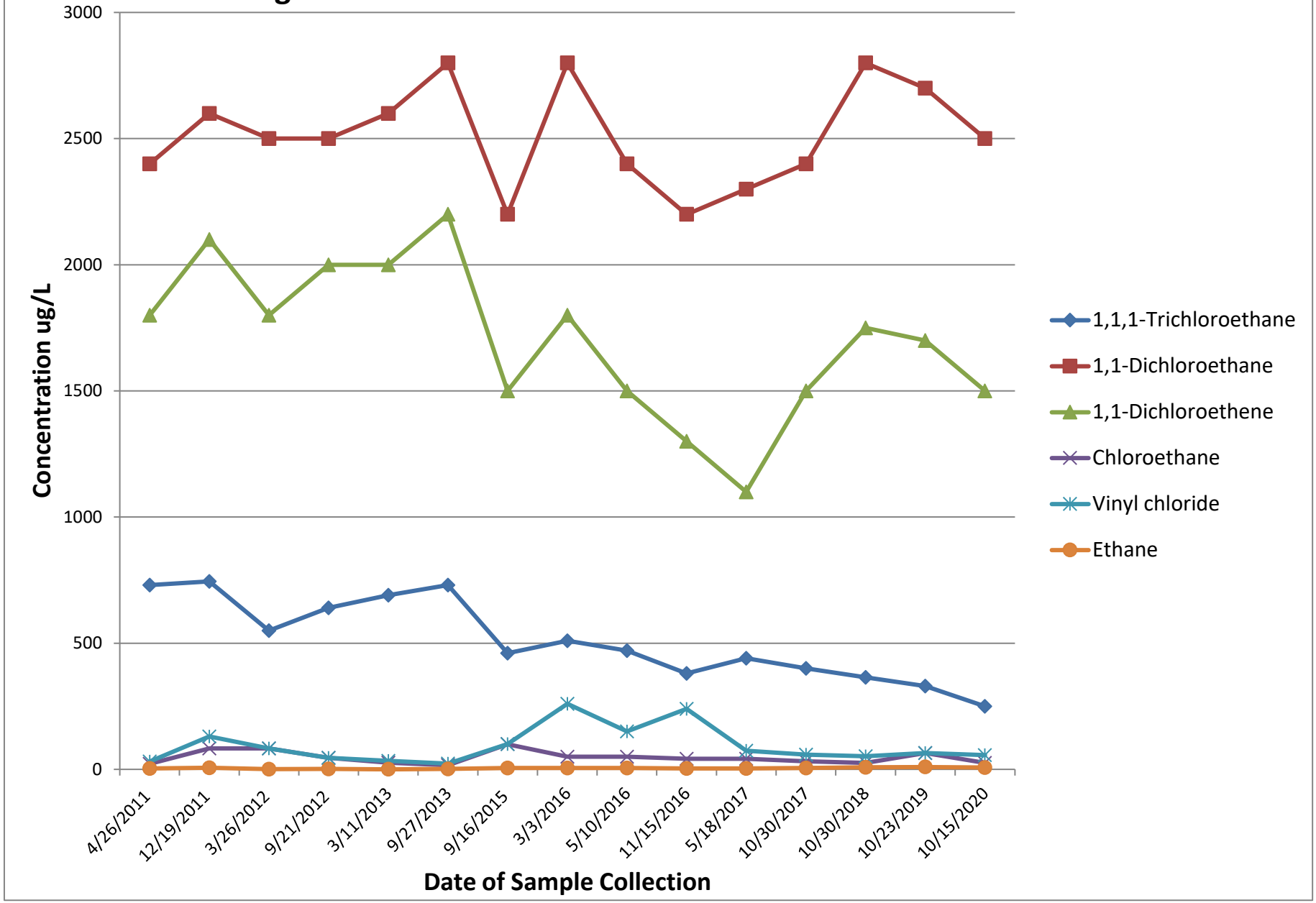


Figure 7. Concentration Versus Time Plot for Well MW-11

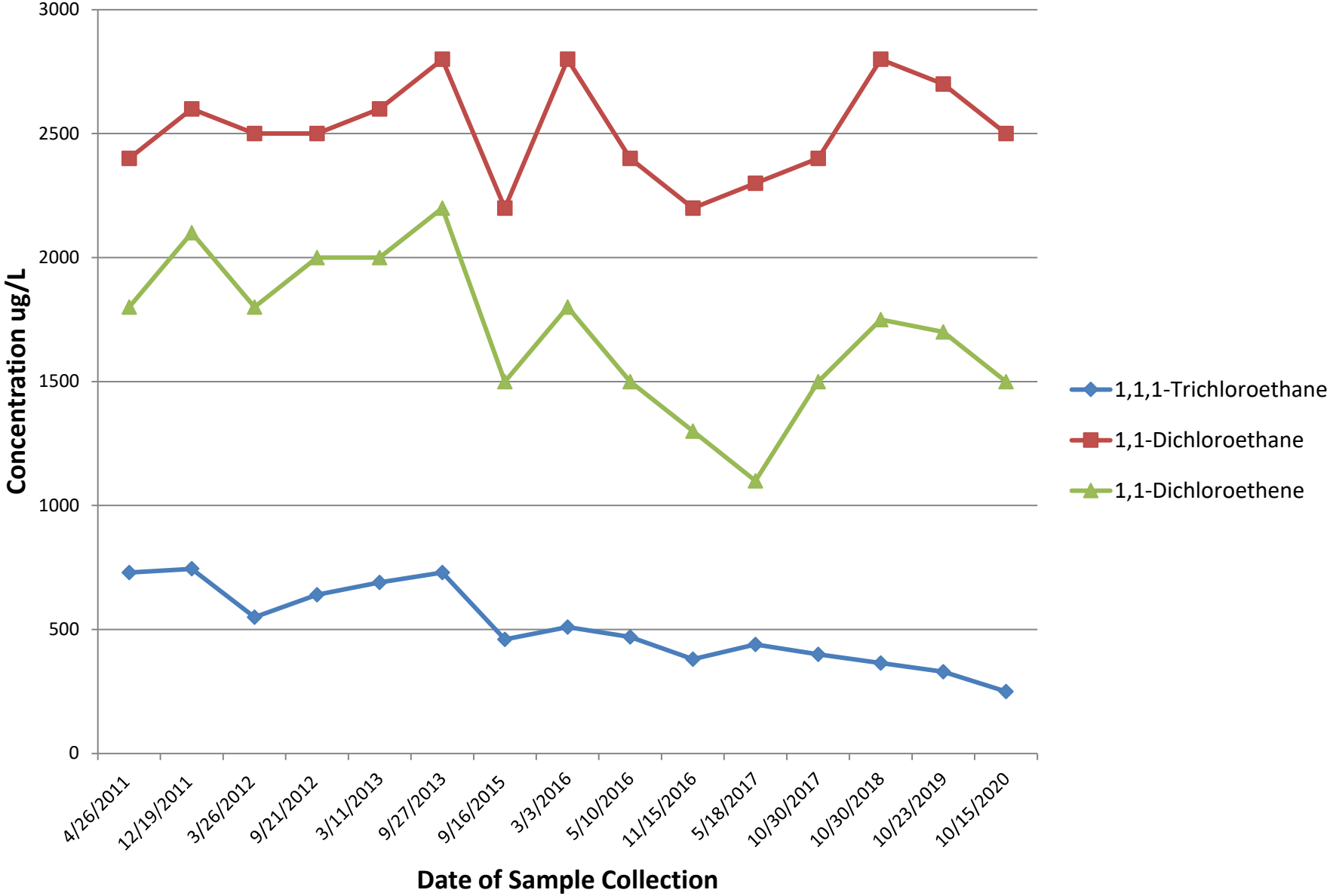


Figure 8. Concentration Versus Time Plot for Well MW-11

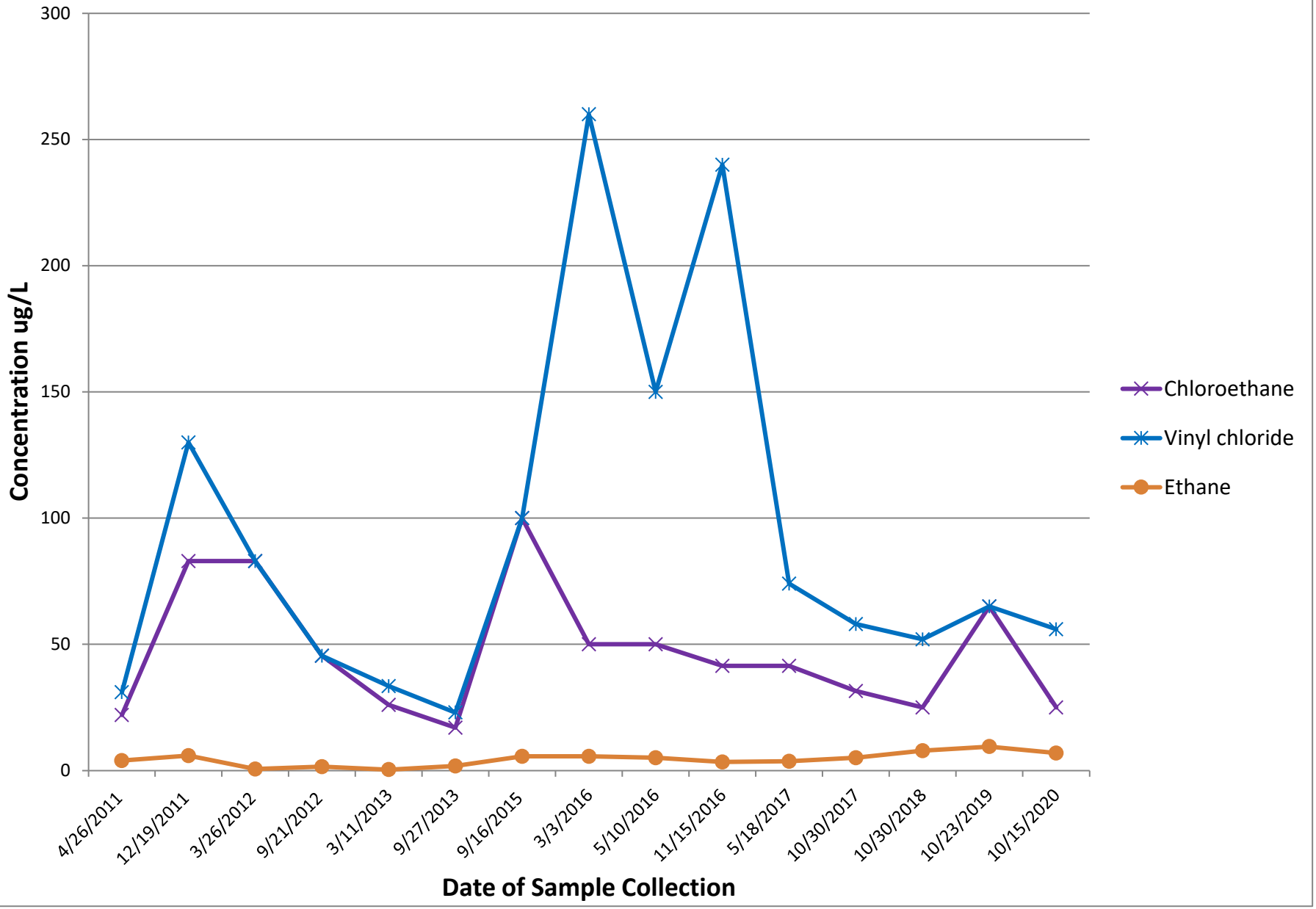


Figure 9. Concentration Versus Time Plot for Well MW-11

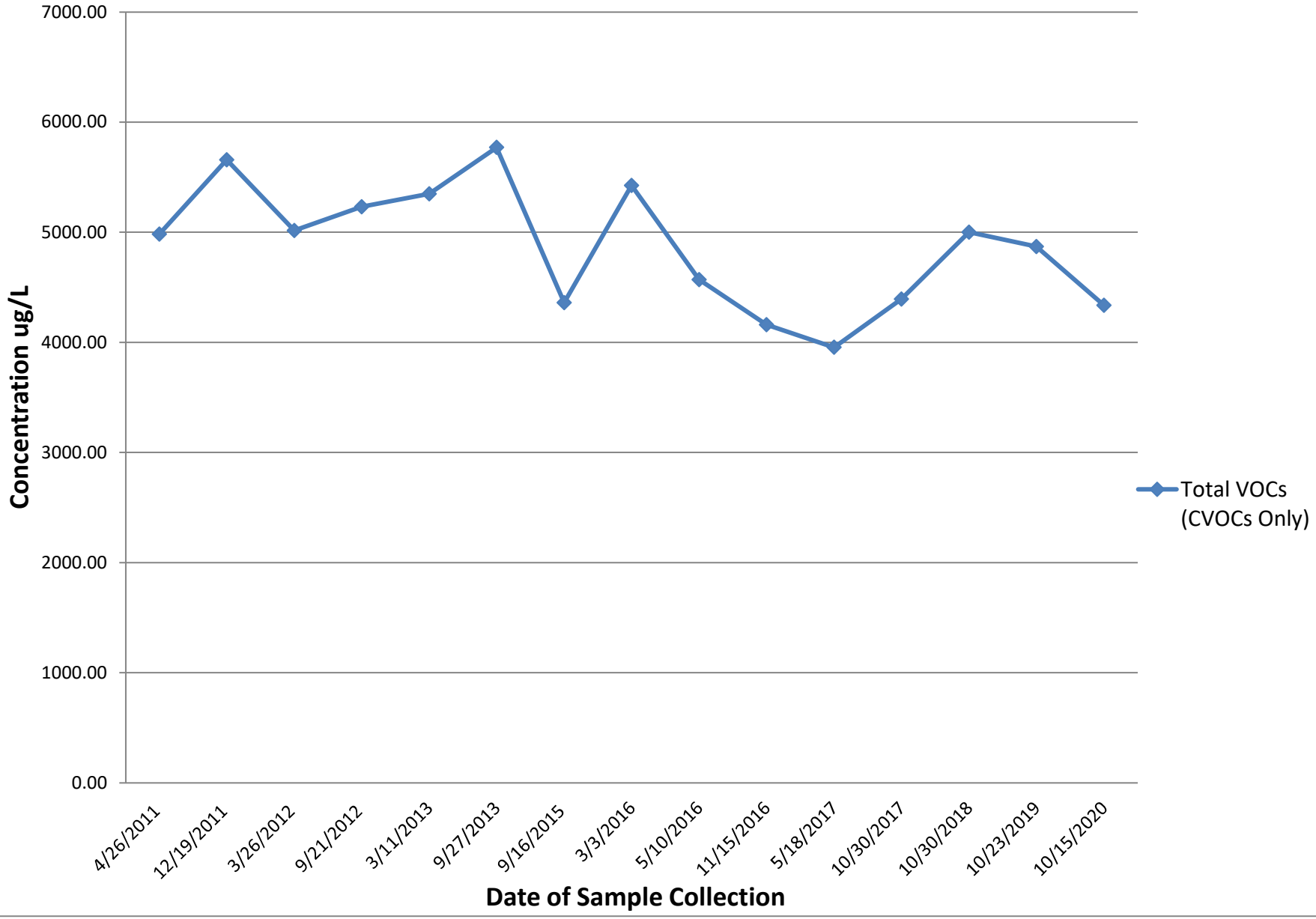


Figure 10. Concentration Versus Time Plot for Well MW-12

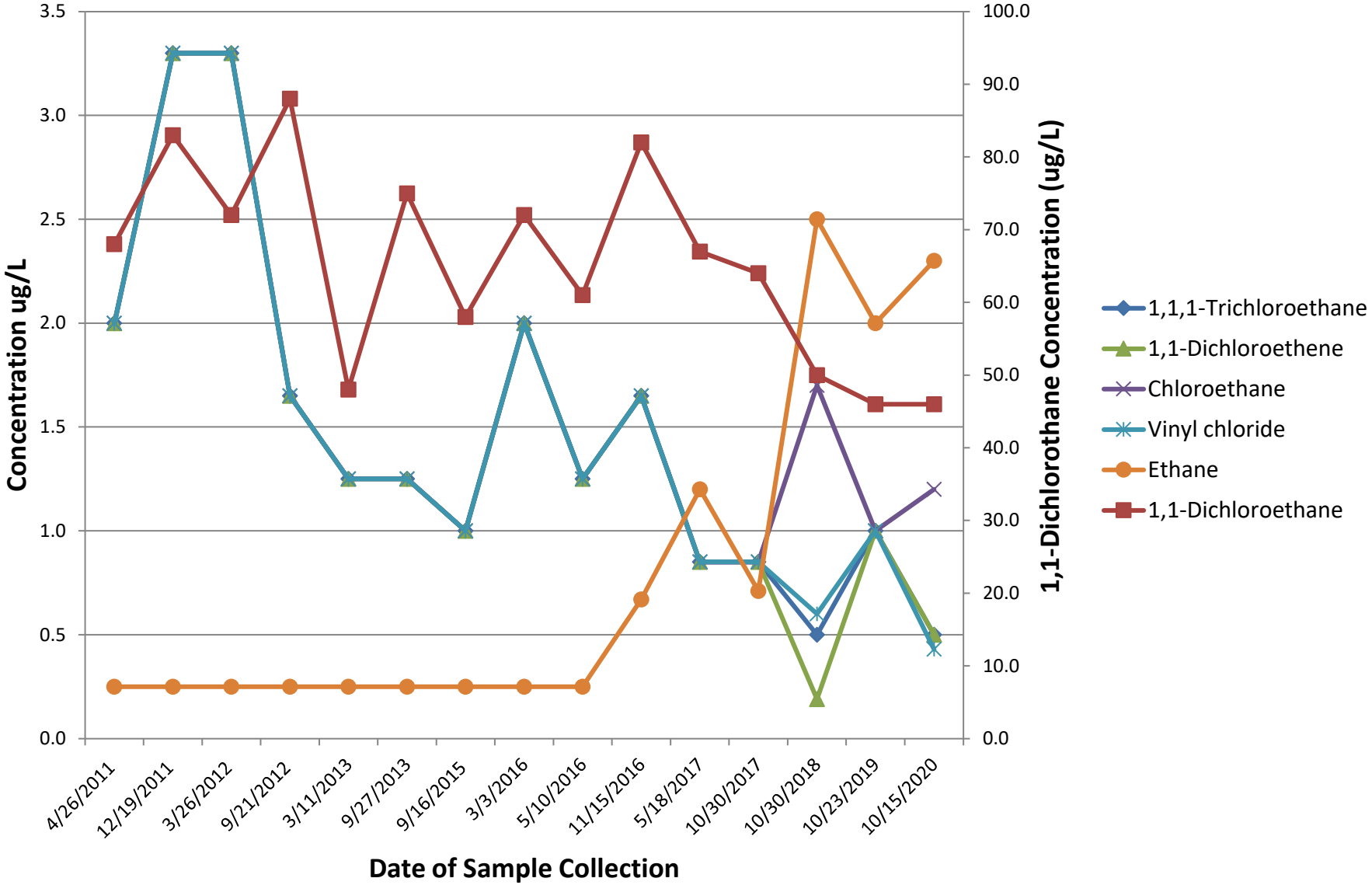


Figure 11. Concentration Versus Time Plot for Well MW-12

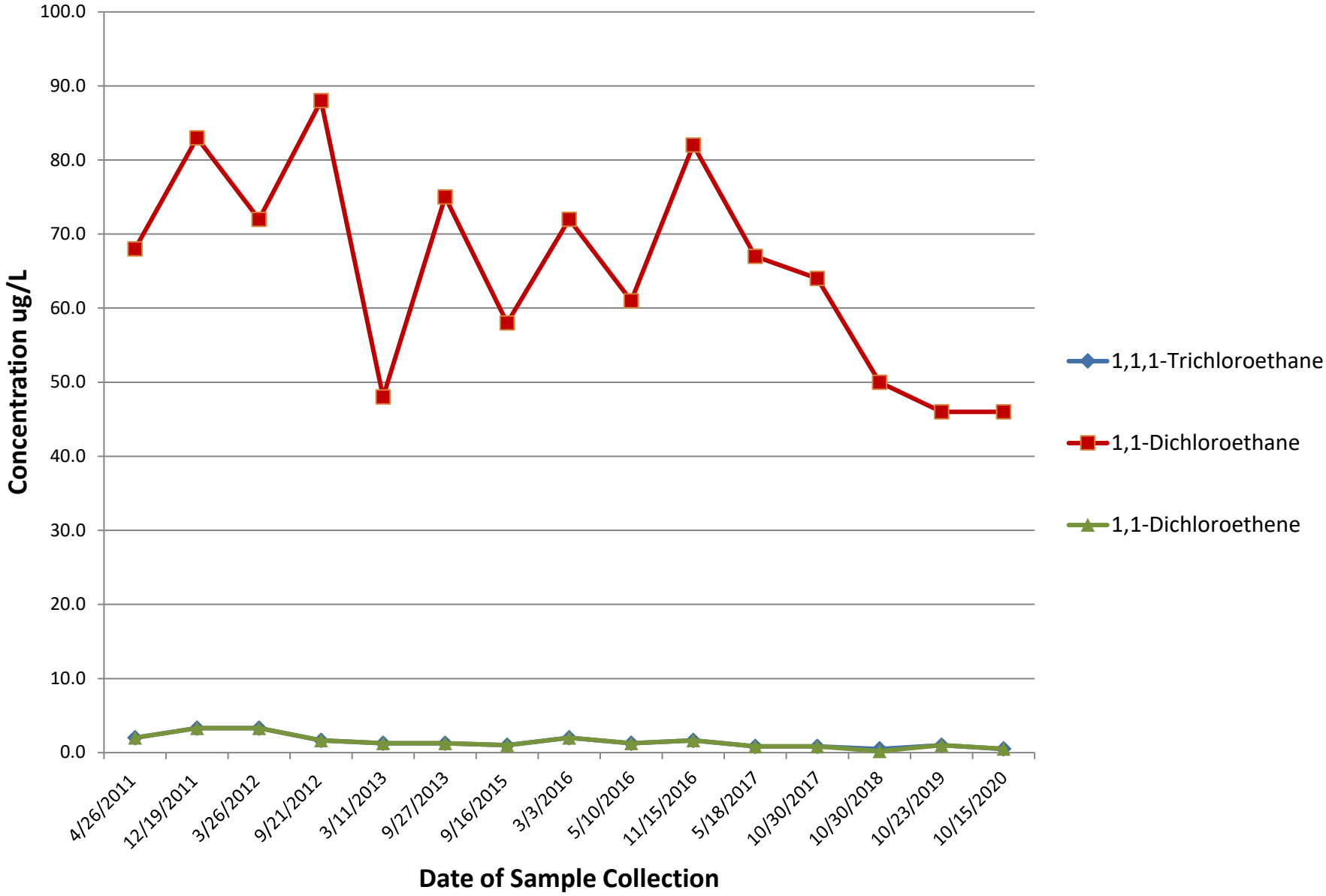


Figure 12. Concentration Versus Time Plot for Well MW-12

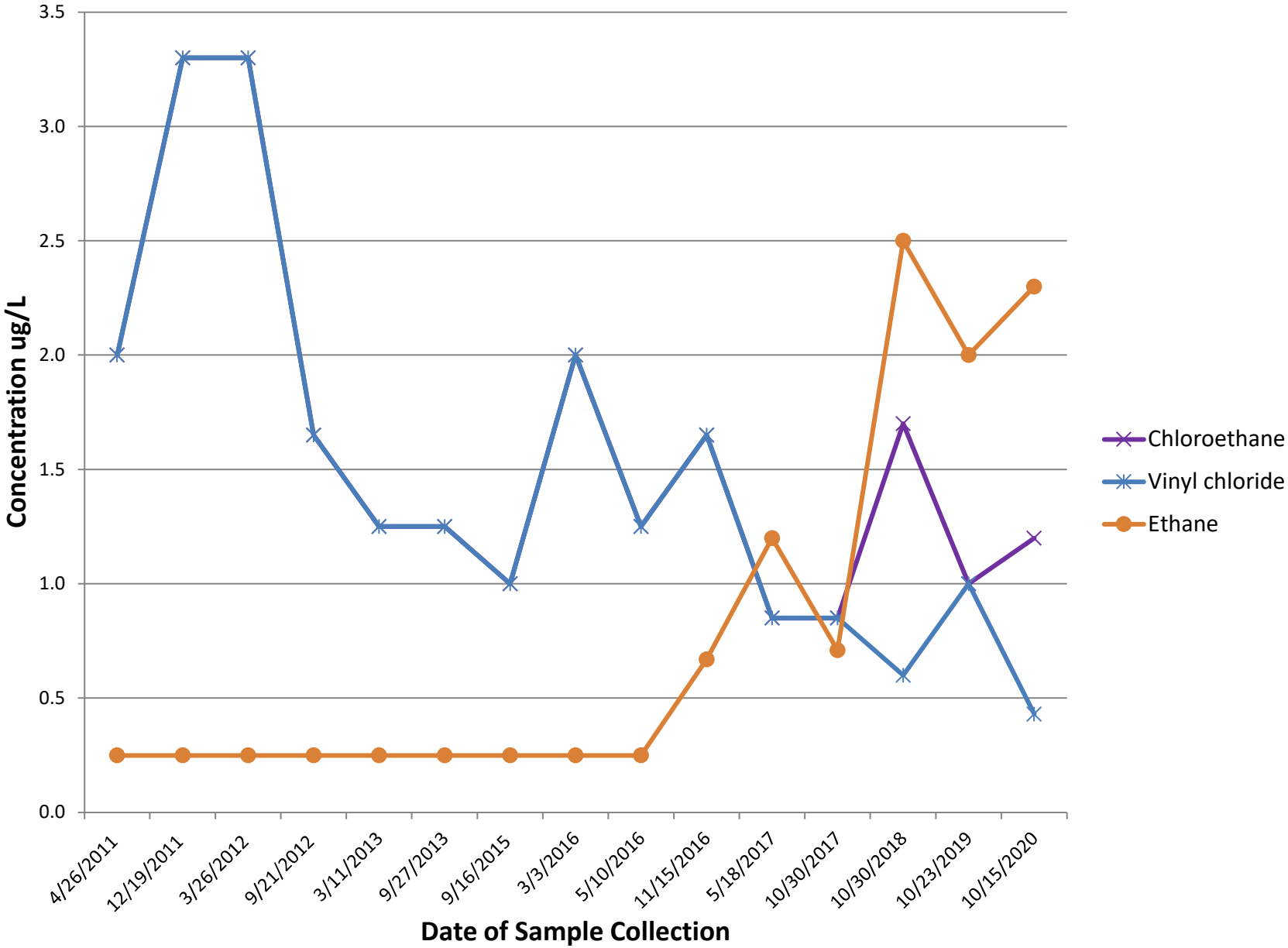
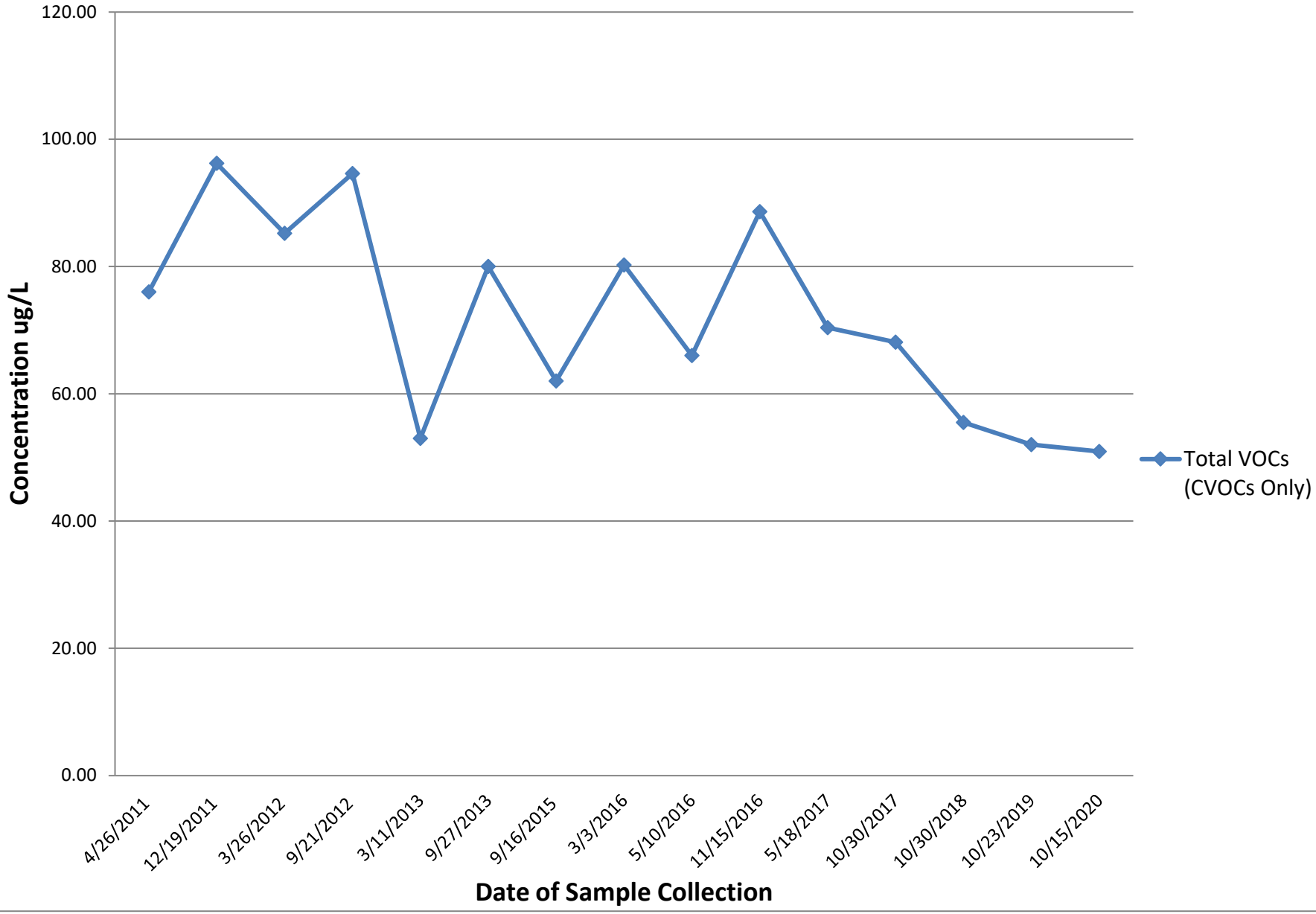


Figure 13. Concentration Versus Time Plot for Well MW-12



Tables

Table 1

Analytical Results Summary - Natural Attenuation Monitoring
Endoline Area Chlorinated Solvent Plume Monitoring Program
GM Tonawanda Engine Plant
Tonawanda, New York

Location ID:				MW-2	MW-2	MW-2	MW-2	MW-2	MW-2	MW-2	MW-2
Sample Name:				GW-17390-042611-KL-04	WG-17390-121911-KL-01	WG-17390-032612-KL-01	WG-17390-032612-KL-02	WG-17390-092012-001	WG-17390-031113-KL-002	WG-17390-092713-KL-010	WG-17390-091615-006
Sample Date:		NYSDEC TOGs Groundwater		4/26/2011	12/19/2011	3/26/2012	3/26/2012 (Duplicate)	9/20/2012	3/11/2013	9/27/2013	9/16/2015
Parameters	**Units**	**Guidance Value**	**Standard**								
Volatile Organic Compounds											
1,1,1-Trichloroethane	ug/L	NC	5	12000	24000	7400	7500	1300 U	170 J	420 U	1000 U
1,1,2,2-Tetrachloroethane	ug/L	NC	5	330 U	710 U	830 U	630 U	1300 U	330 U	420 U	1000 U
1,1,2-Trichloroethane	ug/L	NC	1	330 U	710 U	830 U	630 U	1300 U	330 U	420 U	1000 U
1,1-Dichloroethane	ug/L	NC	5	4700	23000	24000	22000	1300 U	3600	1500	710 J
1,1-Dichloroethene	ug/L	NC	5	140 J	1100	190 J	170 J	1300 U	330 U	420 U	1000 U
1,2-Dichloroethane	ug/L	NC	0.6	330 U	710 U	830 U	630 U	1300 U	330 U	420 U	1000 U
1,2-Dichloroethene (total)	ug/L	5	NC	670 U	-	-	-	-	-	-	2000 U
1,2-Dichloropropane	ug/L	NC	1	330 U	710 U	830 U	630 U	1300 U	330 U	420 U	1000 U
1,4-Dioxane	ug/L	NC	NC	17000 U	-	42000 U	31000 U	63000 U	17000 U	21000 U	50000 U
2-Butanone (Methyl ethyl ketone) (MEK)	ug/L	50	NC	3300 U	7100 U	8300 U	6300 U	13000 U	3300 U	4200 U	10000 U
2-Hexanone	ug/L	50	NC	3300 U	7100 U	8300 U	6300 U	13000 U	3300 U	4200 U	10000 U
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ug/L	NC	NC	3300 U	7100 U	8300 U	6300 U	13000 U	3300 U	4200 U	10000 U
Acetone	ug/L	50	NC	3300 U	7100 U	1200 J	980 J	13000 U	3300 U	1600 J	10000 U
Benzene	ug/L	NC	1	330 U	200 J	270 J	260 J	320 J	190 J	170 J	1000 U
Bromodichloromethane	ug/L	50	NC	330 U	710 U	830 U	630 U	1300 U	330 U	420 U	1000 U
Bromoform	ug/L	50	NC	330 U	710 U	830 U	630 U	1300 U	330 U	420 U	1000 U
Bromomethane (Methyl bromide)	ug/L	NC	5	330 U	710 U	830 U	630 U	1300 U	330 U	420 U	1000 U
Carbon disulfide	ug/L	60	60	330 U	710 U	830 U	630 U	1300 U	330 U	420 U	1000 U
Carbon tetrachloride	ug/L	NC	5	330 U	710 U	830 U	630 U	1300 U	330 U	420 U	1000 U
Chlorobenzene	ug/L	NC	5	330 U	710 U	830 U	630 U	1300 U	330 U	420 U	1000 U
Chloroethane	ug/L	NC	5	740	3700	4200 J	2400 J	42000	13000	10000	22000
Chloroform (Trichloromethane)	ug/L	NC	7	330 U	710 U	830 U	630 U	1300 U	330 U	420 U	1000 U
Chloromethane (Methyl chloride)	ug/L	NC	5	330 U	710 U	830 U	630 U	1300 U	330 U	420 U	1000 U
cis-1,2-Dichloroethene	ug/L	NC	5	-	710 U	830 U	630 U	1300 U	330 U	420 U	-
cis-1,3-Dichloropropene	ug/L	NC	NC	330 U	710 U	830 U	630 U	1300 U	330 U	420 U	1000 U
Dibromochloromethane	ug/L	50	NC	330 U	710 U	830 U	630 U	1300 U	330 U	420 U	1000 U
Ethylbenzene	ug/L	NC	5	80 J	120 J	160 J	140 J	1300 U	90 J	84 J	1000 U
Methylene chloride	ug/L	NC	5	330 U	710 U	320 J	230 J	1300 U	340 U	420 U	1000 U
Styrene	ug/L	NC	5	330 U	710 U	830 U	630 U	1300 U	330 U	420 U	1000 U
Tetrachloroethene	ug/L	NC	5	330 U	710 U	830 U	630 U	1300 U	330 U	420 U	1000 U
Toluene	ug/L	NC	5	68 J	190 J	180 J	170 J	390 J	220 J	200 J	1000 U
trans-1,2-Dichloroethene	ug/L	NC	5	-	710 U	830 U	630 U	1300 U	330 U	420 U	-
trans-1,3-Dichloropropene	ug/L	NC	NC	330 U	710 U	830 U	630 U	1300 U	330 U	420 U	1000 U
Trichloroethene	ug/L	NC	5	330 U	710 U	830 U	630 U	1300 U	330 U	420 U	1000 U
Vinyl chloride	ug/L	NC	2	330 U	710 U	830 U	630 U	1300 U	330 U	420 U	1000 U
Xylenes (total)	ug/L	NC	5	380 J	590 J	680 J	600 J	410 J	450 J	480 J	2000 U
Dissolved Gases											
Ethane	ug/L	NC	NC	19	25	11	18	54	48	79	240
Methane	ug/L	NC	NC	5800	3700	2700	3300	1200	6300	3500	5100
Wet Chemistry											
Alkalinity, total (as CaCO3)	ug/L	NC	NC	209000	240000	260000 J	280000	230000	330000	220000	310000
Ammonia	ug/L	NC	2000	3000	4200	3600	3600	4200	3400 J	2900	2100
Anaerobic 1,1,1-TCA specific microbial population	cfu/mL	NC	NC	1260	1470	10900	-	-	-	-	-
Biochemical oxygen demand (BOD)	ug/L	NC	NC	12000	43000 J	94000	98000	91000 J	71000	69000	24000 U
Chemical oxygen demand (COD)	ug/L	NC	NC	35000	200000	190000 J	180000	210000	130000	84000	81000
Dehalobacter spp.	unknown	NC	NC	absent	present	present	-	-	-	-	-
Dehalococcoides spp.	unknown	NC	NC	present	present	present	-	-	-	-	-
Nitrate (as N)	ug/L	NC	10000	100 U	100 U	100 U	100 U	100 U	100 U	100 U	500 U
Nitrite (as N)	ug/L	NC	1000	100 U	100 U	100 U	100 U	100 U	100 U	100 U	500 U
Orthophosphate	ug/L	NC	NC	-	-	61 J	54 J	40 J	45 J	500 U	-
Phosphorus	ug/L	NC	NC	200	130	-	-	-	-	-	80 J
Sulfate	ug/L	NC	250000	6000	1000	460 J	400 J	4700	850 J	4300	5600
Sulfide	ug/L	50	NC	1400	2400	1100	960 J	2100	1000 U	470 J	5500
Total microbial population - aerobic	cfu/mL	NC	NC	56640	1770	15200	-	-	-	-	-
Total microbial population - anaerobic	cfu/mL	NC	NC	11880	3520	13900	-	-	-	-	-
Total organic carbon (TOC)	ug/L	NC	NC	10000	65000	46000	43000	78000	37000	22000	24000

Table 1

Analytical Results Summary - Natural Attenuation Monitoring
Endoline Area Chlorinated Solvent Plume Monitoring Program
GM Tonawanda Engine Plant
Tonawanda, New York

Location ID:				MW-2	MW-2	MW-2	MW-2	MW-2	MW-2	MW-2	MW-2
Sample Name:				GW-17390-042611-KL-04	WG-17390-121911-KL-01	WG-17390-032612-KL-01	WG-17390-032612-KL-02	WG-17390-092012-001	WG-17390-031113-KL-002	WG-17390-092713-KL-010	WG-17390-091615-006
Sample Date:		NYSDEC TOGs Groundwater		4/26/2011	12/19/2011	3/26/2012	3/26/2012 (Duplicate)	9/20/2012	3/11/2013	9/27/2013	9/16/2015
Parameters	**Units**	**Guidance Value**	**Standard**								
Field Parameters											
Conductivity	mS/cm	NC	NC	-	1.289	1.47	-	1.76	1.49	4.66	1.03
Dissolved oxygen (DO)	ug/L	NC	NC	-	280	2800	-	5560	6580	420	540
Oxidation reduction potential (ORP)	millivolts	NC	NC	-	-209.2	-119	-	-153	-148	-166	-134
pH	s.u.	NC	NC	-	6.82	7.11	-	6.77	7.32	7.29	7.08
Temperature	Deg C	NC	NC	-	8.4	6.1	-	18	11	17.73	18.67
Turbidity	NTU	NC	NC	-	1	5.8	-	1	11	0	1.37

Notes:
[1] - NYSDEC TOGs Groundwater Standards and Guidance - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidance Values, dated June 1998 and addenda.
ug/L - micrograms per liter or parts per billion (ppb)
NC - No Criteria
3.1 J - Estimated Concentration. Analyte was detected at a concentration below the reporting limit
100 U - result is non-detect at the associated value

Table 1

Analytical Results Summary - Natural Attenuation Monitoring
Endoline Area Chlorinated Solvent Plume Monitoring Program
GM Tonawanda Engine Plant
Tonawanda, New York

Location ID:		MW-2	MW-2	MW-2	MW-2	MW-2	MW-2	MW-2	MW-2
Sample Name:		WG-17390-022916-001	WG-17390-051016-002	WG-17390-111516-KL-08	WG-17390-111516-KL-09	WG-17390-051817-DO-005	WG-17390-051817-DO-006	WG-17390-103117-005	WG-17390-102918-001
Sample Date:		2/29/2016	5/10/2016	11/15/2016	11/15/2016 (Duplicate)	5/18/2017	5/18/2017 Duplicate	10/31/17	10/29/2018
Parameters	**Units**								
Volatile Organic Compounds									
1,1,1-Trichloroethane	ug/L	620 J	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
1,1,2,2-Tetrachloroethane	ug/L	1000 U	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
1,1,2-Trichloroethane	ug/L	1000 U	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
1,1-Dichloroethane	ug/L	11000	8900	2400 J	2600	1300 U	630 J	4200	3500
1,1-Dichloroethene	ug/L	1000 U	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
1,2-Dichloroethane	ug/L	1000 U	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
1,2-Dichloroethene (total)	ug/L	2000 U	3300 U	5000 U	5000 U	2500 U	2500 U	2000 U	2000 U
1,2-Dichloropropane	ug/L	1000 U	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
1,4-Dioxane	ug/L	50000 U	83000 U	130000 U	130000 U	63000 U	63000 U	50000 U	50000 U
2-Butanone (Methyl ethyl ketone) (MEK)	ug/L	10000 U	17000 U	25000 U	25000 U	13000 U	13000 U	10000 U	10000 U
2-Hexanone	ug/L	10000 U	17000 U	25000 U	25000 U	13000 U	13000 U	10000 U	10000 U
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ug/L	10000 U	17000 U	25000 U	25000 U	13000 U	13000 U	10000 U	10000 U
Acetone	ug/L	1100 JB	17000 U	25000 U	25000 U	13000 U	13000 U	10000 U	10000 U
Benzene	ug/L	1000 U	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	230 J
Bromodichloromethane	ug/L	1000 U	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
Bromoform	ug/L	1000 U	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
Bromomethane (Methyl bromide)	ug/L	1000 U	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
Carbon disulfide	ug/L	1000 U	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
Carbon tetrachloride	ug/L	1000 U	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
Chlorobenzene	ug/L	1000 U	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
Chloroethane	ug/L	26000	34000	45000	49000	37000	38000	60000	45000
Chloroform (Trichloromethane)	ug/L	1000 U	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
Chloromethane (Methyl chloride)	ug/L	1000 U	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
cis-1,2-Dichloroethene	ug/L	-	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
cis-1,3-Dichloropropene	ug/L	1000 U	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
Dibromochloromethane	ug/L	1000 U	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
Ethylbenzene	ug/L	1000 U	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
Methylene chloride	ug/L	1000 U	1700 U	2500 U	3850 U	1300 U	1300 U	1000 U	5000 U
Styrene	ug/L	1000 U	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
Tetrachloroethene	ug/L	1000 U	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
Toluene	ug/L	1000 U	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
trans-1,2-Dichloroethene	ug/L	-	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
trans-1,3-Dichloropropene	ug/L	1000 U	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
Trichloroethene	ug/L	1000 U	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
Vinyl chloride	ug/L	1000 U	1700 U	2500 U	2500 U	1300 U	1300 U	1000 U	1000 U
Xylenes (total)	ug/L	2000 U	3300 U	5000 U	5000 U	2500 U	2500 U	350 J	240 J
Dissolved Gases									
Ethane	ug/L	-	140	170	180	230	230	290	410
Methane	ug/L	-	6300	4400	5200	9600	9000	9800	14000
Wet Chemistry									
Alkalinity, total (as CaCO3)	ug/L	350000	360000	310000	320000	280000	290000	260000	250000
Ammonia	ug/L	1500	1700 B	2800 B	2800 B	--	--	3500	3300
Anaerobic 1,1,1-TCA specific microbial population	cfu/mL	-	-	-	-	--	--	--	-
Biochemical oxygen demand (BOD)	ug/L	26000	43000	60000 B	68000 B	95000 J	82000 J	35000	9300
Chemical oxygen demand (COD)	ug/L	120000	140000	250000 J	240000 J	230000	220000	250000	180000
Dehalobacter spp.	unknown	-	-	-	-	-	-	-	-
Dehalococcoides spp.	unknown	-	-	-	-	-	-	-	-
Nitrate (as N)	ug/L	100 U	100 U	100 U	100 U	100 UJ	100 UJ	100 U	100 U
Nitrite (as N)	ug/L	100 U	500 U	100 U	100 U	100 UJ	100 UJ	100 U	100 U
Orthophosphate	ug/L	-	-	-	-	--	--	--	-
Phosphorus	ug/L	100 U	-	61 J	100 U	96 J	68 J	54 J	90 J
Sulfate	ug/L	1400	810 J	760 J	1300	1000 U	1000 U	1000 U	3100
Sulfide	ug/L	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U
Total microbial population - aerobic	cfu/mL	-	-	-	-	-	-	-	-
Total microbial population - anaerobic	cfu/mL	-	-	-	-	-	-	-	-
Total organic carbon (TOC)	ug/L	29000	30000	68000	66000	37000	36000	75000	27000

Table 1

Analytical Results Summary - Natural Attenuation Monitoring
Endoline Area Chlorinated Solvent Plume Monitoring Program
GM Tonawanda Engine Plant
Tonawanda, New York

Location ID:		MW-2	MW-2	MW-2	MW-2	MW-2	MW-2	MW-2	MW-2
Sample Name:		WG-17390-022916-001	WG-17390-051016-002	WG-17390-111516-KL-08	WG-17390-111516-KL-09	WG-17390-051817-DO-005	WG-17390-051817-DO-006	WG-17390-103117-005	WG-17390-102918-001
Sample Date:		2/29/2016	5/10/2016	11/15/2016	11/15/2016 (Duplicate)	5/18/2017	5/18/2017 Duplicate	10/31/17	10/29/2018
Parameters	**Units**								
Field Parameters									
Conductivity	mS/cm	1.51	1.36	1.65	1.65	1.48	1.48	1.86	1.71
Dissolved oxygen (DO)	ug/L	0	3800	580	580	0.24	0.24	0.98	--
Oxidation reduction potential (ORP)	millivolts	-152	-	-101	-101	-145	-145	-52	-156
pH	s.u.	7.67	7.43	7.71	7.71	7.29	7.29	7.11	6.95
Temperature	Deg C	8.02	14.87	14.0	14.0	17.58	17.58	13.77	14.3
Turbidity	NTU	4.04	3.8	3.6	3.6	2.52	2.52	28.6	13.2

Notes:
[1] - NYSDEC TOGs Groundwater Standards and Guidance - NYSDEC Division of Water
Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidance
June 1998 and addenda.
ug/L - micrograms per liter or parts per billion (ppb)
NC - No Criteria
3.1 J - Estimated Concentration. Analyte was detected at a concentration below the
100 U - result is non-detect at the associated value

Table 1

Analytical Results Summary - Natural Attenuation Monitoring
Endoline Area Chlorinated Solvent Plume Monitoring Program
GM Tonawanda Engine Plant
Tonawanda, New York

Location ID:		MW-2	MW-2	MW-2	MW-2	MW-11	MW-11	MW-11	MW-11	MW-11
Sample Name:		WG-17390-102319-003	WG-17390-102319-004	WG-17390-101520-001	WG-17390-101520-002	GW-17390-042611-KL-07	WG-17390-121911-KL-02	WG-17390-121911-KL-03	WG-17390-032612-KL-03	WG-17390-092112-003
Sample Date:		10/23/2019	10/23/2019 Duplicate	10/15/2020	10/15/2020 Duplicate	4/26/2011	12/19/2011	12/19/2011 (Duplicate)	3/26/2012	9/21/2012
Parameters	**Units**									
Volatile Organic Compounds										
1,1,1-Trichloroethane	ug/L	400 U	400 U	13 J	45 J	730	760	730	550	640
1,1,2,2-Tetrachloroethane	ug/L	400 U	400 U	4.0 U	130 U	71 U	130 U	130 U	83 U	91 U
1,1,2-Trichloroethane	ug/L	400 U	400 U	4.0 U	130 U	71 U	130 U	130 U	83 U	91 U
1,1-Dichloroethane	ug/L	28000	24000	1600 J	20000 J	2400	2600	2500	2500	2500
1,1-Dichloroethene	ug/L	400 U	400 U	6.0	130 U	1800	2100	2100	1800	2000
1,2-Dichloroethane	ug/L	400 U	400 U	4.0 U	130 U	16 J	130 U	130 U	83 U	91 U
1,2-Dichloroethene (total)	ug/L	400 U	400 U	6.5	130 U	98 J	-	-	-	-
1,2-Dichloropropane	ug/L	400 U	400 U	4.0 U	130 U	71 U	130 U	130 U	83 U	91 U
1,4-Dioxane	ug/L	20000 U	20000 U	200 U	6300 U	3600 U	-	-	4200 U	4500 U
2-Butanone (Methyl ethyl ketone) (MEK)	ug/L	4000 U	4000 U	40 U	1300 U	710 U	1300 U	1300 U	830 U	910 U
2-Hexanone	ug/L	4000 U	4000 U	40 U	1300 U	710 U	1300 U	1300 U	830 U	910 U
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ug/L	4000 U	4000 U	40 U	1300 U	710 U	1300 U	1300 U	830 U	910 U
Acetone	ug/L	4000 U	4000 U	40 U	1300 U	710 U	1300 U	1300 U	130 J	910 U
Benzene	ug/L	180 J	190 J	300 J	160 J	71 U	130 U	130 U	83 U	91 U
Bromodichloromethane	ug/L	400 U	400 U	4.0 U	130 U	71 U	130 U	130 U	83 U	91 U
Bromoform	ug/L	400 U	400 U	4.0 U	130 U	71 U	130 U	130 U	83 U	91 U
Bromomethane (Methyl bromide)	ug/L	400 U	400 U	4.0 U	130 U	71 U	130 U	130 U	83 U	91 U
Carbon disulfide	ug/L	400 U	400 U	4.0 U	130 U	71 U	130 U	130 U	83 U	91 U
Carbon tetrachloride	ug/L	400 U	400 U	4.0 U	130 U	71 U	130 U	130 U	83 U	91 U
Chlorobenzene	ug/L	400 U	400 U	4.0 U	130 U	71 U	130 U	130 U	83 U	91 U
Chloroethane	ug/L	36000	37000	32000	30000	22 J	130 U	36 J	83 U	91 U
Chloroform (Trichloromethane)	ug/L	400 U	400 U	4.0 U	130 U	71 U	130 U	130 U	83 U	91 U
Chloromethane (Methyl chloride)	ug/L	400 U	400 U	4.0 U	130 U	71 U	130 U	130 U	83 U	91 U
cis-1,2-Dichloroethene	ug/L	400 U	400 U	2.8 J	130 U	-	110 J	110 J	110	100
cis-1,3-Dichloropropene	ug/L	400 U	400 U	4.0 U	130 U	71 U	130 U	130 U	83 U	91 U
Dibromochloromethane	ug/L	400 U	400 U	4.0 U	130 U	71 U	130 U	130 U	83 U	91 U
Ethylbenzene	ug/L	400 U	400 U	43 J	24 J	71 U	130 U	130 U	83 U	91 U
Methylene chloride	ug/L	2000 U	2000 U	20 U	630 U	71 U	130 U	130 U	83 U	91 U
Styrene	ug/L	400 U	400 U	4.0 U	130 U	71 U	130 U	130 U	83 U	91 U
Tetrachloroethene	ug/L	400 U	400 U	4.0 U	130 U	71 U	130 U	130 U	83 U	91 U
Toluene	ug/L	400 U	400 U	13	18 J	71 U	130 U	130 U	83 U	91 U
trans-1,2-Dichloroethene	ug/L	400 U	400 U	3.7 J	130 U	-	130 U	130 U	83 U	91 U
trans-1,3-Dichloropropene	ug/L	400 U	400 U	4.0 U	130 U	71 U	130 U	130 U	83 U	91 U
Trichloroethene	ug/L	400 U	400 U	4.0 U	130 U	71 U	130 U	130 U	16 J	16 J
Vinyl chloride	ug/L	400 U	400 U	12 J	31 J	31 J	130 U	130 U	83 U	91 U
Xylenes (total)	ug/L	93 J	98 J	300 J	120 J	140 U	250 U	250 U	170 U	180 U
Dissolved Gases										
Ethane	ug/L	370	-	290 J	570 J	4.0	5.9	6.2	0.65	1.5
Methane	ug/L	11000	-	7700 J	16000 J	860	1200	1200	93	280
Wet Chemistry										
Alkalinity, total (as CaCO3)	ug/L	290000	-	290000	-	422000	450000	460000	440000 J	450000
Ammonia	ug/L	3400	-	4.3	-	2000 U	2000 U	2000 U	2000 U	2000 U
Anaerobic 1,1,1-TCA specific microbial population	cfu/mL	-	-	15400	-	3360	115	-	200	-
Biochemical oxygen demand (BOD)	ug/L	8400 J	-	15000 J	-	2000 U	2000 UJ	2000 UJ	2000 U	2000 U
Chemical oxygen demand (COD)	ug/L	120000	-	140000	-	180000	190000	160000	100000 J	160000
Dehalobacter spp.	unknown	-	-	-	-	present	present	-	present	-
Dehalococcoides spp.	unknown	-	-	-	-	absent	absent	-	absent	-
Nitrate (as N)	ug/L	500 UJ	-	100 UJ	-	100 U	500 U	500 U	100 U	100 U
Nitrite (as N)	ug/L	100 UJ	-	100 UJ	-	5000 U	500 U	5000 U	2500 U	100 U
Orthophosphate	ug/L	-	-	-	-	-	-	-	100 U	R
Phosphorus	ug/L	100 U	-	57 J	-	40 J	100 U	100 U	-	-
Sulfate	ug/L	3000	-	1300	-	1960000	2000000	2000000	3100000	3900000
Sulfide	ug/L	1000 U	-	1500	-	1000 U	1000 U	1000 U	1000 U	1000 U
Total microbial population - aerobic	cfu/mL	-	-	20900	-	40800	1670	-	555	-
Total microbial population - anaerobic	cfu/mL	-	-	15400	-	6080	1450	-	215	-
Total organic carbon (TOC)	ug/L	26000	-	29000	-	5000	6500	6900	3100	4000

Table 1

Analytical Results Summary - Natural Attenuation Monitoring
Endoline Area Chlorinated Solvent Plume Monitoring Program
GM Tonawanda Engine Plant
Tonawanda, New York

Location ID:		MW-2	MW-2	MW-2	MW-2	MW-11	MW-11	MW-11	MW-11	MW-11
Sample Name:		WG-17390-102319-003	WG-17390-102319-004	WG-17390-101520-001	WG-17390-101520-002	GW-17390-042611-KL-07	WG-17390-121911-KL-02	WG-17390-121911-KL-03	WG-17390-032612-KL-03	WG-17390-092112-003
Sample Date:		10/23/2019	10/23/2019 Duplicate	10/15/2020	10/15/2020 Duplicate	4/26/2011	12/19/2011	12/19/2011 (Duplicate)	3/26/2012	9/21/2012
Parameters	**Units**									
Field Parameters										
Conductivity	mS/cm	2.14	-	1.49	-	-	14.67	-	16.3	15.6
Dissolved oxygen (DO)	ug/L	310	-	6.58	-	-	230	-	-	5030
Oxidation reduction potential (ORP)	millivolts	-187	-	-148	-	-	-12.7	-	97	-73
pH	s.u.	7.71	-	7.32	-	-	6.12	-	6.27	6.23
Temperature	Deg C	15.9	-	11.0	-	-	10.04	-	10.1	19.4
Turbidity	NTU	50.2	-	11	-	-	5.2	-	-	0

Notes:
[1] - NYSDEC TOGs Groundwater Standards and Guidance - NYSDEC Division of Water
Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidance
June 1998 and addenda.
ug/L - micrograms per liter or parts per billion (ppb)
NC - No Criteria
3.1 J - Estimated Concentration. Analyte was detected at a concentration below the
100 U - result is non-detect at the associated value

Table 1

Analytical Results Summary - Natural Attenuation Monitoring
Endoline Area Chlorinated Solvent Plume Monitoring Program
GM Tonawanda Engine Plant
Tonawanda, New York

Location ID:		MW-11	MW-11	MW-11	MW-11	MW-11	MW-11	MW-11	MW-11	MW-11	MW-11
Sample Name:		WG-17390-031113-KL-001	WG-17390-092713-KL-005	WG-17390-091615-009	WG-17390-030316-004	WG-17390-051016-001	WG-17390-111516-KL-07	WG-17390-051817-DO-007	WG-17390-103017-001	WG-17390-103018-003
Sample Date:		3/11/2013	9/27/2013	9/16/2015	3/3/2016	5/10/2016	11/15/2016	5/18/2017	10/30/17	10/30/2018
Parameters	**Units**									
Volatile Organic Compounds										
1,1,1-Trichloroethane	ug/L	690	730	460	510	470	380	440	400	370
1,1,2,2-Tetrachloroethane	ug/L	67 U	40 U	200 U	100 U	100 U	83 U	83 U	63 U	50 U
1,1,2-Trichloroethane	ug/L	67 U	40 U	200 U	100 U	100 U	83 U	83 U	63 U	50 U
1,1-Dichloroethane	ug/L	2600	2800	2200	2800	2400	2200	2300	2400	2800
1,1-Dichloroethene	ug/L	2000	2200	1500	1800	1500	1300	1100	1500	1800
1,2-Dichloroethane	ug/L	67 U	14 J	200 U	100 U	100 U	83 U	83 U	63 U	15 J
1,2-Dichloroethene (total)	ug/L	-	-	89 J	110 J	100 J	89 J	83 J	94 J	100
1,2-Dichloropropane	ug/L	67 U	40 U	200 U	100 U	100 U	83 U	83 U	63 U	50 U
1,4-Dioxane	ug/L	3300 U	2000 U	10000 U	5000 U	5000 U	4170 U	4200 U	3100 U	2500 U
2-Butanone (Methyl ethyl ketone) (MEK)	ug/L	670 U	400 U	2000 U	1000 U	1000 U	830 U	830 U	630 U	500 U
2-Hexanone	ug/L	670 U	400 U	2000 U	1000 U	1000 U	830 U	830 U	630 U	500 U
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ug/L	670 U	400 U	2000 U	1000 U	1000 U	830 U	830 U	630 U	500 U
Acetone	ug/L	670 U	400 U	2000 U	110 JB	1000 U	830 U	830 U	630 U	500 U
Benzene	ug/L	67 U	40 U	200 U	100 U	100 U	83 U	83 U	63 U	50 U
Bromodichloromethane	ug/L	67 U	40 U	200 U	100 U	100 U	83 U	83 U	63 U	50 U
Bromoform	ug/L	67 U	40 U	200 U	100 U	100 U	83 U	83 UJ	63 U	50 U
Bromomethane (Methyl bromide)	ug/L	67 U	40 U	200 U	100 U	100 U	83 U	83 U	63 U	50 U
Carbon disulfide	ug/L	67 U	40 U	200 U	100 U	100 U	83 U	83 U	63 U	50 U
Carbon tetrachloride	ug/L	67 U	40 U	200 U	100 U	100 U	83 U	83 U	63 U	50 U
Chlorobenzene	ug/L	67 U	40 U	200 U	100 U	100 U	83 U	83 U	63 U	50 U
Chloroethane	ug/L	26 J	17 J	200 U	100 U	100 U	83 U	83 U	63 U	50 U
Chloroform (Trichloromethane)	ug/L	67 U	40 U	200 U	100 U	100 U	83 U	83 U	63 U	50 U
Chloromethane (Methyl chloride)	ug/L	67 U	40 U	200 U	100 U	100 U	83 U	83 U	63 U	50 U
cis-1,2-Dichloroethene	ug/L	100	120	-	-	100	89	83	94	100
cis-1,3-Dichloropropene	ug/L	67 U	40 U	200 U	100 U	100 U	83 U	83 U	63 U	50 U
Dibromochloromethane	ug/L	67 U	40 U	200 U	100 U	100 U	83 U	83 U	63 U	50 U
Ethylbenzene	ug/L	67 U	40 U	200 U	100 U	100 U	83 U	83 U	63 U	50 U
Methylene chloride	ug/L	83 U	40 U	200 U	100 U	100 U	83 U	83 U	63 U	250 U
Styrene	ug/L	67 U	40 U	200 U	100 U	100 U	83 U	83 U	63 U	50 U
Tetrachloroethene	ug/L	67 U	40 U	200 U	100 U	100 U	83 U	83 U	63 U	50 U
Toluene	ug/L	67 U	40 U	200 U	100 U	100 U	83 U	83 U	63 U	10 J
trans-1,2-Dichloroethene	ug/L	67 U	40 U	-	-	100 U	83 U	83 U	63 U	50 U
trans-1,3-Dichloropropene	ug/L	67 U	40 U	200 U	100 U	100 U	83 U	83 U	63 U	50 U
Trichloroethene	ug/L	20 J	19 J	200 U	100 U	100 U	83 U	83 U	63 U	16 J
Vinyl chloride	ug/L	67 U	23 J	200 U	260	150	240	74 J	58 J	54
Xylenes (total)	ug/L	130 U	80 U	400 U	200 U	200 U	170 U	170 U	130 U	100 U
Dissolved Gases										
Ethane	ug/L	0.42 J	1.8	5.6	-	5.1	3.4	3.7	5.1	7.7
Methane	ug/L	59	340	1200	-	1200	670	840	1100	2200
Wet Chemistry										
Alkalinity, total (as CaCO3)	ug/L	470000	440000	480000	490000	460000	440000	410000	410000	520000
Ammonia	ug/L	2000 U	870 J	6300	670	170 JB	260 B	350	350	270
Anaerobic 1,1,1-TCA specific microbial population	cfu/mL	-	-	-	-	-	-	-	-	-
Biochemical oxygen demand (BOD)	ug/L	2000 U	2000 U	3500	2000 U	2000 U	2000 U	2600 J	2600 J	2000 U
Chemical oxygen demand (COD)	ug/L	99000	220000	150000	17000	62000	52000 J	56000	56000	53000
Dehalobacter spp.	unknown	-	-	-	-	-	-	-	-	-
Dehalococcoides spp.	unknown	-	-	-	-	-	-	-	-	-
Nitrate (as N)	ug/L	100 U	100 U	5000 U	500 U	100 U	1000 U	100 UJ	100 UJ	500 U
Nitrite (as N)	ug/L	2500 U	500 U	5000 U	500 U	2500 U	1000 U	100 UJ	100 UJ	500 U
Orthophosphate	ug/L	100 U	500 U	-	-	-	-	-	-	-
Phosphorus	ug/L	-	-	82 J	100 U	-	100 U	100 U	100 U	96 J
Sulfate	ug/L	2600000	2300000	1700000	930000	2000000	2200000	2000000	2000000	2000000
Sulfide	ug/L	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U
Total microbial population - aerobic	cfu/mL	-	-	-	-	-	-	-	-	-
Total microbial population - anaerobic	cfu/mL	-	-	-	-	-	-	-	-	-
Total organic carbon (TOC)	ug/L	4800	4300	28000	1600	1300	2300	3200	3200	3200

Table 1

Analytical Results Summary - Natural Attenuation Monitoring
Endoline Area Chlorinated Solvent Plume Monitoring Program
GM Tonawanda Engine Plant
Tonawanda, New York

Location ID:		MW-11	MW-11	MW-11	MW-11	MW-11	MW-11	MW-11	MW-11	MW-11
Sample Name:		WG-17390-031113-KL-001	WG-17390-092713-KL-005	WG-17390-091615-009	WG-17390-030316-004	WG-17390-051016-001	WG-17390-111516-KL-07	WG-17390-051817-DO-007	WG-17390-103017-001	WG-17390-103018-003
Sample Date:		3/11/2013	9/27/2013	9/16/2015	3/3/2016	5/10/2016	11/15/2016	5/18/2017	10/30/17	10/30/2018
Parameters	**Units**									
Field Parameters										
Conductivity	mS/cm	15.5	26.1	13.9	18.4	14.2	20.5	14.7	18.3	18.2
Dissolved oxygen (DO)	ug/L	1120	-	5120	0	8100	460	0.26	0.88	-
Oxidation reduction potential (ORP)	millivolts	155	-58	-146	-110	-	15	-33	43	-61
pH	s.u.	7.08	6.86	6.75	7.53	6.86	7.15	7.01	6.66	6.76
Temperature	Deg C	9.74	18.62	24.99	7.75	12.59	15.7	16.44	14.27	14.3
Turbidity	NTU	3.4	0	4.84	1.07	11.2	1.6	2.41	3.3	13

Notes:
[1] - NYSDEC TOGs Groundwater Standards and Guidance - NYSDEC Division of Water
Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidance
June 1998 and addenda.
ug/L - micrograms per liter or parts per billion (ppb)
NC - No Criteria
3.1 J - Estimated Concentration. Analyte was detected at a concentration below the
100 U - result is non-detect at the associated value

Table 1

Analytical Results Summary - Natural Attenuation Monitoring
Endoline Area Chlorinated Solvent Plume Monitoring Program
GM Tonawanda Engine Plant
Tonawanda, New York

Location ID:		MW-11	MW-11	MW-11	MW-12	MW-12	MW-12	MW-12	MW-12	MW-12
Sample Name:		WG-17390-103018-004	WG-17390-102319-002	WG-17390-101520-003	GW-17390-042611-KL-06	WG-17390-121911-KL-04	WG-17390-032712-KL-04	WG-17390-092112-004	WG-17390-031113-KL-003	WG-17390-092713-KL-006
Sample Date:		10/30/2018 Duplicate	10/23/2019	10/15/2020	4/26/2011	12/19/2011	3/27/2012	9/21/2012	3/11/2013	9/27/2013
Parameters	**Units**									
Volatile Organic Compounds										
1,1,1-Trichloroethane	ug/L	360	330	250	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
1,1,2,2-Tetrachloroethane	ug/L	50 U	130 U	50 U	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
1,1,2-Trichloroethane	ug/L	50 U	130 U	50 U	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
1,1-Dichloroethane	ug/L	2800	2700	2500	68	83	72	88	48	75
1,1-Dichloroethene	ug/L	1700	1700	1500	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
1,2-Dichloroethane	ug/L	15 J	130 U	11 J	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
1,2-Dichloroethene (total)	ug/L	100	100 J	76	4.0 U	-	-	-	-	-
1,2-Dichloropropane	ug/L	50 U	130 U	50 U	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
1,4-Dioxane	ug/L	2500 U	6300 U	2500 U	100 U	-	170 U	170 U	130 U	130 U
2-Butanone (Methyl ethyl ketone) (MEK)	ug/L	62 J	1300 U	500 U	20 U	33 U	33 U	33 U	25 U	25 U
2-Hexanone	ug/L	500 U	1300 U	500 U	20 U	33 U	33 U	33 U	25 U	25 U
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ug/L	500 U	1300 U	500 U	20 U	33 U	33 U	33 U	25 U	25 U
Acetone	ug/L	500 U	1300 U	500 U	20 U	33 U	33 U	33 U	25 U	25 U
Benzene	ug/L	50 U	130 U	50 U	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
Bromodichloromethane	ug/L	50 U	130 U	50 U	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
Bromoform	ug/L	50 U	130 U	50 U	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
Bromomethane (Methyl bromide)	ug/L	50 U	130 U	50 U	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
Carbon disulfide	ug/L	50 U	130 U	50 U	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
Carbon tetrachloride	ug/L	50 U	130 U	50 U	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
Chlorobenzene	ug/L	50 U	130 U	50 U	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
Chloroethane	ug/L	50 U	130 U	50 U	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
Chloroform (Trichloromethane)	ug/L	50 U	130 U	50 U	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
Chloromethane (Methyl chloride)	ug/L	50 U	130 U	50 U	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
cis-1,2-Dichloroethene	ug/L	100	100 J	76	-	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
cis-1,3-Dichloropropene	ug/L	50 U	130 U	50 U	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
Dibromochloromethane	ug/L	50 U	130 U	50 U	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
Ethylbenzene	ug/L	50 U	130 U	50 U	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
Methylene chloride	ug/L	250 U	630 U	250 U	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
Styrene	ug/L	50 U	130 U	50 U	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
Tetrachloroethene	ug/L	50 U	130 U	50 U	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
Toluene	ug/L	10 J	130 U	7.9 J	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
trans-1,2-Dichloroethene	ug/L	50 U	130 U	50 U	-	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
trans-1,3-Dichloropropene	ug/L	50 U	130 U	50 U	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
Trichloroethene	ug/L	15 J	19 J	15 J	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
Vinyl chloride	ug/L	49 J	130 U	56	2.0 U	3.3 U	3.3 U	3.3 U	2.5 U	2.5 U
Xylenes (total)	ug/L	100 U	250 U	100 U	4.0 U	6.7 U	6.7 U	6.7 U	5.0 U	5.0 U
Dissolved Gases										
Ethane	ug/L	8.1	9.5	6.9	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Methane	ug/L	2200	2300	2400	0.50	8.1	1.1	5.1	5.8	14
Wet Chemistry										
Alkalinity, total (as CaCO3)	ug/L	-	490000	450000	484000	510000	500000	510000	450000	490000
Ammonia	ug/L	-	670	140 J	2000 U	2000 U	2000 U	2000 U	850 J	2000 U
Anaerobic 1,1,1-TCA specific microbial population	cfu/mL	-	-	0	490	0 U	10	-	-	-
Biochemical oxygen demand (BOD)	ug/L	-	2000 UJ	1900 J	2000 U	2000 UJ	2000 U	2000 U	2000 U	2000 U
Chemical oxygen demand (COD)	ug/L	-	63000	58000	56000	72000	45000	27000	25000	35000 U
Dehalobacter spp.	unknown	-	-	-	present	present	present	-	-	-
Dehalococcoides spp.	unknown	-	-	-	absent	absent	absent	-	-	-
Nitrate (as N)	ug/L	-	10000 UJ	4000 UJ	53 J	500 U	100 U	100 U	150	100 U
Nitrite (as N)	ug/L	-	1000 UJ	4000 UJ	1000 U	500 U	2000 U	100 U	1000 U	500 U
Orthophosphate	ug/L	-	-	-	-	-	100 U	R	100 U	500 U
Phosphorus	ug/L	-	880	100 U	40 J	100 U	-	-	-	-
Sulfate	ug/L	-	1900000	1800000	1020000	130000	1100000	1900000	1100000	1400000
Sulfide	ug/L	-	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U
Total microbial population - aerobic	cfu/mL	-	-	25	3440	10	80	-	-	-
Total microbial population - anaerobic	cfu/mL	-	-	0	42400	10	10	-	-	-
Total organic carbon (TOC)	ug/L	-	2500	6900	7000	8400	5500	5700	6100	6500

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Analytical Results Summary - Natural Attenuation Monitoring
Endoline Area Chlorinated Solvent Plume Monitoring Program
GM Tonawanda Engine Plant
Tonawanda, New York

Location ID:		MW-11	MW-11	MW-11	MW-12	MW-12	MW-12	MW-12	MW-12	MW-12
Sample Name:		WG-17390-103018-004	WG-17390-102319-002	WG-17390-101520-003	GW-17390-042611-KL-06	WG-17390-121911-KL-04	WG-17390-032712-KL-04	WG-17390-092112-004	WG-17390-031113-KL-003	WG-17390-092713-KL-006
Sample Date:		10/30/2018	10/23/2019	10/15/2020	4/26/2011	12/19/2011	3/27/2012	9/21/2012	3/11/2013	9/27/2013
		Duplicate								
Parameters	**Units**									
Field Parameters										
Conductivity	mS/cm	-	17.8	15.5	-	5.775	5.03	4.94	4.63	4.63
Dissolved oxygen (DO)	ug/L	-	140	1.12	-	1610	3700	6150	7530	2930
Oxidation reduction potential (ORP)	millivolts	-	-44	155	-	43.8	79	19	125	-32
pH	s.u.	-	7.28	7.08	-	6.52	6.99	6.5	7.47	5.53
Temperature	Deg C	-	16.5	9.74	-	10	8.5	19.6	13.17	18.43
Turbidity	NTU	-	164	3.4	-	0.2	140	0	0	76.2

Notes:
[1] - NYSDEC TOGs Groundwater Standards and Guidance - NYSDEC Division of Water
Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidance
June 1998 and addenda.
ug/L - micrograms per liter or parts per billion (ppb)
NC - No Criteria
3.1 J - Estimated Concentration. Analyte was detected at a concentration below the
100 U - result is non-detect at the associated value

Table 1

Analytical Results Summary - Natural Attenuation Monitoring
Endoline Area Chlorinated Solvent Plume Monitoring Program
GM Tonawanda Engine Plant
Tonawanda, New York

Location ID:		MW-12	MW-12	MW-12	MW-12	MW-12	MW-12	MW-12	MW-12	MW-12	MW-12
Sample Name:		WG-17390-092713-KL-007	WG-17390-091615-007	WG-17390-091615-008	WG-17390-030316-002	WG-17390-030316-003	WG-17390-051016-003	WG-17390-051016-004	WG-17390-111516-KL-0	WG-17390-051817-DO-008	WG-17390-103017-003
Sample Date:		9/27/2013 (Duplicate)	9/16/2015	9/16/2015 (Duplicate)	3/3/2016	3/3/2016 (Duplicate)	5/10/2016	5/10/2016 (Duplicate)	11/15/2016	5/18/2017	10/30/17
Parameters	**Units**										
Volatile Organic Compounds											
1,1,1-Trichloroethane	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
1,1,2,2-Tetrachloroethane	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
1,1,2-Trichloroethane	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
1,1-Dichloroethane	ug/L	76	58	53	72	72	61	64	82	67	64
1,1-Dichloroethene	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
1,2-Dichloroethane	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.2	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
1,2-Dichloroethene (total)	ug/L	-	4.0 U	4.0 U	8.0 U	4.0 U	5.0 U	5.0 U	6.7 U	3.3 U	3.3 U
1,2-Dichloropropane	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
1,4-Dioxane	ug/L	170 U	100 U	100 U	200 U	100 U	130 U	130 U	170 U	34 J	62 J
2-Butanone (Methyl ethyl ketone) (MEK)	ug/L	33 U	20 U	20 U	40 U	20 U	25 U	25 U	33 U	17 U	17 U
2-Hexanone	ug/L	33 U	20 U	20 U	40 U	20 U	25 U	25 U	33 U	17 U	17 U
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ug/L	33 U	20 U	20 U	40 U	20 U	25 U	25 U	33 U	17 U	17 U
Acetone	ug/L	33 U	20 U	20 U	4.7 JB	2.9 JB	25 U	25 U	33 U	17 U	18 U
Benzene	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.2 J
Bromodichloromethane	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
Bromoform	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
Bromomethane (Methyl bromide)	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
Carbon disulfide	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
Carbon tetrachloride	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
Chlorobenzene	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
Chloroethane	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
Chloroform (Trichloromethane)	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
Chloromethane (Methyl chloride)	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
cis-1,2-Dichloroethene	ug/L	3.3 U	-	-	-	-	2.5 U	2.5 U	3.3 U	1.7 U	0.50 J
cis-1,3-Dichloropropene	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
Dibromochloromethane	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
Ethylbenzene	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
Methylene chloride	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
Styrene	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
Tetrachloroethene	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
Toluene	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
trans-1,2-Dichloroethene	ug/L	3.3 U	-	-	-	-	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
trans-1,3-Dichloropropene	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
Trichloroethene	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
Vinyl chloride	ug/L	3.3 U	2.0 U	2.0 U	4.0 U	2.0 U	2.5 U	2.5 U	3.3 U	1.7 U	1.7 U
Xylenes (total)	ug/L	6.7 U	4.0 U	4.0 U	8.0 U	4.0 U	5.0 U	5.0 U	6.7 U	3.3 U	3.3 U
Dissolved Gases											
Ethane	ug/L	-	0.50 U	-	-	-	0.25 J	0.33 J	0.67	1.2	0.71 J
Methane	ug/L	-	3.1	-	-	-	32	51	590	1300	3200
Wet Chemistry											
Alkalinity, total (as CaCO3)	ug/L	-	460000	-	430000	-	480000	490000	540000	480000	480000
Ammonia	ug/L	-	200 U	-	200 U	-	64 JB	44 JB	200 U	-	-
Anaerobic 1,1,1-TCA specific microbial population	cfu/mL	-	-	-	-	-	-	-	-	-	-
Biochemical oxygen demand (BOD)	ug/L	-	2000 U	-	2000 U	-	2000 U	2000 U	2000 U	2000 UJ	2000 UJ
Chemical oxygen demand (COD)	ug/L	-	37000	-	30000	-	20000	20000	30000 J	19000	19000
Dehalobacter spp.	unknown	-	-	-	-	-	-	-	-	-	-
Dehalococcoides spp.	unknown	-	-	-	-	-	-	-	-	-	-
Nitrate (as N)	ug/L	-	2500 U	-	500 U	-	100 U	100 U	2000 U	100 UJ	100 UJ
Nitrite (as N)	ug/L	-	2500 U	-	500 U	-	2500 U	2500 U	2000 U	100 UJ	100 UJ
Orthophosphate	ug/L	-	-	-	-	-	-	-	-	-	-
Phosphorus	ug/L	-	100 U	-	100 U	-	-	-	100 U	100 U	100 U
Sulfate	ug/L	-	780000	-	900000	-	960000	950000	1000000	1600000	1600000
Sulfide	ug/L	-	1000 U	-	1000 U	-	1000 U	1000 U	1000 U	1000 U	1000 U
Total microbial population - aerobic	cfu/mL	-	-	-	-	-	-	-	-	-	-
Total microbial population - anaerobic	cfu/mL	-	-	-	-	-	-	-	-	-	-
Total organic carbon (TOC)	ug/L	-	1800	-	1900	-	1400	1300	3800	2200	2200

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Tonawanda, New York

Location ID:		MW-12	MW-12	MW-12	MW-12	MW-12	MW-12	MW-12	MW-12	MW-12	MW-12
Sample Name:		WG-17390-092713-KL-007	WG-17390-091615-007	WG-17390-091615-008	WG-17390-030316-002	WG-17390-030316-003	WG-17390-051016-003	WG-17390-051016-004	WG-17390-111516-KL-0	WG-17390-051817-DO-008	WG-17390-103017-003
Sample Date:		9/27/2013 (Duplicate)	9/16/2015	9/16/2015 (Duplicate)	3/3/2016	3/3/2016 (Duplicate)	5/10/2016	5/10/2016 (Duplicate)	11/15/2016	5/18/2017	10/30/17
Parameters	**Units**										
Field Parameters											
Conductivity	mS/cm	-	8.22	-	7.57	-	6.5	-	6.23	4.93	6.66
Dissolved oxygen (DO)	ug/L	-	4170	-	0	-	4480	-	540	0.32	0
Oxidation reduction potential (ORP)	millivolts	-	65	-	-147	-	-	-	-19	-76	.61
pH	s.u.	-	6.97	-	7.79	-	7.21	-	6.67	7.14	6.69
Temperature	Deg C	-	20.93	-	9.56	-	15.02	-	16.4	18.12	14.5
Turbidity	NTU	-	0.61	-	1.2	-	1.71	-	1.8	1.09	15

Notes:
[1] - NYSDEC TOGs Groundwater Standards and Guidance - NYSDEC Division of Water
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GM Tonawanda Engine Plant
Tonawanda, New York

Location ID:		**MW-12**	**MW-12**	**MW-12**
Sample Name:		**WG-17390-103018-002**	**WG-17390-102319-001**	**WG-17390-101520-004**
Sample Date:		**10/30/2018**	**10/23/2019**	**10/15/2020**
Parameters	**Units**			
Volatile Organic Compounds				
1,1,1-Trichloroethane	ug/L	1.0 U	2.0 U	1.0 U
1,1,2,2-Tetrachloroethane	ug/L	1.0 U	2.0 U	1.0 U
1,1,2-Trichloroethane	ug/L	1.0 U	2.0 U	1.0 U
1,1-Dichloroethane	ug/L	**50**	**46**	**46**
1,1-Dichloroethene	ug/L	0.19 J	2.0 U	1.0 U
1,2-Dichloroethane	ug/L	1.0 U	2.0 U	1.0 U
1,2-Dichloroethene (total)	ug/L	0.57 J	2.0 U	0.40 J
1,2-Dichloropropane	ug/L	1.0 U	2.0 U	1.0 U
1,4-Dioxane	ug/L	49 J	60 J	48 J
2-Butanone (Methyl ethyl ketone) (MEK)	ug/L	10 U	20 U	10 U
2-Hexanone	ug/L	10 U	20 U	10 U
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ug/L	10 U	20 U	10 U
Acetone	ug/L	**410**	**340**	**140**
Benzene	ug/L	0.72 J	0.54 J	0.40 J
Bromodichloromethane	ug/L	1.0 U	2.0 U	1.0 U
Bromoform	ug/L	1.0 U	2.0 U	1.0 U
Bromomethane (Methyl bromide)	ug/L	1.0 U	2.0 U	1.0 U
Carbon disulfide	ug/L	1.0 U	2.0 U	1.0 U
Carbon tetrachloride	ug/L	1.0 U	2.0 U	1.0 U
Chlorobenzene	ug/L	1.0 U	2.0 U	1.0 U
Chloroethane	ug/L	1.7	2.0 U	1.2
Chloroform (Trichloromethane)	ug/L	1.0 U	2.0 U	1.0 U
Chloromethane (Methyl chloride)	ug/L	1.0 U	2.0 U	1.0 U
cis-1,2-Dichloroethene	ug/L	0.57 J	0.61 J	0.40 J
cis-1,3-Dichloropropene	ug/L	1.0 U	2.0 U	1.0 U
Dibromochloromethane	ug/L	1.0 U	2.0 U	1.0 U
Ethylbenzene	ug/L	1.0 U	2.0 U	1.0 U
Methylene chloride	ug/L	5.0 U	10 U	5.0 U
Styrene	ug/L	1.0 U	2.0 U	1.0 U
Tetrachloroethene	ug/L	1.0 U	2.0 U	1.0 U
Toluene	ug/L	1.0 U	2.0 U	1.0 U
trans-1,2-Dichloroethene	ug/L	1.0 U	2.0 U	1.0 U
trans-1,3-Dichloropropene	ug/L	1.0 U	2.0 U	1.0 U
Trichloroethene	ug/L	1.0 U	2.0 U	1.0 U
Vinyl chloride	ug/L	0.60 J	2.0 U	0.43 J
Xylenes (total)	ug/L	2.0 U	4.0 U	2.0 U
Dissolved Gases				
Ethane	ug/L	2.4 / 2.6	2.0	2.3
Methane	ug/L	4100 / 3000	2600	2400
Wet Chemistry				
Alkalinity, total (as CaCO3)	ug/L	640000	660000	610000
Ammonia	ug/L	530	1800	900
Anaerobic 1,1,1-TCA specific microbial population	cfu/mL	-	-	1460
Biochemical oxygen demand (BOD)	ug/L	5700	4200 J	3600
Chemical oxygen demand (COD)	ug/L	81000	49000	51000
Dehalobacter spp.	unknown	-	-	-
Dehalococcoides spp.	unknown	-	-	-
Nitrate (as N)	ug/L	200 U	2000 UJ	2000 UJ
Nitrite (as N)	ug/L	200 U	100 UJ	2000 UJ
Orthophosphate	ug/L	-	-	-
Phosphorus	ug/L	120	93 J	93 J
Sulfate	ug/L	**460000**	**610000**	**560000**
Sulfide	ug/L	1000 U	1000 U	1000 U
Total microbial population - aerobic	cfu/mL	-	-	5100
Total microbial population - anaerobic	cfu/mL	-	-	4360
Total organic carbon (TOC)	ug/L	15000	15000	14000

Table 1

Analytical Results Summary - Natural Attenuation Monitoring
Endoline Area Chlorinated Solvent Plume Monitoring Program
GM Tonawanda Engine Plant
Tonawanda, New York

Location ID:		**MW-12**	**MW-12**	**MW-12**
Sample Name:		**WG-17390-103018-002**	**WG-17390-102319-001**	**WG-17390-101520-004**
Sample Date:		**10/30/2018**	**10/23/2019**	**10/15/2020**
Parameters	**Units**			
Field Parameters				
Conductivity	mS/cm	7.15	7.10	4.63
Dissolved oxygen (DO)	ug/L	-	250	7.53
Oxidation reduction potential (ORP)	millivolts	1164	-148	125
pH	s.u.	6.78	7.19	7.47
Temperature	Deg C	15.7	16.3	13.17
Turbidity	NTU	62.4	57.6	0.7

Notes:
[1] - NYSDEC TOGs Groundwater Standards and Guidance - NYSDEC Division of Water
Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidance
June 1998 and addenda.
ug/L - micrograms per liter or parts per billion (ppb)
NC - No Criteria
3.1 J - Estimated Concentration. Analyte was detected at a concentration below the
100 U - result is non-detect at the associated value

Table 2

Analytical Results Summary - Plume Migration Monitoring
Endoline Area Chlorinated Solvent Plume Monitoring Program
GM Tonawanda Engine Plant
Tonawanda, New York

Location ID:				MW-1	MW-1	MW-1	MW-1	MW-1	MW-1	MW-1	MW-1
Sample Name:				GW-17390-042511-KL-02	WG-17390-032712-KL-11	WG-17390-092112-007	WG-17390-031113-KL-006	WG-17390-092613-KL-002	WG-17390-091515-001	WG-17390-051016-005	WG-17390-111416-KL-03
Sample Date:		NYSDEC TOGs Groundwater		4/25/2011	3/27/2012	9/21/2012	3/11/2013	9/26/2013	9/15/2015	5/10/2016	11/14/2016
Parameters	**Units**	**Guidance Value**	**Standard**								
Volatile Organic Compounds											
1,1,1-Trichloroethane	ug/L	NC	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	ug/L	NC	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	ug/L	NC	1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	ug/L	NC	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethene	ug/L	NC	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	ug/L	NC	0.6	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethene (total)	ug/L	5	NC	2.0 U	-	-	-	-	2.0 U	2.0 U	2.0 U
1,2-Dichloropropane	ug/L	NC	1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dioxane	ug/L	NC	NC	50 U	50 U	50 U	50 U	20 J	50 U	50 U	26 J
2-Butanone (Methyl ethyl ketone) (MEK)	ug/L	50	NC	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone	ug/L	50	NC	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ug/L	NC	NC	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	ug/L	50	NC	10 U	10 U	1.1 J	10 U	10 U	10 U	10 U	10 U
Benzene	ug/L	NC	1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	ug/L	50	NC	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	ug/L	50	NC	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane (Methyl bromide)	ug/L	NC	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon disulfide	ug/L	60	60	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon tetrachloride	ug/L	NC	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chlorobenzene	ug/L	NC	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	ug/L	NC	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroform (Trichloromethane)	ug/L	NC	7	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane (Methyl chloride)	ug/L	NC	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	ug/L	NC	5	-	1.0 U	1.0 U	1.0 U	1.0 U	-	1.0 U	1.0 U
cis-1,3-Dichloropropene	ug/L	NC	NC	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	ug/L	50	NC	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Ethylbenzene	ug/L	NC	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene chloride	ug/L	NC	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Styrene	ug/L	NC	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethene	ug/L	NC	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	ug/L	NC	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	ug/L	NC	5	-	1.0 U	1.0 U	1.0 U	1.0 U	-	1.0 U	1.0 U
trans-1,3-Dichloropropene	ug/L	NC	NC	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	ug/L	NC	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Vinyl chloride	ug/L	NC	2	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Xylenes (total)	ug/L	NC	5	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Field Parameters											
Conductivity	mS/cm	NC	NC	-	3.92	4.17	4.22	4.53	4.77	6.07	6.65
Dissolved oxygen (DO)	ug/L	NC	NC	-	20	4820	1260	4380	3220	6730	1130
Oxidation reduction potential (ORP)	millivolts	NC	NC	-	-20	-127	176	-144	-163	-	160
pH	s.u.	NC	NC	-	7.05	6.44	7.1	6.65	6.54	6.96	6.62
Temperature, field	Deg C	NC	NC	-	11.7	21.2	10.45	20.2	22.46	17.26	14.5
Turbidity	NTU	NC	NC	-	0	0	12.2	73.9	1.5	2.84	2.40

Notes:
[1] - NYSDEC TOGs Groundwater Standards and Guidance - NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidance Values, dated June 1998 and addenda.
ug/L - micrograms per liter or parts per billion (ppb)
NC - No Criteria
3.1 J - Estimated Concentration. Analyte was detected at a concentration below the reporting limit
100 U - result is non-detect at the associated value

Table 2

Analytical Results Summary - Plume Migration Monitoring
Endoline Area Chlorinated Solvent Plume Monitoring Program
GM Tonawanda Engine Plant
Tonawanda, New York

Location ID:		MW-1	MW-1	MW-1	MW-1	MW-1	MW-9	MW-9	MW-9	MW-9
Sample Name:		WG-17390-051717-DO-001	WG-17390-103017-004	WG-17390-110118-007	WG-17390-102419-006	WG-17390-101620-006	GW-17390-042711-KL-10	GW-17390-042711-KL-11	WG-17390-032712-KL-05	WG-17390-092012-002
Sample Date:		5/17/2017	10/30/17	11/01/2018	10/24/2019	10/16/2020	4/28/2011	4/28/2011 (Duplicate)	3/27/2012	9/20/2012
Parameters	**Units**									
Volatile Organic Compounds										
1,1,1-Trichloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.3	1.3	1.7	1.5
1,1-Dichloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethene (total)	ug/L	2.0 U	2.0 U	2.0 U	1.0 U	1.0 U	2.0 U	2.0 U	-	-
1,2-Dichloropropane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dioxane	ug/L	36 J	34 J	15 J	39 J	18 J	50 U	50 U	50 U	50 U
2-Butanone (Methyl ethyl ketone) (MEK)	ug/L	10 U	10 U	2.2 J	10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone	ug/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ug/L	10 U	10 U	0.96 J	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	ug/L	10 U	10 U	6.9 J	10 U	10 U	10 U	10 U	10 U	10 U
Benzene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane (Methyl bromide)	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon disulfide	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.87 J
Carbon tetrachloride	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chlorobenzene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroform (Trichloromethane)	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane (Methyl chloride)	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	-	-	1.0 U	1.0 U
cis-1,3-Dichloropropene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Ethylbenzene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene chloride	ug/L	1.0 U	1.0 U	5.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Styrene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	-	-	1.0 U	1.0 U
trans-1,3-Dichloropropene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Vinyl chloride	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Xylenes (total)	ug/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Field Parameters										
Conductivity	mS/cm	6.51	8.06	7.67	8.83	3.44	-	-	2.61	2.82
Dissolved oxygen (DO)	ug/L	0.26	0.41	3030	220	1.38	-	-	3870	5830
Oxidation reduction potential (ORP)	millivolts	-3	2	-49	-70	-247	-	-	93	-36
pH	s.u.	7.03	6.71	6.09	7.32	7.61	-	-	7.35	7.05
Temperature, field	Deg C	18.82	15.05	15.1	16.3	15.3	-	-	4.9	19.3
Turbidity	NTU	1.65	4.2	--	12.1	13	-	-	0	0

Notes:
[1] - NYSDEC TOGs Groundwater Standards and Guidance - NYSDEC Division of Wate
Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidan
June 1998 and addenda.
ug/L - micrograms per liter or parts per billion (ppb)
NC - No Criteria
3.1 J - Estimated Concentration. Analyte was detected at a concentration below t
100 U - result is non-detect at the associated value

Table 2

Analytical Results Summary - Plume Migration Monitoring
Endoline Area Chlorinated Solvent Plume Monitoring Program
GM Tonawanda Engine Plant
Tonawanda, New York

Location ID:		MW-9	MW-9	MW-9	MW-9R	MW-9R	MW-9R	MW-9R	MW-9R	MW-9R
Sample Name:		WG-17390-031213-KL-010	WG-17390-092613-KL-004	WG-17390-091515-005	WG-17390-051116-010	WG-17390-111416-KL-01	WG-17390-051717-DO-003	WG-17390-103117-009	WG-17390-103018-006	WG-17390-102419-008
Sample Date:		3/12/2013	9/26/2013	9/15/2015	5/11/2016	11/14/2016	5/17/2017	10/31/17	10/30/2018	10/24/2019
Parameters	**Units**									
Volatile Organic Compounds										
1,1,1-Trichloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	ug/L	1.6	1.2	1.2	1.9	1.8	1.5	0.69 J	1.3	1.2
1,1-Dichloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethene (total)	ug/L	-	-	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	1.0 U
1,2-Dichloropropane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dioxane	ug/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
2-Butanone (Methyl ethyl ketone) (MEK)	ug/L	10 U	10 U	10 U	2.7 J	10 U	10 U	10 U	10 U	10 U
2-Hexanone	ug/L	10 U	10 U	10 U	1.2 J	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ug/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	ug/L	10 U	10 U	10 U	5.6 J	10 U	1.9 J	10 U	10 U	10 U
Benzene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane (Methyl bromide)	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon disulfide	ug/L	1.0 U	1.0 U	1.0 U	11	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon tetrachloride	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chlorobenzene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.68 J	1.0 U	1.0 U
Chloroform (Trichloromethane)	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane (Methyl chloride)	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	ug/L	1.0 U	1.0 U	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,3-Dichloropropene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Ethylbenzene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene chloride	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U
Styrene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	ug/L	1.0 U	1.0 U	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,3-Dichloropropene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Vinyl chloride	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Xylenes (total)	ug/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Field Parameters										
Conductivity	mS/cm	2.71	97.6	1.95	5.7	6.29	5.19	5.34	4.91	4.79
Dissolved oxygen (DO)	ug/L	1330	6870	230	3600	620	0.1	1.31	-	240
Oxidation reduction potential (ORP)	millivolts	54	-64	17	-	-49	-126	-43	-112	-167
pH	s.u.	7.68	6.87	7.36	6.88	6.36	7.12	6.89	7.08	7.68
Temperature, field	Deg C	7.16	18.01	22.82	13.77	14.8	16.74	15.14	15.6	16.3
Turbidity	NTU	3	14.53	18.2	12.9	29	6.17	0.2	75.3	30.9

Notes:
[1] - NYSDEC TOGs Groundwater Standards and Guidance - NYSDEC Division of Wate
Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidan
June 1998 and addenda.
ug/L - micrograms per liter or parts per billion (ppb)
NC - No Criteria
3.1 J - Estimated Concentration. Analyte was detected at a concentration below t
100 U - result is non-detect at the associated value

Table 2

Analytical Results Summary - Plume Migration Monitoring
Endoline Area Chlorinated Solvent Plume Monitoring Program
GM Tonawanda Engine Plant
Tonawanda, New York

Location ID:		MW-9R	MW-101	MW-101	MW-101	MW-101	MW-101	MW-101	MW-101	MW-101
Sample Name:		WG-17390-101620-008	GW-17390-042611-KL-05	WG-17390-032812-KL-14	WG-17390-092112-005	WG-17390-092112-006	WG-17390-031113-KL-005	WG-17390-092613-KL-003	WG-17390-091515-003	WG-17390-051016-007
Sample Date:		10/16/2020	4/26/2011	3/28/2012	9/21/2012	9/21/2012 (Duplicate)	3/11/2013	9/26/2013	9/15/2015	5/10/2016
Parameters	**Units**									
Volatile Organic Compounds										
1,1,1-Trichloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.41 J	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	ug/L	1.2	1.0 U	1.0 U	0.39 J	0.29 J	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethene (total)	ug/L	1.0 U	2.0 U	-	-	-	-	-	2.0 U	2.0 U
1,2-Dichloropropane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dioxane	ug/L	50 U	50 U	-	50 U	50 U	50 U	50 U	50 U	50 U
2-Butanone (Methyl ethyl ketone) (MEK)	ug/L	10 U	0.98 J	10 U	10 U	10 U	10 U	10 U	0.99 J	10 U
2-Hexanone	ug/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ug/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	ug/L	10 U	3.9 J	10 U	1.1 J	1.4 J	10 U	1.8 J	2.4 J	1.5 J
Benzene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane (Methyl bromide)	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon disulfide	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon tetrachloride	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chlorobenzene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0	0.53 J	1.0 U	1.0 U	1.0 U	1.0 U
Chloroform (Trichloromethane)	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane (Methyl chloride)	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	ug/L	1.0 U	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	-	1.0 U
cis-1,3-Dichloropropene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Ethylbenzene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene chloride	ug/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Styrene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	ug/L	1.0 U	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	-	1.0 U
trans-1,3-Dichloropropene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Vinyl chloride	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Xylenes (total)	ug/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Field Parameters										
Conductivity	mS/cm	2.71	-	26.7	24.9	24.9	69.6	34.9	49.2	58.4
Dissolved oxygen (DO)	ug/L	1.33	-	2160	4280	4280	1830	1020	2900	3430
Oxidation reduction potential (ORP)	millivolts	54	-	70	-161	-161	66	21	-136	-
pH	s.u.	7.68	-	7.16	6.67	6.67	7.22	6.98	6.81	7.47
Temperature, field	Deg C	7.16	-	11.2	22.7	22.7	10.96	22.04	28.35	15.97
Turbidity	NTU	3.0	-	0.4	20	20	9.4	5.8	19.6	4.2

Notes:
[1] - NYSDEC TOGs Groundwater Standards and Guidance - NYSDEC Division of Wate
Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidan
June 1998 and addenda.
ug/L - micrograms per liter or parts per billion (ppb)
NC - No Criteria
3.1 J - Estimated Concentration. Analyte was detected at a concentration below t
100 U - result is non-detect at the associated value

Table 2

Analytical Results Summary - Plume Migration Monitoring
Endoline Area Chlorinated Solvent Plume Monitoring Program
GM Tonawanda Engine Plant
Tonawanda, New York

Location ID:		MW-101	MW-101	MW-101	MW-101	MW-101	MW-101	MW-102	MW-102	MW-102
Sample Name:		WG-17390-111416-KL-02	WG-17390-051717-DO-004	WG-17390-103117-007	WG-17390-103018-005	WG-17390-102419-007	WG-17390-101620-005	GW-17390-042511-KL-01	WG-17390-032712-KL-09	WG-17390-092112-008
Sample Date:		11/14/2016	5/17/2017	10/31/17	10/30/2018	10/24/2019	10/16/2020	4/25/2011	3/27/2012	9/21/2012
Parameters	**Units**									
Volatile Organic Compounds										
1,1,1-Trichloroethane	ug/L	0.31 J	1.0 U	1.0 U	0.25 J	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
1,1,2,2-Tetrachloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
1,1,2-Trichloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
1,1-Dichloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.6	2.7	3.2
1,1-Dichloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
1,2-Dichloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
1,2-Dichloroethene (total)	ug/L	2.0 U	2.0 U	2.0 U	2.0 U	1.0 U	1.0 U	2.0 U	-	-
1,2-Dichloropropane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
1,4-Dioxane	ug/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	84 U	77 U
2-Butanone (Methyl ethyl ketone) (MEK)	ug/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	17 U	15 U
2-Hexanone	ug/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	17 U	15 U
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ug/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	17 U	15 U
Acetone	ug/L	1.0 U	2.0 J	10 U	10 U	10 U	10 U	10 U	17 U	2.1 J
Benzene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
Bromodichloromethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
Bromoform	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
Bromomethane (Methyl bromide)	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
Carbon disulfide	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
Carbon tetrachloride	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
Chlorobenzene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
Chloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
Chloroform (Trichloromethane)	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
Chloromethane (Methyl chloride)	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
cis-1,2-Dichloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	-	1.7 U	1.5 U
cis-1,3-Dichloropropene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
Dibromochloromethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
Ethylbenzene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
Methylene chloride	ug/L	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U	5.0 U	1.0 U	1.7 U	1.5 U
Styrene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
Tetrachloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
Toluene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
trans-1,2-Dichloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	-	1.7 U	1.5 U
trans-1,3-Dichloropropene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
Trichloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
Vinyl chloride	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7 U	1.5 U
Xylenes (total)	ug/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	3.3 U	3.1 U
Field Parameters										
Conductivity	mS/cm	62	39.5	49.1	47	45.9	69.6	-	1.6	1.8
Dissolved oxygen (DO)	ug/L	720	0.64	0.91	-	230	1.83	-	210	5250
Oxidation reduction potential (ORP)	millivolts	-48	-64	-12	-62	9	66	-	-100	-136
pH	s.u.	7.37	7.36	6.9	7.06	7.66	7.22	-	7.24	6.59
Temperature, field	Deg C	15.1	20.72	10.61	15.8	16.7	10.96	-	10.1	19.5
Turbidity	NTU	24	4.65	16.9	59.2	26.4	9.4	-	0	12

Notes:
[1] - NYSDEC TOGs Groundwater Standards and Guidance - NYSDEC Division of Wate
Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidan
June 1998 and addenda.
ug/L - micrograms per liter or parts per billion (ppb)
NC - No Criteria
3.1 J - Estimated Concentration. Analyte was detected at a concentration below t
100 U - result is non-detect at the associated value

Table 2

Analytical Results Summary - Plume Migration Monitoring
Endoline Area Chlorinated Solvent Plume Monitoring Program
GM Tonawanda Engine Plant
Tonawanda, New York

Location ID:		MW-102	MW-102	MW-102	MW-102	MW-102	MW-102	MW-102	MW-102	MW-102
Sample Name:		WG-17390-031213-KL-011	WG-17390-092613-KL-001	WG-17390-091515-002	WG-17390-051016-006	WG-17390-111416-KL-04	WG-17390-051717-DO-002	WG-17390-103117-006	WG-17390-110118-008	WG-17390-102419-005
Sample Date:		3/12/2013	9/26/2013	9/15/2015	5/10/2016	11/14/2016	5/17/2017	10/31/17	11/01/2018	10/24/2019
Parameters	**Units**									
Volatile Organic Compounds										
1,1,1-Trichloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	ug/L	2.1	1.7	1.5	1.9	2.6	1.8	0.40 J	0.33 J	1.1
1,1-Dichloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethene (total)	ug/L	-	-	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	1.0 U
1,2-Dichloropropane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dioxane	ug/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
2-Butanone (Methyl ethyl ketone) (MEK)	ug/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone	ug/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ug/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	ug/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzene	ug/L	1.1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane (Methyl bromide)	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon disulfide	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon tetrachloride	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chlorobenzene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroform (Trichloromethane)	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane (Methyl chloride)	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	ug/L	1.0 U	1.0 U	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,3-Dichloropropene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Ethylbenzene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene chloride	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U
Styrene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	ug/L	1.0 U	1.0 U	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,3-Dichloropropene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Vinyl chloride	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Xylenes (total)	ug/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Field Parameters										
Conductivity	mS/cm	1.57	13.4	0.884	1.46	1.82	1.42	1.42	1.37	1.72
Dissolved oxygen (DO)	ug/L	2110	480	530	8060	810	0.33	0.8	3650	240
Oxidation reduction potential (ORP)	millivolts	-5	-159	-128	-	-21	108	-30	-145	-166
pH	s.u.	7.25	7.01	7.22	7.12	6.42	7.21	7.07	6.47	7.69
Temperature, field	Deg C	8.5	19.31	19.92	15.52	13.7	21.26	11.34	15.9	15.8
Turbidity	NTU	17	0	1.25	8.76	2.75	1.23	5.4	-	16.8

Notes:
[1] - NYSDEC TOGs Groundwater Standards and Guidance - NYSDEC Division of Wate
Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidan
June 1998 and addenda.
ug/L - micrograms per liter or parts per billion (ppb)
NC - No Criteria
3.1 J - Estimated Concentration. Analyte was detected at a concentration below t
100 U - result is non-detect at the associated value

Table 2

Analytical Results Summary - Plume Migration Monitoring
Endoline Area Chlorinated Solvent Plume Monitoring Program
GM Tonawanda Engine Plant
Tonawanda, New York

Location ID:		MW-102	MW-103	MW-103	MW-103	MW-103	MW-103	MW-103	MW-103	MW-103
Sample Name:		WG-17390-101620-007	WG-17390-032812-KL-13	WG-17390-092112-009	WG-17390-031213-KL-015	WG-17390-092713-KL-012	WG-17390-091515-004	WG-17390-051116-012	WG-17390-111416-KL-05	WG-17390-103117-008
Sample Date:		10/16/2020	3/28/2012	9/21/2012	3/12/2013	9/27/2013	9/15/2015	5/11/2016	11/14/2016	10/31/17
Parameters	**Units**									
Volatile Organic Compounds										
1,1,1-Trichloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	ug/L	1.7	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethene (total)	ug/L	1.0 U	-	-	-	-	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dichloropropane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dioxane	ug/L	50 U	-	50 U	50 U	50 U	50 U	50 U	18 J	50 U
2-Butanone (Methyl ethyl ketone) (MEK)	ug/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone	ug/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ug/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	ug/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane (Methyl bromide)	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon disulfide	ug/L	1.0 U	1.0 U	1.0 U	0.17 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon tetrachloride	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chlorobenzene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroform (Trichloromethane)	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane (Methyl chloride)	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	-	1.0 U	1.0 U	1.0 U
cis-1,3-Dichloropropene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Ethylbenzene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene chloride	ug/L	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Styrene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	0.14 J	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	-	1.0 U	1.0 U	1.0 U
trans-1,3-Dichloropropene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Vinyl chloride	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Xylenes (total)	ug/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Field Parameters										
Conductivity	mS/cm	1.57	3.62	3.13	3.18	2.98	2.85	-	3.04	3.77
Dissolved oxygen (DO)	ug/L	2.11	640	4770	2150	3660	3510	-	1310	0.99
Oxidation reduction potential (ORP)	millivolts	-5	-65	-47	-52	-45	-102	-	68	28
pH	s.u.	7.25	7.78	6.38	7.12	5.4	6.81	6	6.25	6.82
Temperature, field	Deg C	18.5	16.8	20.2	18.6	21.16	24.89	-	20.1	16.61
Turbidity	NTU	17	-	16	0	5.8	2.23	-	1.9	25.1

Notes:
[1] - NYSDEC TOGs Groundwater Standards and Guidance - NYSDEC Division of Wate
Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidan
June 1998 and addenda.
ug/L - micrograms per liter or parts per billion (ppb)
NC - No Criteria
3.1 J - Estimated Concentration. Analyte was detected at a concentration below t
100 U - result is non-detect at the associated value

Table 2

Analytical Results Summary - Plume Migration Monitoring
Endoline Area Chlorinated Solvent Plume Monitoring Program
GM Tonawanda Engine Plant
Tonawanda, New York

Location ID:		**MW-103**	**MW-103**	**MW-103**
Sample Name:		**WG-17390-110118-009**	**WG-17390-102419-009**	**WG-17390-101620-009**
Sample Date:		**11/01/2018**	**10/24/2019**	**10/16/2020**
Parameters	**Units**			
Volatile Organic Compounds				
1,1,1-Trichloroethane	ug/L	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	ug/L	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	ug/L	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	ug/L	1.0 U	1.0 U	1.0 U
1,1-Dichloroethene	ug/L	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	ug/L	1.0 U	1.0 U	1.0 U
1,2-Dichloroethene (total)	ug/L	2.0 U	1.0 U	1.0 U
1,2-Dichloropropane	ug/L	1.0 U	1.0 U	1.0 U
1,4-Dioxane	ug/L	18 J	50 U	50 U
2-Butanone (Methyl ethyl ketone) (MEK)	ug/L	10 U	10 U	10 U
2-Hexanone	ug/L	10 U	10 U	10 U
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ug/L	10 U	10 U	10 U
Acetone	ug/L	10 U	10 U	10 U
Benzene	ug/L	1.0 U	1.0 U	1.0 U
Bromodichloromethane	ug/L	1.0 U	1.0 U	1.0 U
Bromoform	ug/L	1.0 U	1.0 U	1.0 U
Bromomethane (Methyl bromide)	ug/L	1.0 U	1.0 U	1.0 U
Carbon disulfide	ug/L	1.0 U	1.0 U	1.0 U
Carbon tetrachloride	ug/L	1.0 U	1.0 U	1.0 U
Chlorobenzene	ug/L	1.0 U	1.0 U	1.0 U
Chloroethane	ug/L	1.0 U	1.0 U	1.0 U
Chloroform (Trichloromethane)	ug/L	1.0 U	1.0 U	1.0 U
Chloromethane (Methyl chloride)	ug/L	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	ug/L	1.0 U	1.0 U	1.0 U
cis-1,3-Dichloropropene	ug/L	1.0 U	1.0 U	1.0 U
Dibromochloromethane	ug/L	1.0 U	1.0 U	1.0 U
Ethylbenzene	ug/L	1.0 U	1.0 U	1.0 U
Methylene chloride	ug/L	5.0 U	5.0 U	5.0 U
Styrene	ug/L	1.0 U	1.0 U	1.0 U
Tetrachloroethene	ug/L	1.0 U	1.0 U	1.0 U
Toluene	ug/L	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	ug/L	1.0 U	1.0 U	1.0 U
trans-1,3-Dichloropropene	ug/L	1.0 U	1.0 U	1.0 U
Trichloroethene	ug/L	1.0 U	1.0 U	1.0 U
Vinyl chloride	ug/L	1.0 U	1.0 U	1.0 U
Xylenes (total)	ug/L	2.0 U	2.0 U	2.0 U
Field Parameters				
Conductivity	mS/cm	2.84	3.21	3.18
Dissolved oxygen (DO)	ug/L	410	310	2.15
Oxidation reduction potential (ORP)	millivolts	-40	-32	-52
pH	s.u.	7.01	7.41	7.12
Temperature, field	Deg C	19.5	19.3	18.6
Turbidity	NTU	-	7.3	1

Notes:
[1] - NYSDEC TOGs Groundwater Standards and Guidance - NYSDEC Division of Wate
Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidan
June 1998 and addenda.
ug/L - micrograms per liter or parts per billion (ppb)
NC - No Criteria
3.1 J - Estimated Concentration. Analyte was detected at a concentration below t
100 U - result is non-detect at the associated value

Table 3

Groundwater Monitoring Parameters
Endoline Area Chlorinated Solvent Plume Monitoring Program
GM Tonawanda Engine Plant
Tonawanda, New York

Volatile Organic Compounds
1,1,1-Trichloroethane
1,1,2,2-Tetrachloroethane
1,1,2-Trichloroethane
1,1-Dichloroethane
1,1-Dichloroethene
1,2,4-Trimethylbenzene
1,2-Dichloroethane
1,2-Dichloroethene (total)
1,2-Dichloropropane
1,3,5-Trimethylbenzene
1,4-Dioxane
2-Butanone (Methyl ethyl ketone) (MEK)
2-Hexanone
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)
Acetone
Benzene
Bromodichloromethane
Bromoform
Bromomethane (Methyl bromide)
Carbon disulfide
Carbon tetrachloride
Chlorobenzene
Chloroethane
Chloroform (Trichloromethane)
Chloromethane (Methyl chloride)
cis-1,2-Dichloroethene
cis-1,3-Dichloropropene
Dibromochloromethane
Ethylbenzene
m&p-Xylene
Methylene chloride
o-Xylene
Styrene
Tetrachloroethene
Toluene
trans-1,2-Dichloroethene
trans-1,3-Dichloropropene
Trichloroethene
Vinyl chloride
Xylene (total)

Dissolved Gas
Ethane
Methane

Field Parameters
Conductivity
Dissolved oxygen (DO)
Oxidation reduction potential (ORP)
pH
Temperature, field
Turbidity

Wet Chemistry
Aerobic 1,1,1-TCA specific microbial population
Ammonia
Alkalinity, total (as CaCO3)
Anaerobic 1,1,1-TCA specific microbial population
Biochemical oxygen demand (BOD)
Nitrate (as N)
Nitrite (as N)
Orthophosphate
Phosphate, total
Sulfate
Sulfite
Chemical oxygen demand (COD)
Total microbial population - aerobic
Total microbial population - anaerobic
Total organic carbon (TOC)

Appendix A
Data Validation Reports

Memorandum

January 3, 2019

To:	Kathy Galanti	Ref. No.:	057307-133030
From:	Kathy Willy/adh/21	Tel:	716-205-1942
CC:	Chris Barton		

Subject: **Analytical Results and Reduced Validation**
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October-November 2018

1. Introduction

This document details a reduced validation of analytical results for water samples collected in support of the Groundwater Plume Monitoring at the GM Tonawanda site during October and November 2018. Samples were submitted to TestAmerica Laboratories, Inc. located in North Canton, Ohio. A sample collection and analysis summary is presented in Table 1. The validated analytical results are summarized in Table 2. A summary of the analytical methodology is presented in Table 3.

Standard GHD report deliverables were submitted by the laboratory. The final results and supporting quality assurance/quality control (QA/QC) data were assessed. Evaluation of the data was based on information obtained from the chain of custody forms, finished report forms, method blank data, recovery data from surrogate spikes/laboratory control samples (LCS)/matrix spikes (MS), and QA/QC samples.

The QA/QC criteria by which these data have been assessed are outlined in the analytical methods referenced in Table 3 and applicable guidance from the documents entitled:

i) "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review", United States Environmental Protection Agency (USEPA) 540-R-10-011, January 2010

ii) "USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review", USEPA 540-R-08-01, June 2008

These items will subsequently be referred to as the "Guidelines" in this Memorandum.

2. Sample Holding Time and Preservation

The sample holding time criteria for the analyses are summarized in Table 3. Sample chain of custody documents and analytical reports were used to determine sample holding times. All samples were analyzed within the required holding times.

All samples were properly preserved, delivered on ice, and stored by the laboratory at the required temperature (0-6°C).

3. Laboratory Method Blank Analyses

Method blanks are prepared from a purified matrix and analyzed with investigative samples to determine the existence and magnitude of sample contamination introduced during the analytical procedures.

For this study, laboratory method blanks were analyzed at a minimum frequency of 1 per 20 investigative samples and/or 1 per analytical batch.

All method blank results were non-detect, indicating that laboratory contamination was not a factor for this investigation with the exception of a low concentration of biochemical oxygen demand (BOD) in both method blanks indicating a potential for laboratory contamination. All associated sample results with concentrations similar to that found in the blanks were assumed to be a reflection of laboratory contamination and were qualified as non-detect. A summary of qualified results is presented in Table 4.

4. Surrogate Spike Recoveries - Organic Analyses

In accordance with the methods employed, all samples, blanks, and QC samples analyzed for volatile organic compounds (VOCs) and dissolved gases are spiked with surrogate compounds prior to sample analysis. Surrogate recoveries provide a means to evaluate the effects of laboratory performance on individual sample matrices.

All samples submitted for VOC and dissolved gases determinations were spiked with the appropriate number of surrogate compounds prior to sample analysis.

Surrogate recoveries were assessed against laboratory control limits. All surrogate recoveries met the laboratory criteria.

5. Laboratory Control Sample Analyses

LCS and/or laboratory control sample duplicates (LCSD) are prepared and analyzed as samples to assess the analytical efficiencies of the methods employed, independent of sample matrix effects. The relative percent difference (RPD) of the LCS/LCSD recoveries is used to evaluate analytical precision.

For this study, LCS/LCSD were analyzed at a minimum frequency of 1 per 20 investigative samples and/or 1 per analytical batch.

Organic Analyses

The LCS/LCSD contained all compounds of interest. Most LCS recoveries were within the laboratory control limits, demonstrating acceptable analytical accuracy. Some high VOC recoveries were reported. Associated

positive sample results were qualified as estimated to reflect the implied high bias. A summary of qualified results is presented in Table 5

Inorganic Analyses

The LCS contained all analytes of interest. LCS recoveries were assessed per the "Guidelines". All LCS recoveries were within the control limits, demonstrating acceptable analytical accuracy.

6. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analyses

To evaluate the effects of sample matrices on the preparation process, measurement procedures, and accuracy of a particular analysis, samples are spiked with a known concentration of the analyte of concern and analyzed as MS/MSD samples. The RPD between the MS and MSD is used to assess analytical precision. If the original sample concentration is significantly greater than the spike concentration, the recovery is not assessed.

MS/MSD analyses were performed as indicated on Table 1.

Organic Analyses

The MS/MSD samples were spiked with all compounds of interest. Most percent recoveries and RPD values were within the laboratory control limits, demonstrating acceptable analytical accuracy and precision. One high VOC MS recovery and one high VOC MSD recovery were reported. No qualification of the data was performed based on the acceptable recovery of the companion spike and the acceptable RPD.

Inorganic Analyses

The MS/MSD samples were spiked with the analytes of interest, and the results were evaluated using the "Guidelines". All percent recoveries and RPD values were within the control limits, demonstrating acceptable analytical accuracy and precision.

7. Duplicate Sample Analyses - Inorganic Analyses

Analytical precision is evaluated based on the analysis of laboratory duplicate samples. For this study, duplicate samples were prepared and analyzed by the laboratory for inorganic analyses as specified in Table 1. The laboratory performed additional site-specific duplicate analyses internally. The duplicate results were evaluated per the "Guidelines". All duplicate analyses performed were acceptable, demonstrating acceptable analytical precision.

8. Field QA/QC Samples

The field QA/QC consisted of one trip blank sample and one field duplicate sample set.

Trip Blank Sample Analysis

To evaluate contamination from sample collection, transportation, storage, and analytical activities, one trip blank was submitted to the laboratory for VOC analysis. All results were non-detect for the compounds of interest.

Field Duplicate Sample Analysis

To assess the analytical and sampling protocol precision, one field duplicate sample was collected and submitted "blind" to the laboratory, as specified in Table 1. The RPDs associated with this duplicate sample must be less than 50 percent for water samples. If the reported concentration in either the investigative sample or its duplicate is less than five times the reporting limit (RL), the evaluation criterion is one times the RL value for water samples, respectively.

All field duplicate results were within acceptable agreement, demonstrating acceptable sampling and analytical precision.

9. Analyte Reporting

The laboratory reported detected results down to the laboratory's method detection limit (MDL) for each analyte. Positive analyte detections less than the RL but greater than the MDL were qualified as estimated (J) in Table 2 unless qualified otherwise in this memorandum. Non-detect results were presented as non-detect at the RL in Table 2.

10. Conclusion

Based on the assessment detailed in the foregoing, the data summarized in Table 2 are acceptable with the specific qualifications noted herein.

Table 1

Sample Collection and Analysis Summary
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October-November 2018

					Analysis/Parameters											
Sample Identification	**Location**	**Matrix**	**Collection Date (mm/dd/yyyy)**	**Collection Time (hr:min)**	**Nitrate/Nitrite**	**Sulfate**	**Methane, Ethane**	**Alkalinity**	**Ammonia**	**Phosphorous**	**Sulfide**	**BOD**	**COD**	**TOC**	**VOCs**	**Comments**
WG-17390-110118-007	MW-1	Water	11/01/2018	09:15											X	
WG-17390-102918-001	MW-2	Water	10/29/2018	12:00	X	X	X	X	X	X	X	X	X	X	X	MS/MSD/MD
WG-17390-103018-006	MW-9	Water	10/30/2018	14:45											X	
WG-17390-103018-005	MW-101	Water	10/30/2018	12:45											X	
WG-17390-110118-008	MW-102	Water	11/01/2018	10:00											X	
WG-17390-110118-009	MW-103	Water	11/01/2018	11:15											X	
WG-17390-103018-003	MW-11	Water	10/30/2018	10:30	X	X	X	X	X	X	X	X	X	X	X	
WG-17390-103018-004	MW-11	Water	10/30/2018	10:30											X	Field duplicate of sample WG-17390-103018-003
WG-17390-110118-010	MW-11	Water	11/01/2018	11:30			X									
WG-17390-103018-002	MW-12	Water	10/30/2018	09:15	X	X	X	X	X	X	X	X	X	X	X	
WG-17390-110118-011	MW-12	Water	11/01/2018	11:45			X									MS/MSD
TB-17390-103018-001	-	Water	10/30/2018	08:00											X	Trip Blank

Notes:

BOD - Biochemical Oxygen Demand
COD - Chemical Oxygen Demand
TOC - Total Organic Carbon
VOCs - Volatile Organic Compounds
MS/MSD - Matrix Spike/Matrix Spike Duplicate
MD - Matrix Duplicate
\- - Not applicable

Table 2

Analytical Results Summary
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October-November 2018

Location ID:		MW-1	MW-2	MW-9	MW-101
Sample Name:		WG-17390-110118-007	WG-17390-102918-001	WG-17390-103018-006	WG-17390-103018-005
Sample Date:		11/01/2018	10/29/2018	10/30/2018	10/30/2018
Parameters	**Unit**				
Volatile Organic Compounds					
1,1,1-Trichloroethane	µg/L	1.0 U	1000 U	1.0 U	0.25 J
1,1,2,2-Tetrachloroethane	µg/L	1.0 U	1000 U	1.0 U	1.0 U
1,1,2-Trichloroethane	µg/L	1.0 U	1000 U	1.0 U	1.0 U
1,1-Dichloroethane	µg/L	1.0 U	3500	1.3	1.0 U
1,1-Dichloroethene	µg/L	1.0 U	1000 U	1.0 U	1.0 U
1,2-Dichloroethane	µg/L	1.0 U	1000 U	1.0 U	1.0 U
1,2-Dichloroethene (total)	µg/L	2.0 U	2000 U	2.0 U	2.0 U
1,2-Dichloropropane	µg/L	1.0 U	1000 U	1.0 U	1.0 U
1,4-Dioxane	µg/L	15 J	50000 U	50 U	50 U
2-Butanone (Methyl ethyl ketone) (MEK)	µg/L	2.2 J	10000 U	10 U	10 U
2-Hexanone	µg/L	10 U	10000 U	10 U	10 U
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	µg/L	0.96 J	10000 U	10 U	10 U
Acetone	µg/L	6.9 J	10000 U	10 U	10 U
Benzene	µg/L	1.0 U	230 J	1.0 U	1.0 U
Bromodichloromethane	µg/L	1.0 U	1000 U	1.0 U	1.0 U
Bromoform	µg/L	1.0 U	1000 U	1.0 U	1.0 U
Bromomethane (Methyl bromide)	µg/L	1.0 U	1000 U	1.0 U	1.0 U
Carbon disulfide	µg/L	1.0 U	1000 U	1.0 U	1.0 U
Carbon tetrachloride	µg/L	1.0 U	1000 U	1.0 U	1.0 U
Chlorobenzene	µg/L	1.0 U	1000 U	1.0 U	1.0 U
Chloroethane	µg/L	1.0 U	45000	1.0 U	1.0 U
Chloroform (Trichloromethane)	µg/L	1.0 U	1000 U	1.0 U	1.0 U
Chloromethane (Methyl chloride)	µg/L	1.0 U	1000 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	µg/L	1.0 U	1000 U	1.0 U	1.0 U
cis-1,3-Dichloropropene	µg/L	1.0 U	1000 U	1.0 U	1.0 U
Dibromochloromethane	µg/L	1.0 U	1000 U	1.0 U	1.0 U
Ethylbenzene	µg/L	1.0 U	1000 U	1.0 U	1.0 U
Methylene chloride	µg/L	5.0 U	5000 U	5.0 U	5.0 U
Styrene	µg/L	1.0 U	1000 U	1.0 U	1.0 U
Tetrachloroethene	µg/L	1.0 U	1000 U	1.0 U	1.0 U
Toluene	µg/L	1.0 U	1000 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	µg/L	1.0 U	1000 U	1.0 U	1.0 U
trans-1,3-Dichloropropene	µg/L	1.0 U	1000 U	1.0 U	1.0 U
Trichloroethene	µg/L	1.0 U	1000 U	1.0 U	1.0 U
Vinyl chloride	µg/L	1.0 U	1000 U	1.0 U	1.0 U
Xylenes (total)	µg/L	2.0 U	240 J	2.0 U	2.0 U

Table 2

Analytical Results Summary
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October-November 2018

Location ID:		MW-1	MW-2	MW-9	MW-101
Sample Name:		WG-17390-110118-007	WG-17390-102918-001	WG-17390-103018-006	WG-17390-103018-005
Sample Date:		11/01/2018	10/29/2018	10/30/2018	10/30/2018
Parameters	**Unit**				
Dissolved Gases					
Ethane	µg/L	-	410	-	-
Methane	µg/L	-	14000	-	-
General Chemistry					
Alkalinity, total (as CaCO3)	mg/L	-	250	-	-
Ammonia-N	mg/L	-	3.3	-	-
Biochemical oxygen demand (BOD)	mg/L	-	9.3	-	-
Chemical oxygen demand (COD)	mg/L	-	180	-	-
Nitrate (as N)	mg/L	-	0.10 U	-	-
Nitrite (as N)	mg/L	-	0.10 U	-	-
Phosphorus	mg/L	-	0.090 J	-	-
Sulfate	mg/L	-	3.1	-	-
Sulfide	mg/L	-	1.0 U	-	-
Total organic carbon (TOC)	mg/L	-	27	-	-

Table 2

Analytical Results Summary
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October-November 2018

Location ID:		MW-102	MW-103	MW-11	MW-11
Sample Name:		WG-17390-110118-008	WG-17390-110118-009	WG-17390-103018-003	WG-17390-103018-004
Sample Date:		11/01/2018	11/01/2018	10/30/2018	10/30/2018 Duplicate
Parameters	**Unit**				
Volatile Organic Compounds					
1,1,1-Trichloroethane	µg/L	1.0 U	1.0 U	370	360
1,1,2,2-Tetrachloroethane	µg/L	1.0 U	1.0 U	50 U	50 U
1,1,2-Trichloroethane	µg/L	1.0 U	1.0 U	50 U	50 U
1,1-Dichloroethane	µg/L	0.33 J	1.0 U	2800	2800
1,1-Dichloroethene	µg/L	1.0 U	1.0 U	1800	1700
1,2-Dichloroethane	µg/L	1.0 U	1.0 U	15 J	15 J
1,2-Dichloroethene (total)	µg/L	2.0 U	2.0 U	100	100
1,2-Dichloropropane	µg/L	1.0 U	1.0 U	50 U	50 U
1,4-Dioxane	µg/L	50 U	18 J	2500 U	2500 U
2-Butanone (Methyl ethyl ketone) (MEK)	µg/L	10 U	10 U	500 U	62 J
2-Hexanone	µg/L	10 U	10 U	500 U	500 U
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	µg/L	10 U	10 U	500 U	500 U
Acetone	µg/L	10 U	10 U	500 U	500 U
Benzene	µg/L	1.0 U	1.0 U	50 U	50 U
Bromodichloromethane	µg/L	1.0 U	1.0 U	50 U	50 U
Bromoform	µg/L	1.0 U	1.0 U	50 U	50 U
Bromomethane (Methyl bromide)	µg/L	1.0 U	1.0 U	50 U	50 U
Carbon disulfide	µg/L	1.0 U	1.0 U	50 U	50 U
Carbon tetrachloride	µg/L	1.0 U	1.0 U	50 U	50 U
Chlorobenzene	µg/L	1.0 U	1.0 U	50 U	50 U
Chloroethane	µg/L	1.0 U	1.0 U	50 U	50 U
Chloroform (Trichloromethane)	µg/L	1.0 U	1.0 U	50 U	50 U
Chloromethane (Methyl chloride)	µg/L	1.0 U	1.0 U	50 U	50 U
cis-1,2-Dichloroethene	µg/L	1.0 U	1.0 U	100	100
cis-1,3-Dichloropropene	µg/L	1.0 U	1.0 U	50 U	50 U
Dibromochloromethane	µg/L	1.0 U	1.0 U	50 U	50 U
Ethylbenzene	µg/L	1.0 U	1.0 U	50 U	50 U
Methylene chloride	µg/L	5.0 U	5.0 U	250 U	250 U
Styrene	µg/L	1.0 U	1.0 U	50 U	50 U
Tetrachloroethene	µg/L	1.0 U	1.0 U	50 U	50 U
Toluene	µg/L	1.0 U	1.0 U	10 J	10 J
trans-1,2-Dichloroethene	µg/L	1.0 U	1.0 U	50 U	50 U
trans-1,3-Dichloropropene	µg/L	1.0 U	1.0 U	50 U	50 U
Trichloroethene	µg/L	1.0 U	1.0 U	16 J	15 J
Vinyl chloride	µg/L	1.0 U	1.0 U	54	49 J
Xylenes (total)	µg/L	2.0 U	2.0 U	100 U	100 U

Table 2

Analytical Results Summary
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October-November 2018

Location ID:		MW-102	MW-103	MW-11	MW-11
Sample Name:		WG-17390-110118-008	WG-17390-110118-009	WG-17390-103018-003	WG-17390-103018-004
Sample Date:		11/01/2018	11/01/2018	10/30/2018	10/30/2018 Duplicate
Parameters	**Unit**				
Dissolved Gases					
Ethane	µg/L	-	-	7.7	-
Methane	µg/L	-	-	2200	-
General Chemistry					
Alkalinity, total (as CaCO3)	mg/L	-	-	520	-
Ammonia-N	mg/L	-	-	0.27	-
Biochemical oxygen demand (BOD)	mg/L	-	-	2.0 U	-
Chemical oxygen demand (COD)	mg/L	-	-	53	-
Nitrate (as N)	mg/L	-	-	0.50 U	-
Nitrite (as N)	mg/L	-	-	0.50 U	-
Phosphorus	mg/L	-	-	0.096 J	-
Sulfate	mg/L	-	-	2000	-
Sulfide	mg/L	-	-	1.0 U	-
Total organic carbon (TOC)	mg/L	-	-	3.2	-

Table 2

Analytical Results Summary
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October-November 2018

Location ID:		MW-11	MW-12	MW-12
Sample Name:		WG-17390-110118-010	WG-17390-103018-002	WG-17390-110118-011
Sample Date:		11/01/2018	10/30/2018	11/01/2018
Parameters	**Unit**			
Volatile Organic Compounds				
1,1,1-Trichloroethane	µg/L	-	1.0 U	-
1,1,2,2-Tetrachloroethane	µg/L	-	1.0 U	-
1,1,2-Trichloroethane	µg/L	-	1.0 U	-
1,1-Dichloroethane	µg/L	-	50	-
1,1-Dichloroethene	µg/L	-	0.19 J	-
1,2-Dichloroethane	µg/L	-	1.0 U	-
1,2-Dichloroethene (total)	µg/L	-	0.57 J	-
1,2-Dichloropropane	µg/L	-	1.0 U	-
1,4-Dioxane	µg/L	-	49 J	-
2-Butanone (Methyl ethyl ketone) (MEK)	µg/L	-	10 U	-
2-Hexanone	µg/L	-	10 U	-
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	µg/L	-	10 U	-
Acetone	µg/L	-	410	-
Benzene	µg/L	-	0.72 J	-
Bromodichloromethane	µg/L	-	1.0 U	-
Bromoform	µg/L	-	1.0 U	-
Bromomethane (Methyl bromide)	µg/L	-	1.0 U	-
Carbon disulfide	µg/L	-	1.0 U	-
Carbon tetrachloride	µg/L	-	1.0 U	-
Chlorobenzene	µg/L	-	1.0 U	-
Chloroethane	µg/L	-	1.7	-
Chloroform (Trichloromethane)	µg/L	-	1.0 U	-
Chloromethane (Methyl chloride)	µg/L	-	1.0 U	-
cis-1,2-Dichloroethene	µg/L	-	0.57 J	-
cis-1,3-Dichloropropene	µg/L	-	1.0 U	-
Dibromochloromethane	µg/L	-	1.0 U	-
Ethylbenzene	µg/L	-	1.0 U	-
Methylene chloride	µg/L	-	5.0 U	-
Styrene	µg/L	-	1.0 U	-
Tetrachloroethene	µg/L	-	1.0 U	-
Toluene	µg/L	-	1.0 U	-
trans-1,2-Dichloroethene	µg/L	-	1.0 U	-
trans-1,3-Dichloropropene	µg/L	-	1.0 U	-
Trichloroethene	µg/L	-	1.0 U	-
Vinyl chloride	µg/L	-	0.60 J	-
Xylenes (total)	µg/L	-	2.0 U	-

Table 2

Analytical Results Summary
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October-November 2018

	Location ID:	MW-11	MW-12	MW-12
	Sample Name:	WG-17390-110118-010	WG-17390-103018-002	WG-17390-110118-011
	Sample Date:	11/01/2018	10/30/2018	11/01/2018
Parameters	**Unit**			
Dissolved Gases				
Ethane	µg/L	8.1	2.4	2.6
Methane	µg/L	2200	4100	3000
General Chemistry				
Alkalinity, total (as CaCO3)	mg/L	-	640	-
Ammonia-N	mg/L	-	0.53	-
Biochemical oxygen demand (BOD)	mg/L	-	5.7	-
Chemical oxygen demand (COD)	mg/L	-	81	-
Nitrate (as N)	mg/L	-	0.20 U	-
Nitrite (as N)	mg/L	-	0.20 U	-
Phosphorus	mg/L	-	0.12	-
Sulfate	mg/L	-	460	-
Sulfide	mg/L	-	1.0 U	-
Total organic carbon (TOC)	mg/L	-	15	-

Notes:

J - Estimated concentration
U - Not detected at the associated reporting limit
- - Not applicable

Table 3

Analytical Methods
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October-November 2018

Parameter	Method	Matrix	Holding Time	
			Collection to Extraction (Days)	Collection or Extraction to Analysis (Days)
Volatile Organic Compounds (VOCs)	SW-846 8260B	Water	-	14
Alkalinity	SM 2320 B	Water	-	14
Ammonia	SM 4500 NH3 D	Water	-	28
Nitrate/Nitrite	EPA 300.0	Water	-	48 hours
Sulfate	EPA 300.0	Water	-	28
Sulfide	SM 4500 S2 F	Water	-	7
Phosphorus	SM 4500 P E	Water	-	28
Chemical Oxygen Demand (COD)	SM 5220	Water	-	28
Biochemical Oxygen Demand (BOD)	SM 5210 B	Water	-	48 hours
Total Organic Carbon (TOC)	SM 5310 C	Water	-	28
Methane, Ethane	RSK-175	Water	-	14

Notes:

- - Not applicable

Method References:

SW-846 - "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, 1986, with subsequent revisions

EPA 300.0 - Methods for Chemical Analysis of Water and Wastes", USEPA 600/4-79-202, March 1983 (with all subsequent revisions)

SM - "Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992, with subsequent revisions

RSK - Sample Prep and Calculations for Dissolved Gas Analysis in Water Samples Using a GC Headspace Equilibration Technique, RSKSOP-175, Rev. 0, 8/11/94, USEPA Research Lab

Table 4

Qualified Sample Results Due to Analyte Concentrations in the Method Blanks
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October-November 2018

Parameter	Analyte	Analysis Date (mm/dd/yyyy)	Blank Result *	Sample ID	Original Result	Qualified Result	Units
General Chemistry	Biochemical oxygen demand (BOD)	10/31/2018	1.30 J	WG-17390-103018-003	1.6 J	2.0 U	mg/L

Notes:

* - Blank result adjusted for sample factors where applicable
U - Not detected at the associated reporting limit
J - Estimated concentration

Table 5

Qualified Sample Results Due to Outlying LCS/LCSD Results
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October-November 2018

Parameter	Analyte	LCS Date (mm/dd/yyyy)	LCS % Recovery	LCSD % Recovery	RPD (percent)	Control Limits		Associated Sample ID	Qualified Result	Units
						% Recovery	RPD			
VOCs	1,4-Dioxane	11/06/2018	150	177	16	10 - 175	35	WG-17390-110118-007	15 J	µg/L
								WG-17390-110118-009	18 J	µg/L

Notes:

LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
RPD - Relative Percent Difference
J - Estimated concentration
VOCs - Volatile Organic Compounds

Memorandum

November 21, 2019

To:	Kathy Galanti	Ref. No.:	057307-133030
From:	Kathy Willy/adh/27	Tel:	716-205-1942
CC:	Chris Barton		

Subject: **Analytical Results and Reduced Validation**
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October 2019

1. Introduction

This document details a reduced validation of analytical results for water samples collected in support of the Groundwater Plume Monitoring at the GM Tonawanda site during October 2019. Samples were submitted to TestAmerica Laboratories, Inc. located in North Canton, Ohio. A sample collection and analysis summary is presented in Table 1. The validated analytical results are summarized in Table 2. A summary of the analytical methodology is presented in Table 3.

Standard GHD report deliverables were submitted by the laboratory. The final results and supporting quality assurance/quality control (QA/QC) data were assessed. Evaluation of the data was based on information obtained from the chain of custody forms, finished report forms, method blank data, recovery data from surrogate spikes/laboratory control samples (LCS)/matrix spikes (MS), and QA/QC samples.

The QA/QC criteria by which these data have been assessed are outlined in the analytical methods referenced in Table 3 and applicable guidance from the documents entitled:

i) United States Environmental Protection Agency (USEPA) "National Functional Guidelines for Inorganic Superfund Methods Data Review", EPA-540-R-2016-001, September 2016

i) USEPA "National Functional Guidelines for Superfund Organic Methods Data Review", EPA-540-R-2016-002, September 2016

These items will subsequently be referred to as the "Guidelines" in this Memorandum.

2. Sample Holding Time and Preservation

The sample holding time criteria for the analyses are summarized in Table 3. Sample chain of custody documents and analytical reports were used to determine sample holding times. Most samples were analyzed within the required holding times. Samples requiring nitrate/nitrite and biochemical oxygen demand

(BOD) were analyzed outside of the method required hold times due to a laboratory login error. All associated sample results were qualified as estimated to reflect the potential low bias. A summary of qualified results is presented in Table 4.

All samples were properly preserved, delivered on ice, and stored by the laboratory at the required temperature (0-6°C).

3. Laboratory Method Blank Analyses

Method blanks are prepared from a purified matrix and analyzed with investigative samples to determine the existence and magnitude of sample contamination introduced during the analytical procedures.

For this study, laboratory method blanks were analyzed at a minimum frequency of 1 per 20 investigative samples and/or 1 per analytical batch.

All method blank results were non-detect, indicating that laboratory contamination was not a factor for this investigation with the exception of a low concentration of ethane in one method blank indicating a potential for laboratory contamination. All associated sample results were greater than the concentration reported in the blank, and no qualification of the data was required.

4. Surrogate Spike Recoveries - Organic Analyses

In accordance with the methods employed, all samples, blanks, and QC samples analyzed for volatile organic compounds (VOCs) and dissolved gases are spiked with surrogate compounds prior to sample analysis. Surrogate recoveries provide a means to evaluate the effects of laboratory performance on individual sample matrices.

All samples submitted for VOC and dissolved gases determinations were spiked with the appropriate number of surrogate compounds prior to sample analysis.

Surrogate recoveries were assessed against laboratory control limits. All surrogate recoveries met the laboratory criteria.

5. Laboratory Control Sample Analyses

LCS and/or LCS/laboratory control sample duplicates (LCSD) are prepared and analyzed as samples to assess the analytical efficiencies of the methods employed, independent of sample matrix effects. The relative percent difference (RPD) of the LCS/LCSD recoveries is used to evaluate analytical precision.

For this study, LCS/LCSD were analyzed at a minimum frequency of 1 per 20 investigative samples and/or 1 per analytical batch.

Organic Analyses

The LCS or LCS/LCSD contained all compounds of interest. All LCS recoveries and RPDs (where applicable) were within the laboratory control limits, demonstrating acceptable analytical accuracy and precision with the exception of one high 1,4-dioxane recovery. Associated positive sample results were qualified as estimated to reflect the implied high bias. Non-detect results would not have been impacted. A summary of qualified results is presented in Table 5.

Inorganic Analyses

The LCS contained all analytes of interest. LCS recoveries were assessed per the "Guidelines". All LCS recoveries were within the control limits, demonstrating acceptable analytical accuracy.

6. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analyses

To evaluate the effects of sample matrices on the preparation process, measurement procedures, and accuracy of a particular analysis, samples are spiked with a known concentration of the analyte of concern and analyzed as MS/MSD samples. The RPD between the MS and MSD is used to assess analytical precision.

MS/MSD analyses were performed internally by the laboratory for VOCs, nitrate (as N), nitrite (as N), and sulfate only.

Organic Analyses

The MS/MSD samples were spiked with all compounds of interest. All percent recoveries and RPD values were within the laboratory control limits, demonstrating acceptable analytical accuracy and precision with the exception of some high 1,4-dioxane recoveries. The associated sample result was non-detect, and no qualification of the data was required.

Inorganic Analyses

The MS/MSD samples were spiked with the analytes of interest, and the results were evaluated using the "Guidelines". All percent recoveries and RPD values were within the control limits, demonstrating acceptable analytical accuracy and precision.

7. Duplicate Sample Analyses - Inorganic Analyses

Analytical precision is evaluated based on the analysis of laboratory duplicate samples. For this study, duplicate samples were prepared and analyzed by the laboratory internally for alkalinity only. The duplicate result was evaluated per the "Guidelines". The duplicate analysis performed was acceptable, demonstrating acceptable analytical precision.

8. Field QA/QC Samples

The field QA/QC consisted of one trip blank sample and one field duplicate sample set.

Trip Blank Sample Analysis

To evaluate contamination from sample collection, transportation, storage, and analytical activities, one trip blank was submitted to the laboratory for VOC analysis. All results were non-detect for the compounds of interest.

Field Duplicate Sample Analysis

To assess the analytical and sampling protocol precision, one field duplicate sample was collected and submitted "blind" to the laboratory, as specified in Table 1. The RPDs associated with this duplicate sample must be less than 50 percent for water samples. If the reported concentration in either the investigative sample or its duplicate is less than five times the reporting limit (RL), the evaluation criterion is one times the RL value for water samples, respectively.

All field duplicate results were in agreement, demonstrating acceptable sampling and analytical precision.

9. Analyte Reporting

The laboratory reported detected results down to the laboratory's method detection limit (MDL) for each analyte. Positive analyte detections less than the RL but greater than the MDL were qualified as estimated (J) in Table 2 unless qualified otherwise in this memorandum. Non-detect results were presented as non-detect at the RL in Table 2.

10. Conclusion

Based on the assessment detailed in the foregoing, the data summarized in Table 2 are acceptable with the specific qualifications noted herein.

Table 1

Sample Collection and Analysis Summary
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October 2019

Sample Identification	Location	Matrix	Collection Date (mm/dd/yyyy)	Collection Time (hr:min)	Analysis/Parameters											Comments
					Nitrate/Nitrite	Sulfate	Methane, Ethane	Alkalinity	Ammonia	Phosphorous	Sulfide	BOD	COD	TOC	VOCs	
WG-17390-102419-006	MW-1	Water	10/24/2019	11:00											x	
WG-17390-102319-003	MW-2	Water	10/23/2019	15:00	x	x	x	x	x	x	x	x	x	x	x	
WG-17390-102319-004	MW-2	Water	10/23/2019	15:00											x	Field duplicate of sample WG-17390-102319-003
WG-17390-102419-008	MW-9	Water	10/24/2019	13:00											x	
WG-17390-102419-007	MW-101	Water	10/24/2019	12:00											x	
WG-17390-102419-005	MW-102	Water	10/24/2019	10:00											x	
WG-17390-102419-009	MW-103	Water	10/24/2019	14:30											x	
WG-17390-102319-002	MW-11	Water	10/23/2019	13:10	x	x	x	x	x	x	x	x	x	x	x	
WG-17390-102319-001	MW-12	Water	10/23/2019	11:00	x	x	x	x	x	x	x	x	x	x	x	
TB-17390-102319-010	-	Water	10/23/2019	-											x	Trip Blank

Notes:

BOD - Biochemical Oxygen Demand
COD - Chemical Oxygen Demand
TOC - Total Organic Carbon
VOCs - Volatile Organic Compounds
- - Not applicable

Table 2

Analytical Results Summary
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October 2019

Location ID:		MW-1	MW-2	MW-2	MW-9	MW-101
Sample Name:		WG-17390-102419-006	WG-17390-102319-003	WG-17390-102319-004	WG-17390-102419-008	WG-17390-102419-007
Sample Date:		10/24/2019	10/23/2019	10/23/2019 Duplicate	10/24/2019	10/24/2019
Parameters	**Unit**					
Volatile Organic Compounds						
1,1,1-Trichloroethane	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
1,1,2-Trichloroethane	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
1,1-Dichloroethane	µg/L	1.0 U	28000	24000	1.2	1.0 U
1,1-Dichloroethene	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
1,2-Dichloroethane	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
1,2-Dichloroethene (total)	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
1,2-Dichloropropane	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
1,4-Dioxane	µg/L	39 J	20000 U	20000 U	50 U	50 U
2-Butanone (Methyl ethyl ketone) (MEK)	µg/L	10 U	4000 U	4000 U	10 U	10 U
2-Hexanone	µg/L	10 U	4000 U	4000 U	10 U	10 U
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	µg/L	10 U	4000 U	4000 U	10 U	10 U
Acetone	µg/L	10 U	4000 U	4000 U	10 U	10 U
Benzene	µg/L	1.0 U	180 J	190 J	1.0 U	1.0 U
Bromodichloromethane	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
Bromoform	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
Bromomethane (Methyl bromide)	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
Carbon disulfide	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
Carbon tetrachloride	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
Chlorobenzene	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
Chloroethane	µg/L	1.0 U	36000	37000	1.0 U	1.0 U
Chloroform (Trichloromethane)	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
Chloromethane (Methyl chloride)	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
cis-1,3-Dichloropropene	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
Dibromochloromethane	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
Ethylbenzene	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
Methylene chloride	µg/L	5.0 U	2000 U	2000 U	5.0 U	5.0 U
Styrene	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
Tetrachloroethene	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
Toluene	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
trans-1,3-Dichloropropene	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
Trichloroethene	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
Vinyl chloride	µg/L	1.0 U	400 U	400 U	1.0 U	1.0 U
Xylenes (total)	µg/L	2.0 U	93 J	98 J	2.0 U	2.0 U

Table 2

Analytical Results Summary
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October 2019

Location ID:		MW-1	MW-2	MW-2	MW-9	MW-101
Sample Name:		WG-17390-102419-006	WG-17390-102319-003	WG-17390-102319-004	WG-17390-102419-008	WG-17390-102419-007
Sample Date:		10/24/2019	10/23/2019	10/23/2019 Duplicate	10/24/2019	10/24/2019
Parameters	**Unit**					
Dissolved Gases						
Ethane	µg/L	-	370	-	-	-
Methane	µg/L	-	11000	-	-	-
General Chemistry						
Alkalinity, total (as CaCO3)	mg/L	-	290	-	-	-
Ammonia-N	mg/L	-	3.4	-	-	-
Biochemical oxygen demand (BOD)	mg/L	-	8.4 J	-	-	-
Chemical oxygen demand (COD)	mg/L	-	120	-	-	-
Nitrate (as N)	mg/L	-	0.50 UJ	-	-	-
Nitrite (as N)	mg/L	-	0.10 UJ	-	-	-
Phosphorus	mg/L	-	0.10 U	-	-	-
Sulfate	mg/L	-	3.0	-	-	-
Sulfide	mg/L	-	1.0 U	-	-	-
Total organic carbon (TOC)	mg/L	-	26	-	-	-

Table 2

Analytical Results Summary
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October 2019

Location ID:		MW-102	MW-103	MW-11	MW-12
Sample Name:		WG-17390-102419-005	WG-17390-102419-009	WG-17390-102319-002	WG-17390-102319-001
Sample Date:		10/24/2019	10/24/2019	10/23/2019	10/23/2019
Parameters	**Unit**				
Volatile Organic Compounds					
1,1,1-Trichloroethane	µg/L	1.0 U	1.0 U	330	2.0 U
1,1,2,2-Tetrachloroethane	µg/L	1.0 U	1.0 U	130 U	2.0 U
1,1,2-Trichloroethane	µg/L	1.0 U	1.0 U	130 U	2.0 U
1,1-Dichloroethane	µg/L	1.1	1.0 U	2700	46
1,1-Dichloroethene	µg/L	1.0 U	1.0 U	1700	2.0 U
1,2-Dichloroethane	µg/L	1.0 U	1.0 U	130 U	2.0 U
1,2-Dichloroethene (total)	µg/L	1.0 U	1.0 U	100 J	2.0 U
1,2-Dichloropropane	µg/L	1.0 U	1.0 U	130 U	2.0 U
1,4-Dioxane	µg/L	50 U	50 U	6300 U	60 J
2-Butanone (Methyl ethyl ketone) (MEK)	µg/L	10 U	10 U	1300 U	20 U
2-Hexanone	µg/L	10 U	10 U	1300 U	20 U
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	µg/L	10 U	10 U	1300 U	20 U
Acetone	µg/L	10 U	10 U	1300 U	340
Benzene	µg/L	1.0 U	1.0 U	130 U	0.54 J
Bromodichloromethane	µg/L	1.0 U	1.0 U	130 U	2.0 U
Bromoform	µg/L	1.0 U	1.0 U	130 U	2.0 U
Bromomethane (Methyl bromide)	µg/L	1.0 U	1.0 U	130 U	2.0 U
Carbon disulfide	µg/L	1.0 U	1.0 U	130 U	2.0 U
Carbon tetrachloride	µg/L	1.0 U	1.0 U	130 U	2.0 U
Chlorobenzene	µg/L	1.0 U	1.0 U	130 U	2.0 U
Chloroethane	µg/L	1.0 U	1.0 U	130 U	2.0 U
Chloroform (Trichloromethane)	µg/L	1.0 U	1.0 U	130 U	2.0 U
Chloromethane (Methyl chloride)	µg/L	1.0 U	1.0 U	130 U	2.0 U
cis-1,2-Dichloroethene	µg/L	1.0 U	1.0 U	100 J	0.61 J
cis-1,3-Dichloropropene	µg/L	1.0 U	1.0 U	130 U	2.0 U
Dibromochloromethane	µg/L	1.0 U	1.0 U	130 U	2.0 U
Ethylbenzene	µg/L	1.0 U	1.0 U	130 U	2.0 U
Methylene chloride	µg/L	5.0 U	5.0 U	630 U	10 U
Styrene	µg/L	1.0 U	1.0 U	130 U	2.0 U
Tetrachloroethene	µg/L	1.0 U	1.0 U	130 U	2.0 U
Toluene	µg/L	1.0 U	1.0 U	130 U	2.0 U
trans-1,2-Dichloroethene	µg/L	1.0 U	1.0 U	130 U	2.0 U
trans-1,3-Dichloropropene	µg/L	1.0 U	1.0 U	130 U	2.0 U
Trichloroethene	µg/L	1.0 U	1.0 U	19 J	2.0 U
Vinyl chloride	µg/L	1.0 U	1.0 U	130 U	2.0 U
Xylenes (total)	µg/L	2.0 U	2.0 U	250 U	4.0 U

Table 2

Analytical Results Summary
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October 2019

	Location ID:	MW-102	MW-103	MW-11	MW-12
	Sample Name:	WG-17390-102419-005	WG-17390-102419-009	WG-17390-102319-002	WG-17390-102319-001
	Sample Date:	10/24/2019	10/24/2019	10/23/2019	10/23/2019
Parameters	**Unit**				
Dissolved Gases					
Ethane	µg/L	-	-	9.5	2.0
Methane	µg/L	-	-	2300	2600
General Chemistry					
Alkalinity, total (as CaCO3)	mg/L	-	-	490	660
Ammonia-N	mg/L	-	-	0.67	1.8
Biochemical oxygen demand (BOD)	mg/L	-	-	2.0 UJ	4.2 J
Chemical oxygen demand (COD)	mg/L	-	-	63	49
Nitrate (as N)	mg/L	-	-	10 UJ	2.0 UJ
Nitrite (as N)	mg/L	-	-	1.0 UJ	0.10 UJ
Phosphorus	mg/L	-	-	0.88	0.093 J
Sulfate	mg/L	-	-	1900	610
Sulfide	mg/L	-	-	1.0 U	1.0 U
Total organic carbon (TOC)	mg/L	-	-	2.5	15

Notes:

J - Estimated concentration
U - Not detected at the associated reporting limit
UJ - Not detected; associated reporting limit is estimated
- - Not applicable

Table 3

Analytical Methods
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October 2019

Parameter	Method	Matrix	Holding Time	
			Collection to Extraction (Days)	Collection or Extraction to Analysis (Days)
Volatile Organic Compounds (VOCs)	SW-846 8260B	Water	-	14
Alkalinity	SM 2320 B	Water	-	14
Ammonia	SM 4500 NH3 D	Water	-	28
Nitrate/Nitrite	EPA 300.0	Water	-	48 hours
Sulfate	EPA 300.0	Water	-	28
Sulfide	SM 4500 S2 F	Water	-	7
Phosphorus	SM 4500 P E	Water	-	28
Chemical Oxygen Demand (COD)	SM 5220	Water	-	28
Biochemical Oxygen Demand (BOD)	SM 5210 B	Water	-	48 hours
Total Organic Carbon (TOC)	SM 5310 C	Water	-	28
Methane, Ethane	RSK-175	Water	-	14

Notes:

- - Not applicable

Method References:

SW-846 - "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, 1986, with subsequent revisions
EPA 300.0 - Methods for Chemical Analysis of Water and Wastes", USEPA 600/4-79-202, March 1983 (with all subsequent revisions)
USEPA - United States Environmental Protection Agency
SM - "Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992, with subsequent revisions
RSK - Sample Prep and Calculations for Dissolved Gas Analysis in Water Samples Using a GC Headspace Equilibration Technique, RSKSOP-175, Rev. 0, 8/11/94, USEPA Research Lab

Table 4

Qualified Sample Results Due to Holding Time Exceedance
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October 2019

Parameter	Sample ID	Holding Time (days)	Holding Time Criteria (days)	Analyte	Qualified Sample Results	Units
General Chemistry	WG-17390-102319-001	80 hrs.	48 hrs.	Nitrate (as N)	2.0 UJ	mg/L
General Chemistry	WG-17390-102319-001	80 hrs.	48 hrs.	Nitrite (as N)	0.10 UJ	mg/L
General Chemistry	WG-17390-102319-002	75 hrs.	48 hrs.	Nitrate (as N)	10 UJ	mg/L
General Chemistry	WG-17390-102319-002	75 hrs.	48 hrs.	Nitrite (as N)	1.0 UJ	mg/L
General Chemistry	WG-17390-102319-003	74 hrs.	48 hrs.	Nitrate (as N)	0.50 UJ	mg/L
General Chemistry	WG-17390-102319-003	74 hrs.	48 hrs.	Nitrite (as N)	0.10 UJ	mg/L
General Chemistry	WG-17390-102319-001	73 hrs.	48 hrs.	BOD	4.2 J	mg/L
General Chemistry	WG-17390-102319-002	71 hrs.	48 hrs.	BOD	2.0 UJ	mg/L
General Chemistry	WG-17390-102319-003	70 hrs.	48 hrs.	BOD	8.4 J	mg/L

Notes:

J - Estimated concentration
UJ - Not detected; associated reporting limit is estimated
BOD - Biochemical Oxygen Demand

Table 5

Qualified Sample Results Due to Outlying Laboratory Control Sample Results
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October 2019

Parameter	Analyte	LCS Date (mm/dd/yyyy)	LCS % Recovery	Control Limits % Recovery	Associated Sample ID	Qualified Results	Units
VOCs	1,4-Dioxane	11/03/2019	198	10 - 172	WG-17390-102319-001	60 J	µg/L
					WG-17390-102419-006	39 J	µg/L

Notes:

LCS - Laboratory Control Sample
J - Estimated concentration
VOCs - Volatile Organic Compounds

Memorandum

December 10, 2020

To:	Kathy Galanti	Ref. No.:	057307-133030
From:	Kathy Willy/adh/29	Tel:	716-205-1942
cc:	Chris Barton		

Subject: **Analytical Results and Reduced Validation**
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October 2020

1. Introduction

This document details a reduced validation of analytical results for water samples collected in support of the Groundwater Plume Monitoring at the GM Tonawanda site during October 2020. Samples were submitted to Eurofins TestAmerica Laboratories, Inc. located in North Canton, Ohio. A sample collection and analysis summary is presented in Table 1. The validated analytical results are summarized in Table 2. A summary of the analytical methodology is presented in Table 3.

Standard GHD report deliverables were submitted by the laboratory. The final results and supporting quality assurance/quality control (QA/QC) data were assessed. Evaluation of the data was based on information obtained from the chain of custody forms, finished report forms, method blank data, recovery data from surrogate spikes/laboratory control samples (LCS)/matrix spikes (MS), and QA/QC samples.

The QA/QC criteria by which these data have been assessed are outlined in the analytical methods referenced in Table 3 and applicable guidance from the documents entitled:

i) United States Environmental Protection Agency (USEPA) "National Functional Guidelines for Inorganic Superfund Methods Data Review", EPA-540-R-2016-001, September 2016

i) USEPA "National Functional Guidelines for Superfund Organic Methods Data Review", EPA-540-R-2016-002, September 2016

These items will subsequently be referred to as the "Guidelines" in this Memorandum.

2. Sample Holding Time and Preservation

The sample holding time criteria for the analyses are summarized in Table 3. Sample chain of custody documents and analytical report were used to determine sample holding times. Most samples were analyzed within the required holding times. Samples requiring nitrate/nitrite and biochemical oxygen demand (BOD)

were analyzed outside of the method required hold times due to samples arriving at the laboratory with insufficient time to perform the analyses before the holding times expired. All associated sample results were qualified as estimated to reflect the potential low bias. A summary of qualified results is presented in Table 4.

All samples were properly preserved, delivered on ice, and stored by the laboratory at the required temperature (0-6°C).

3. Laboratory Method Blank Analyses

Method blanks are prepared from a purified matrix and analyzed with investigative samples to determine the existence and magnitude of sample contamination introduced during the analytical procedures.

For this study, laboratory method blanks were analyzed at a minimum frequency of 1 per 20 investigative samples and/or 1 per analytical batch.

All method blank results were non-detect, indicating that laboratory contamination was not a factor for this investigation.

4. Surrogate Spike Recoveries - Organic Analyses

In accordance with the methods employed, all samples, blanks, and QC samples analyzed for volatile organic compounds (VOCs) and dissolved gases are spiked with surrogate compounds prior to sample analysis. Surrogate recoveries provide a means to evaluate the effects of laboratory performance on individual sample matrices.

All samples submitted for VOC and dissolved gases determinations were spiked with the appropriate number of surrogate compounds prior to sample analysis.

Surrogate recoveries were assessed against laboratory control limits. All surrogate recoveries met the laboratory criteria.

5. Laboratory Control Sample Analyses

LCS are prepared and analyzed as samples to assess the analytical efficiencies of the methods employed, independent of sample matrix effects.

For this study, LCS were analyzed at a minimum frequency of 1 per 20 investigative samples and/or 1 per analytical batch.

Organic Analyses

The LCS contained all compounds of interest. All LCS recoveries were within the laboratory control limits, demonstrating acceptable analytical accuracy with the exception of one high 2-hexanone recovery. Associated sample results were non-detect and would not have been impacted by the implied high bias.

Inorganic Analyses

The LCS contained all analytes of interest. LCS recoveries were assessed per the "Guidelines". All LCS recoveries were within the control limits, demonstrating acceptable analytical accuracy.

6. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analyses

To evaluate the effects of sample matrices on the preparation process, measurement procedures, and accuracy of a particular analysis, samples are spiked with a known concentration of the analyte of concern and analyzed as MS/MSD samples. The relative percent difference (RPD) between the MS and MSD is used to assess analytical precision.

MS/MSD analyses were performed internally by the laboratory for VOCs, dissolved gases, and chemical oxygen demand (COD) only.

Organic Analyses

The MS/MSD samples were spiked with all compounds of interest. All percent recoveries and RPD values were within the laboratory control limits, demonstrating acceptable analytical accuracy and precision.

Inorganic Analyses

The MS/MSD samples were spiked with the analytes of interest, and the results were evaluated using the "Guidelines". All percent recoveries and RPD values were within the control limits, demonstrating acceptable analytical accuracy and precision.

7. Field QA/QC Samples

The field QA/QC consisted of one trip blank sample and one field duplicate sample set.

Trip Blank Sample Analysis

To evaluate contamination from sample collection, transportation, storage, and analytical activities, one trip blank was submitted to the laboratory for VOC analysis. All results were non-detect for the compounds of interest.

Field Duplicate Sample Analysis

To assess the analytical and sampling protocol precision, one field duplicate sample was collected and submitted "blind" to the laboratory, as specified in Table 1. The RPDs associated with this duplicate sample must be less than 50 percent for water samples. If the reported concentration in either the investigative sample or its duplicate is less than five times the reporting limit (RL), the evaluation criterion is one times the RL value for water samples.

Good correlation between sample and duplicate results was not achieved for most compounds of interest. Where variability was observed, the sample and its duplicate were qualified as estimated. A summary of qualified results is presented in Table 5.

8. Analyte Reporting

The laboratory reported detected results down to the laboratory's method detection limit (MDL) for each analyte. Positive analyte detections less than the RL but greater than the MDL were qualified as estimated (J) in Table 2 unless qualified otherwise in this memorandum. Non-detect results were presented as non-detect at the RL in Table 2.

The methane result in sample WG-17390-101520-002 exceeded the instrument's calibrated range. Reanalysis at the proper secondary dilution could not be performed due to insufficient sample volume remaining. A summary of the qualified result is presented in Table 6.

9. Conclusion

Based on the assessment detailed in the foregoing, the data summarized in Table 2 are acceptable with the specific qualifications noted herein.

Table 1

Sample Collection and Analysis Summary
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October 2020

Sample Identification	Location	Matrix	Collection Date (mm/dd/yyyy)	Collection Time (hr:min)	Analysis/Parameters											Comments
					Nitrate/Nitrite	Sulfate	Methane, Ethane	Alkalinity	Ammonia	Phosphorous	Sulfide	BOD	COD	TOC	VOCs	
WG-17390-101620-006	MW-1	Water	10/16/2020	11:00											x	
WG-17390-101520-001	MW-2	Water	10/15/2020	11:00	x	x	x	x	x	x	x	x	x	x	x	
WG-17390-101520-002	MW-2	Water	10/15/2020	11:00			x								x	Field duplicate of sample WG-17390-101520-001
WG-17390-101620-008	MW-9	Water	10/16/2020	13:00											x	
WG-17390-101620-005	MW-101	Water	10/16/2020	10:00											x	
WG-17390-101620-007	MW-102	Water	10/16/2020	12:00											x	
WG-17390-101620-009	MW-103	Water	10/16/2020	14:30											x	
WG-17390-101520-003	MW-11	Water	10/15/2020	13:00	x	x	x	x	x	x	x	x	x	x	x	
WG-17390-101520-004	MW-12	Water	10/15/2020	15:00	x	x	x	x	x	x	x	x	x	x	x	
WG-17390-101620-010	-	Water	10/16/2020	15:00											x	Trip Blank

Notes:

BOD - Biochemical Oxygen Demand
COD - Chemical Oxygen Demand
TOC - Total Organic Carbon
VOCs - Volatile Organic Compounds
\- - Not applicable

Table 2

Analytical Results Summary
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October 2020

Location ID:		MW-1	MW-2	MW-2	MW-9
Sample Name:		WG-17390-101620-006	WG-17390-101520-001	WG-17390-101520-002	WG-17390-101620-008
Sample Date:		10/16/2020	10/15/2020	10/15/2020 Duplicate	10/16/2020
Parameters	**Unit**				
Volatile Organic Compounds					
1,1,1-Trichloroethane	µg/L	1.0 U	13 J	45 J	1.0 U
1,1,2,2-Tetrachloroethane	µg/L	1.0 U	4.0 U	130 U	1.0 U
1,1,2-Trichloroethane	µg/L	1.0 U	4.0 U	130 U	1.0 U
1,1-Dichloroethane	µg/L	1.0 U	1600 J	20000 J	1.2
1,1-Dichloroethene	µg/L	1.0 U	6.0	130 U	1.0 U
1,2-Dichloroethane	µg/L	1.0 U	4.0 U	130 U	1.0 U
1,2-Dichloroethene (total)	µg/L	1.0 U	6.5	130 U	1.0 U
1,2-Dichloropropane	µg/L	1.0 U	4.0 U	130 U	1.0 U
1,4-Dioxane	µg/L	18 J	200 U	6300 U	50 U
2-Butanone (Methyl ethyl ketone) (MEK)	µg/L	10 U	40 U	1300 U	10 U
2-Hexanone	µg/L	10 U	40 U	1300 U	10 U
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	µg/L	10 U	40 U	1300 U	10 U
Acetone	µg/L	10 U	40 U	1300 U	10 U
Benzene	µg/L	1.0 U	300 J	160 J	1.0 U
Bromodichloromethane	µg/L	1.0 U	4.0 U	130 U	1.0 U
Bromoform	µg/L	1.0 U	4.0 U	130 U	1.0 U
Bromomethane (Methyl bromide)	µg/L	1.0 U	4.0 U	130 U	1.0 U
Carbon disulfide	µg/L	1.0 U	4.0 U	130 U	1.0 U
Carbon tetrachloride	µg/L	1.0 U	4.0 U	130 U	1.0 U
Chlorobenzene	µg/L	1.0 U	4.0 U	130 U	1.0 U
Chloroethane	µg/L	1.0 U	32000	30000	1.0 U
Chloroform (Trichloromethane)	µg/L	1.0 U	4.0 U	130 U	1.0 U
Chloromethane (Methyl chloride)	µg/L	1.0 U	4.0 U	130 U	1.0 U
cis-1,2-Dichloroethene	µg/L	1.0 U	2.8 J	130 U	1.0 U
cis-1,3-Dichloropropene	µg/L	1.0 U	4.0 U	130 U	1.0 U
Dibromochloromethane	µg/L	1.0 U	4.0 U	130 U	1.0 U
Ethylbenzene	µg/L	1.0 U	43 J	24 J	1.0 U
Methylene chloride	µg/L	5.0 U	20 U	630 U	5.0 U
Styrene	µg/L	1.0 U	4.0 U	130 U	1.0 U
Tetrachloroethene	µg/L	1.0 U	4.0 U	130 U	1.0 U
Toluene	µg/L	1.0 U	13	18 J	1.0 U
trans-1,2-Dichloroethene	µg/L	1.0 U	3.7 J	130 U	1.0 U
trans-1,3-Dichloropropene	µg/L	1.0 U	4.0 U	130 U	1.0 U
Trichloroethene	µg/L	1.0 U	4.0 U	130 U	1.0 U
Vinyl chloride	µg/L	1.0 U	12 J	31 J	1.0 U
Xylenes (total)	µg/L	2.0 U	300 J	120 J	2.0 U

Table 2

Analytical Results Summary
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October 2020

Location ID:		MW-1	MW-2	MW-2	MW-9
Sample Name:		WG-17390-101620-006	WG-17390-101520-001	WG-17390-101520-002	WG-17390-101620-008
Sample Date:		10/16/2020	10/15/2020	10/15/2020 Duplicate	10/16/2020
Parameters	**Unit**				
Dissolved Gases					
Ethane	µg/L	-	290 J	570 J	-
Methane	µg/L	-	7700 J	16000 J	-
General Chemistry					
Alkalinity, total (as CaCO3)	mg/L	-	290	-	-
Ammonia-N	mg/L	-	4.3	-	-
Biochemical oxygen demand (BOD)	mg/L	-	15 J-	-	-
Chemical oxygen demand (COD)	mg/L	-	140	-	-
Nitrate (as N)	mg/L	-	0.10 UJ	-	-
Nitrite (as N)	mg/L	-	0.10 UJ	-	-
Phosphorus	mg/L	-	0.057 J	-	-
Sulfate	mg/L	-	3.1	-	-
Sulfide	mg/L	-	1.5	-	-
Total organic carbon (TOC)	mg/L	-	29	-	-

Table 2

Analytical Results Summary
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October 2020

Location ID:		MW-101	MW-102	MW-103	MW-11	MW-12
Sample Name:		WG-17390-101620-005	WG-17390-101620-007	WG-17390-101620-009	WG-17390-101520-003	WG-17390-101520-004
Sample Date:		10/16/2020	10/16/2020	10/16/2020	10/15/2020	10/15/2020
Parameters	**Unit**					
Volatile Organic Compounds						
1,1,1-Trichloroethane	µg/L	1.0 U	1.0 U	1.0 U	250	1.0 U
1,1,2,2-Tetrachloroethane	µg/L	1.0 U	1.0 U	1.0 U	50 U	1.0 U
1,1,2-Trichloroethane	µg/L	1.0 U	1.0 U	1.0 U	50 U	1.0 U
1,1-Dichloroethane	µg/L	1.0 U	1.7	1.0 U	2500	46
1,1-Dichloroethene	µg/L	1.0 U	1.0 U	1.0 U	1500	1.0 U
1,2-Dichloroethane	µg/L	1.0 U	1.0 U	1.0 U	11 J	1.0 U
1,2-Dichloroethene (total)	µg/L	1.0 U	1.0 U	1.0 U	76	0.40 J
1,2-Dichloropropane	µg/L	1.0 U	1.0 U	1.0 U	50 U	1.0 U
1,4-Dioxane	µg/L	50 U	50 U	50 U	2500 U	48 J
2-Butanone (Methyl ethyl ketone) (MEK)	µg/L	10 U	10 U	10 U	500 U	10 U
2-Hexanone	µg/L	10 U	10 U	10 U	500 U	10 U
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	µg/L	10 U	10 U	10 U	500 U	10 U
Acetone	µg/L	10 U	10 U	10 U	500 U	140
Benzene	µg/L	1.0 U	1.0 U	1.0 U	50 U	0.40 J
Bromodichloromethane	µg/L	1.0 U	1.0 U	1.0 U	50 U	1.0 U
Bromoform	µg/L	1.0 U	1.0 U	1.0 U	50 U	1.0 U
Bromomethane (Methyl bromide)	µg/L	1.0 U	1.0 U	1.0 U	50 U	1.0 U
Carbon disulfide	µg/L	1.0 U	1.0 U	1.0 U	50 U	1.0 U
Carbon tetrachloride	µg/L	1.0 U	1.0 U	1.0 U	50 U	1.0 U
Chlorobenzene	µg/L	1.0 U	1.0 U	1.0 U	50 U	1.0 U
Chloroethane	µg/L	1.0 U	1.0 U	1.0 U	50 U	1.2
Chloroform (Trichloromethane)	µg/L	1.0 U	1.0 U	1.0 U	50 U	1.0 U
Chloromethane (Methyl chloride)	µg/L	1.0 U	1.0 U	1.0 U	50 U	1.0 U
cis-1,2-Dichloroethene	µg/L	1.0 U	1.0 U	1.0 U	76	0.40 J
cis-1,3-Dichloropropene	µg/L	1.0 U	1.0 U	1.0 U	50 U	1.0 U
Dibromochloromethane	µg/L	1.0 U	1.0 U	1.0 U	50 U	1.0 U
Ethylbenzene	µg/L	1.0 U	1.0 U	1.0 U	50 U	1.0 U
Methylene chloride	µg/L	5.0 U	5.0 U	5.0 U	250 U	5.0 U
Styrene	µg/L	1.0 U	1.0 U	1.0 U	50 U	1.0 U
Tetrachloroethene	µg/L	1.0 U	1.0 U	1.0 U	50 U	1.0 U
Toluene	µg/L	1.0 U	1.0 U	1.0 U	7.9 J	1.0 U
trans-1,2-Dichloroethene	µg/L	1.0 U	1.0 U	1.0 U	50 U	1.0 U
trans-1,3-Dichloropropene	µg/L	1.0 U	1.0 U	1.0 U	50 U	1.0 U
Trichloroethene	µg/L	1.0 U	1.0 U	1.0 U	15 J	1.0 U
Vinyl chloride	µg/L	1.0 U	1.0 U	1.0 U	56	0.43 J
Xylenes (total)	µg/L	2.0 U	2.0 U	2.0 U	100 U	2.0 U

Table 2

Analytical Results Summary
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October 2020

Location ID:		MW-101	MW-102	MW-103	MW-11	MW-12
Sample Name:		WG-17390-101620-005	WG-17390-101620-007	WG-17390-101620-009	WG-17390-101520-003	WG-17390-101520-004
Sample Date:		10/16/2020	10/16/2020	10/16/2020	10/15/2020	10/15/2020
Parameters	**Unit**					
Dissolved Gases						
Ethane	µg/L	-	-	-	6.9	2.3
Methane	µg/L	-	-	-	2400	2400
General Chemistry						
Alkalinity, total (as CaCO3)	mg/L	-	-	-	450	610
Ammonia-N	mg/L	-	-	-	0.14 J	0.90
Biochemical oxygen demand (BOD)	mg/L	-	-	-	1.9 J-	3.6
Chemical oxygen demand (COD)	mg/L	-	-	-	58	51
Nitrate (as N)	mg/L	-	-	-	4.0 UJ	2.0 UJ
Nitrite (as N)	mg/L	-	-	-	4.0 UJ	2.0 UJ
Phosphorus	mg/L	-	-	-	0.10 U	0.093 J
Sulfate	mg/L	-	-	-	1800	560
Sulfide	mg/L	-	-	-	1.0 U	1.0 U
Total organic carbon (TOC)	mg/L	-	-	-	6.9	14

Notes:

J - Estimated concentration
J- - Estimated concentration, result may be biased low
U - Not detected at the associated reporting limit
UJ - Not detected; associated reporting limit is estimated
- - Not applicable

Table 3

Analytical Methods
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October 2020

Parameter	Method	Matrix	Holding Time Collection or Extraction to Analysis (Days)
Volatile Organic Compounds (VOCs)	SW-846 8260B	Water	14
Alkalinity	SM 2320 B	Water	14
Ammonia	SM 4500 NH3 D	Water	28
Nitrate/Nitrite	EPA 300.0	Water	48 hours
Sulfate	EPA 300.0	Water	28
Sulfide	SM 4500 S2 F	Water	7
Phosphorus	SM 4500 P E	Water	28
Chemical Oxygen Demand (COD)	SM 5220	Water	28
Biochemical Oxygen Demand (BOD)	SM 5210 B	Water	48 hours
Total Organic Carbon (TOC)	SM 5310 C	Water	28
Methane, Ethane	RSK-175	Water	14

Notes:

- - Not applicable

Method References:

SW-846 - "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, 1986, with subsequent revisions
EPA 300.0 - Methods for Chemical Analysis of Water and Wastes", USEPA 600/4-79-202, March 1983 (with all subsequent revisions)
SM - "Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992, with subsequent revisions
RSK - Sample Prep and Calculations for Dissolved Gas Analysis in Water Samples Using a GC Headspace Equilibration Technique, RSKSOP-175, Rev. 0, 8/11/94, USEPA Research Lab
USEPA - United States Environmental Protection Agency

Table 4

Qualified Sample Results Due to Holding Time Exceedance
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October 2020

Parameter	Sample ID	Holding Time (hours)	Holding Time Criteria (hours)	Analyte	Qualified Sample Results	Units
General Chemistry	WG-17390-101520-001	52	48	Nitrate (as N)	0.10 UJ	mg/L
	WG-17390-101520-003	53	48		4.0 UJ	mg/L
	WG-17390-101520-004	53	48		2.0 UJ	mg/L
General Chemistry	WG-17390-101520-001	52	48	Nitrite (as N)	0.10 UJ	mg/L
	WG-17390-101520-003	53	48		4.0 UJ	mg/L
	WG-17390-101520-004	53	48		2.0 UJ	mg/L
General Chemistry	WG-17390-101520-001	50	48	Biochemical oxygen demand (BOD)	15 J-	mg/L
	WG-17390-101520-003	49	48		1.9 J-	mg/L

Notes:

J- - Estimated concentration, result may be biased low
UJ - Not detected; associated reporting limit is estimated

Table 5

Qualified Sample Data Due to Variability in Field Duplicate Results
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October 2020

Parameter	Analyte	RPD	Sample ID	Qualified Result	Field Duplicate Sample ID	Qualified Result	Units
VOCs	1,1,1-Trichloroethane	110	WG-17390-101520-001	13 J	WG-17390-101520-002	45 J	µg/L
	1,1-Dichloroethane	170		1600 J		20000 J	µg/L
	Benzene	60.9		300 J		160 J	µg/L
	Ethylbenzene	56.7		43 J		24 J	µg/L
	Vinyl chloride	88.4		12 J		31 J	µg/L
	Xylenes (total)	85.7		300 J		120 J	µg/L
Dissolved Gases	Ethane	65.1	WG-17390-101520-001	290 J	WG-17390-101520-002	570 J	µg/L
	Methane	70.0		7700 J		16000 J	µg/L

Notes:

VOCs - Volatile Organic Compounds
RPD - Relative Percent Difference
J - Estimated concentration

Table 6

Qualified Sample Data Due to Exceedance of Calibration Range
Groundwater Plume Monitoring
Endoline Area Remediation/GM Tonawanda
Tonawanda, New York
October 2020

Parameter	Sample ID	Analyte	Qualified Result	Units
Dissolved Gases	WG-17390-101520-002	Methane	16000 J	µg/L

Notes:

J - Estimated concentration

about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

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