

FINAL

NATIONAL ENERGY TECHNOLOGY LABORATORY (NETL)

ALBANY SITE
GROUNDWATER MONITORING REPORT
EVENT 39 - March 2019
REVISION 1

Site Operations Services
Contract Number DE-FE0023656.725.06.00.01

For
U.S. Department of Energy
National Energy Technology Laboratory

Submitted

October 4, 2019

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List of Acronyms

amsl	above mean sea level
bgs	below ground surface
cis-1,2-DCE	cis-1,2-dichloroethene
DEQ	Department of Environmental Quality
DO	dissolved oxygen
DOE	United States Department of Energy
EPA	U.S. Environmental Protection Agency
GWMP	Groundwater Monitoring Plan
ICF	ICF International
MCL	maximum contaminant level
MML	maximum measurable level
mS/cm	milliSiemens per centimeter
mV	millivolts
NETL	National Energy Technology Laboratory
NGVD	National Geodetic Vertical Datum
NTU	nephelometric turbidity units
ORP	oxidation-reduction potential
PCE	tetrachloroethene
PRG	preliminary remediation goal
PVC	polyvinyl chloride
RBC	risk-based concentration
RSL	regional screening level
TCE	trichloroethene
trans-1,2-DCE	trans-1,2-dichloroethene
URS	URS Corporation
VOC	volatile organic compounds
µg/L	micrograms per liter
° C	degrees Celsius

Executive Summary

This report describes the March 2019 (Periodic Event 39) groundwater sampling and analysis activities performed by USSE2 at the United States Department of Energy (DOE) National Energy Technology Laboratory (NETL) in Albany, Oregon (the Site). The March 2019 sampling event is the 39th round of groundwater samples collected from the NETL-Albany site since the initiation of the NETL-Albany groundwater monitoring program in 2002.

Groundwater levels were measured in 35 of the 35 monitoring wells and piezometers. The gauging data was used to create groundwater elevation contour maps for the two identified aquifers on Site. Wells installed in the Perched Aquifer and deeper Gravel Aquifer zones provided spatial coverage to map the potentiometric surfaces of both aquifers as separate hydrogeologic units. Groundwater elevations from wells in the Perched Aquifer measured during the March 2019 event show a flow to the north in the northern portion of the site (from MW-10 to MW-11) and to the south/southwest and to the east away from a potentiometric high near MW-28. In the Gravel Aquifer, groundwater elevation data show a potentiometric high near monitoring well MW-13. Groundwater flows radially away from the high located around MW-13.

Groundwater samples were collected from 31 of the 33 two-inch diameter monitoring wells between March 25 and March 28, 2019. Two wells (MW-1 and MW-21) were not sampled because they are not optimally screened based on the current understanding of the Conceptual Site Model (USSE2, July 2017). Low-flow sampling protocols were followed at each well in accordance with the NETL-Albany Groundwater Monitoring Plan (GWMP, USSE2, January 2018). All groundwater samples were submitted for analysis of volatile organic compounds (VOCs) by Environmental Protection Agency (EPA) Method 8260C.

Six VOCs were detected during the March 2019 sampling event and are discussed in Section 4.1: carbon tetrachloride, chloroform, cis-1,2-dichloroethene (cis-1,2-DCE), tetrachloroethene (PCE), trans-1,2-dichloroethene (trans-1,2-DCE), and trichloroethene (TCE). Five of these VOCs were detected at concentrations that exceed Oregon Groundwater Maximum Measurement Levels (MMLs), Oregon Hot Spot tables, Oregon Risk-Based Concentrations (RBCs), EPA Regional Screening Levels (RSLs), or EPA Primary Maximum Contaminant Levels (MCLs).

1.0 Introduction

This report describes the March 2019 (Periodic Event 39) groundwater sampling and analysis performed by USSE2 at the DOE NETL site in Albany, Oregon (Figure 1). The sampling was conducted in accordance with the Groundwater Monitoring Plan Revision 13, for National Energy Technology Laboratory, Albany, Oregon (USSE2, January 2018) and the National Energy Technology Laboratory, Albany Groundwater Sampling Event 39 Work Plan Memo (February 2019).

The NETL-Albany groundwater monitoring program was initiated in 2001, as was then required by DOE Order 5400.1, General Environmental Protection Program. The sampling has not been mandated by any other regulatory requirement or consent order. These monitoring requirements have since been incorporated into DOE Order 436.1, Departmental Sustainability.

1.1 Project Scope and Objectives

The objective of the NETL-Albany groundwater monitoring program is to perform a site-wide and a limited off-site evaluation of groundwater conditions to determine the presence and extent of groundwater contamination. The NETL-Albany groundwater monitoring program is designed to:

- Obtain data for the purpose of determining baseline conditions of groundwater quality and quantity;
- Demonstrate compliance with and implementation of all applicable regulations and DOE Orders;
- Provide data to permit the early detection of groundwater pollution or contamination;
- Provide a reporting mechanism for detected groundwater pollution or contamination;
- Identify existing and potential groundwater contamination sources and maintain surveillance of these sources;
- Provide data upon which decisions can be made concerning facility operations (including land, buildings and equipment), management and protection of groundwater resources and future remedial activities.

The March 2019 sampling event is the 39th round of groundwater sampling conducted at the Site under the general program that was developed in 2001. The following table lists previous sampling events:

Event 1	July 2002	Event 20	September 2009
Event 2	November/December 2002	Event 21	March 2010
Event 3	February/March 2003	Event 22	August 2010
Event 4	May 2003	Event 23	March 2011
Event 5	August 2003	Event 24	August/September 2011
Event 6	November 2003	Event 25	March 2012
Event 7	February 2004	Event 26	August 2012
Event 8	May 2004	Event 27	March 2013
Event 9	October 2004	Event 28	August 2013
Event 10	February 2005	Event 29	February 2014
Event 11	September 2005	Event 30	August 2014
Event 12	February 2006	Event 31	March 2015
Event 13	October 2006	Event 32	August 2015
Event 14	March 2007	Event 33	April 2016
Event 15	June 2007	Event 34	September 2016
Event 16	October 2007	Event 35	April 2017
Event 17	March 2008	Event 36	August 2017
Event 18	October 2008	Event 37	March 2018
Event 19	March 2009	Event 38	August 2018

The groundwater data generated during these previous sampling events are discussed in detail in their respective periodic groundwater monitoring reports produced by ICF International (ICF, through Event 22) and URS (a legacy

AECOM company, Event 23 through Event 32) and AECOM (with USSE2, Event 33 through Event 38). Historical data are also summarized in the latest version of the GWMP (USSE2, January 2018). Historical data are incorporated into this report in the form of contaminant concentration trend graphs (Figure 6).

A detailed description of the Site, including the site location, physical structures, and site history, is provided in the GWMP.

2.0 Field and Analytical Procedures

This section summarizes the field and analytical procedures conducted by USSE2 during the March 2019 groundwater sampling event. Activities included the sampling and analysis of groundwater and the measurement of depth to groundwater. Field and analytical procedures were conducted in accordance with the GWMP. The monitoring well locations are shown in Figure 2.

2.1 Water Level Measurements

Groundwater depths were recorded at the 35 of 35 monitoring wells and piezometers on site (33 two-inch diameter wells and two one-inch piezometers). Depth to water was measured to the nearest one-hundredth of a foot from the surveyed reference point on the polyvinyl chloride (PVC) well riser using an electronic hand-held water-level meter. These water-level data were used to calculate groundwater elevations and flow gradients that are discussed in Section 3.2 and to develop the contour maps presented in Figures 3 and 4. Table 1 shows the well construction details, and Table 2 and Table 3 show the depth to groundwater and groundwater elevations from Event 39.

2.2 Groundwater Sampling

Groundwater samples were collected between March 25 and March 28, 2019 from 31 of 33 monitoring wells located at NETL-Albany and Liberty Elementary School. Two wells (MW-1 and MW-21) are not sampled because they are screened in the upper part of the Gravel Aquifer, where they do not monitor maximum concentrations of contaminants, and other adjacent wells (i.e., MW-22 and MW-23) are better suited to indicate concentrations at those depths and locations.

Samples were collected using low-flow sampling methods in accordance with the GWMP. Water quality measurements including temperature, pH, specific conductivity, dissolved oxygen (DO), turbidity, and oxidation-reduction potential (ORP) were recorded every 3-5 minutes during purging of monitoring wells using a multi-parameter water quality meter with flow-through cell. Groundwater samples were collected following the stabilization of water-quality parameters. Final water quality readings were recorded and are shown in Table 2. Sampling field logs are provided in Appendix A.

2.3 Laboratory Analysis

The 31 primary groundwater samples were analyzed for VOCs by EPA Method 8260C. Fourteen of the wells were analyzed for total metals by EPA Methods 200.7, 200.8 and 245.1.

Two field duplicates and two matrix spike/matrix spike duplicate quality control samples were collected during the event, one set from MW-4 and MW-28 each. MW-4 was sampled for metals and VOC duplicate, and matrix/matrix spike duplicate. MW-28 was only sampled for VOC duplicates and matrix spike/matrix spike duplicate. Laboratory analysis procedures and methods were performed as described in the GWMP.

The complete laboratory analytical reports are presented in Appendix B and the analytical results for groundwater are tabulated in Appendix C.

2.4 Data Review and Validation

A data validation was performed on groundwater analytical results in accordance with the updated GWMP. The data validation included review of sample documentation, preservation and holding times, blank data, recovery data for laboratory control samples, and precision of duplicate results.

All data is valid as reported and usable for project decision-making purposes. The data validation memorandum is included in Appendix D.

3.0 Hydrogeological Assessment

The following sections summarize the hydrostratigraphy as first described by ICF and refined by AECOM. Section 3.2 describes groundwater flow directions for Event 39.

3.1 Geology and Hydrology

Several distinct geologic units have been identified at the site. The geologic and hydrogeologic characteristics of each unit are summarized below.

3.1.1 Upper Silt Unit

The Upper Silt Unit is present from the ground surface to a depth of approximately 15 feet below ground surface (bgs) and is predominantly silt and silty sand with laterally discontinuous clay lenses and thin water-bearing sands. It contacts the underlying Gravel Aquifer across much of the site. The Upper Silt Unit is subject to non-uniform surface water infiltration that can become locally perched on discontinuous clay lenses and saturate discontinuous sand lenses. These conditions contribute to a non-uniform saturation and heterogeneous groundwater elevations and groundwater flow throughout the unit.

3.1.2 Upper Clay Unit

The Upper Clay Unit is a laterally discontinuous, dense, dry clay with a maximum thickness of approximately 10 feet. The Upper Clay Unit, when encountered, is located between the Upper Silt Unit and the underlying Gravel Aquifer at a depth of approximately 12 to 18 feet bgs. The current understanding of the lateral extent of the clay shows it as an inverted “T” shaped structure; however, it is important to note that the southern and western extent of the clay has not been evaluated. In some areas, the clay grades into soft, brown, moist, silty clay for about 10 feet from the mapped edge of the dense, hard, dry clay. The soft brown clay may represent some relatively narrow transitional facies at the edge of the Upper Clay Unit.

The Upper Clay Unit is a localized aquitard and groundwater perches on it in some portions of the Site. The approximate extents of the Perched Aquifer were determined by ICF and are shown in Figure 3. Some borings that have penetrated the Upper Clay Unit have encountered an approximately 5-foot-thick zone of dry sediments composed of the underlying Gravel Aquifer, suggesting the Upper Clay Unit (where present) prevents vertical movement of water through the clay and into the Gravel Aquifer. Flow of the perched groundwater (where present) appears to be controlled in part by the surface topography of the clay. With water infiltration being significantly less during the dry season, there are variable flow patterns in the Perched Aquifer, with flow generally somewhat radial due to local mounding around MW-28. Groundwater flow in the southern part of the Site appears to consistently be to the south/southwest regardless of season.

3.1.3 Gravel Aquifer

The Gravel Aquifer is present from a depth of approximately 15 feet bgs to approximately 35 feet bgs and consists of gravelly sands and clayey/silty gravels which are saturated in most portions of the Site. Investigations indicate a change in lithology of the Gravel Aquifer in the northeast portion of the Site. The typical lithology of the Gravel Aquifer transitions to a predominant dark gray, poorly-graded sand with little or no gravel or fines in the northeast portion of the Site. This same unit was observed in several borings in the northwestern part of Liberty Elementary School near the ball fields. Groundwater elevation data and geologic data obtained during site assessments suggest that stratigraphic variations in the overlying Upper Silt Unit may cause local confining conditions in the Gravel Aquifer; therefore, the Gravel Aquifer is considered to be semi-confined. Where the Upper Clay is absent, the Upper Silt Unit directly overlies the Gravel Aquifer and forms a continuous semi-confined aquifer. Locally, the upper portion of the Gravel Aquifer immediately below the Upper Clay has been found to be only partially saturated.

Groundwater flow in the Gravel Aquifer is variable across the Site. The gradient in the central portion of the Site is very flat, and groundwater elevations decrease to the north and south, indicating a flow direction away from the

center portion of the Site with a slight east-southeast trend below Liberty Elementary School. In the southern part of the Site the groundwater gradient is generally to the southwest, and in the northern part of the Site the gradient is toward the northwest or northeast depending on the season. Water levels in wells screened across both the Upper Silt Unit and Gravel Aquifer (MW-1, MW-3, MW-5, MW-6, and MW-14) are consistent with water levels in the Gravel Aquifer. The majority of the 17 wells installed on site since February 2005, and the four off-site wells installed in September 2006 were constructed such that the screened interval only penetrates the deep Gravel Aquifer and does not intercept the Upper Silt Unit. This was later confirmed based on contaminants of potential concerns identified in the earlier sampling events of the site's original wells.

3.1.4 Lower Silt/Clay Unit

The Lower Silt/Clay Unit includes two stratigraphic units (Siltstone and Blue Clay) that underlie the Gravel Aquifer. In general, the Blue Clay underlies the Siltstone Unit; however, in portions of the Site, the Siltstone Unit is not present, and the Gravel Aquifer directly overlies the Blue Clay. The Lower Silt/Clay Unit is an aquitard that restricts the vertical movement of water. The surface of the Lower Silt/Clay Unit in the southwestern portion of the Site dips steeply to the southwest. The surface of the Lower Silt/Clay Unit in the eastern portion of the Site and at Liberty Elementary School dips to the east/northeast. In the northwest part of the Site the Lower Silt Clay dips to the northwest.

3.2 March 2019 Groundwater Elevations and Flow Direction

Groundwater levels were measured in the 35 existing wells and piezometers in March 2019. Groundwater depths ranged from 2.0 feet bgs at MW-7 to 19.20 feet bgs at MW-1. Groundwater elevations ranged from 205.97 feet above mean sea level (amsl) at MW-6 to 222.68 feet amsl at MW-10. Event 39 and historical groundwater elevation data are provided in Table 3. Note that all groundwater elevations are referenced to National Geodetic Vertical Datum (NGVD), 1947.

The wet winters and dry summers result in seasonal variability in groundwater elevations at the Site. The seasonal variability in groundwater elevations reflects the low precipitation during the dry season (between July and September) as compared to higher groundwater elevations during wet season (between November and May).

The average March 2019 groundwater elevation was approximately 4.59 feet higher than the average elevation during the previous dry season (August 2018) and 0.04 feet lower than the previous wet season (March 2018).

Figures 3 and 4 show the groundwater elevation contours for the Perched Aquifer and Gravel Aquifer, respectively, for the March 2019 groundwater level measurements. Groundwater elevations from wells screened in the Gravel Aquifer were used to construct a potentiometric map of the Gravel Aquifer. Selected wells screened across both the Upper Silt and Gravel Aquifer zones are included in groundwater contouring because screens in these wells penetrate well into the Gravel Aquifer and appear to be representative of the Gravel Aquifer. These wells are generally located at the perimeter of the Site.

Groundwater elevations from wells in the Perched Aquifer (Figure 3) measured during the March 2019 event show a flow to the north in the northern portion of the site (from MW-10 to MW-11), and to the south/southwest and to the east away from a topographic high near MW-28. The gradient during March 2019 was 4.09 E-03 (MW-10 to MW-11) in the northern part of the site, and between 1.37 E-02 (MW-10 to MW-8) and 5.91 E-03 (MW-10 to MW-4) in the southern part of the site.

In the Gravel Aquifer, groundwater elevation data show a potentiometric high near monitoring well MW-13. Groundwater flows radially away from the high located around MW-13 (Figure 4). The gradient in the gravel aquifer is relatively flat across the site and under the Liberty Elementary School property; -6.22E-05 between MW-23 and MW-24 and -1.77E-03 (between MW-25 and MW-23). The gradient steepens to the south (1.04E-02 between MW-16 and MW-6 and 6.09E-03 between MW-16 and MW-31). Table 4 shows hydraulic gradient calculations.

4.0 Groundwater Quality Assessment

This section summarizes the results of the chemical analyses performed on groundwater samples collected during the March 2019 sampling event. Groundwater samples from 31 monitoring wells were analyzed for VOCs. Table 5 summarizes the March 2019 groundwater analytical results for detected constituents including the minimum applicable screening criteria, the frequency of detection, the frequency of detections exceeding screening criteria, the minimum and maximum concentrations, and the location of the maximum concentration. Table 6 lists groundwater analytical results for any detected volatile organic chemicals. Appendix B includes the Test America Laboratories Analytical Reports and Appendix C summarizes all reported groundwater lab data of volatile organics.

Table 7 lists federal and state groundwater quality standards and criteria for VOCs. The table includes Oregon Groundwater MMLs as defined in Oregon Administrative Rule 340-040-0020 (Groundwater Quality Protection). The MMLs are the maximum allowable concentrations of the chemicals in groundwater established by the State of Oregon. The Oregon Department of Environmental Quality (DEQ) uses the MMLs in the process of designating groundwater management areas in Oregon where necessary to preserve groundwater quality. MMLs are not *de facto* cleanup levels but are generally consistent with the EPA Primary MCLs. The MCLs are the levels established by the EPA that cannot be exceeded by a public water supply system. Oregon and EPA have also established risk-based criteria for screening purposes. The Oregon Hotspot values are screening values that are a combination of promulgated criteria and guidance values used by the state to prioritize groundwater cleanups. The EPA RSL values were calculated using the latest toxicity values, default exposure assumptions, and physical and chemical properties. The EPA RSL values incorporate the EPA Region III RBC Table, Region VI human health medium-specific screening levels table, and the Region IX Preliminary Remediation Goal (PRG) Table, and was last updated in November 2017. The Oregon DEQ RBC values are similar to the EPA RSLs but use Oregon-specific parameters to calculate risk. Oregon DEQ Petroleum RBCs were updated November 2015. Minimum criteria values used in this report reflect up to date EPA RSLs and Oregon DEQ RBCs.

The March 2019 groundwater data are compared to the lowest screening criteria for each analyte and are discussed in the following sections. Any result annotated with a “U” qualifier (in either the tables or appendices) or reported “ND” in the lab report signifies that the chemical was not detected above the method detection limit. Any result annotated with a “J” qualifier is an estimate, since the value is below the method reporting limit but above the method detection limit.

Laboratory method detection limits for VOCs may be greater than the minimum applicable screening criteria. Therefore, while these compounds were not detected above the method detection limits, they may still be present above screening criteria.

4.1 Volatile Organic Compounds

Six VOCs – carbon tetrachloride, chloroform, cis-1,2-DCE, PCE, trans-1,2-DCE, and TCE - were detected during the March 2019 sampling event. The current and historical concentrations of five common VOCs (carbon tetrachloride, chloroform, cis-1,2-DCE, PCE, and TCE) are presented graphically in Figure 6.

Carbon Tetrachloride. Carbon tetrachloride was detected in 10 of the 31 wells sampled during the March 2019 sampling event at concentrations ranging from 0.30J µg/L at MW-101 to 4900 µg/L at MW-18. Nine the detections of carbon tetrachloride exceeded the minimum groundwater criteria, which is the Oregon DEQ RBC of 0.41 µg/L. In addition, nine of the detections exceed the EPA RSL of 0.43 µg/L. Six of the detections exceed the EPA Primary Drinking Water Standard, the Oregon Hot Spot Value and the Oregon Groundwater MMLs of 5 µg/L. Carbon tetrachloride is an industrial solvent that was historically used in degreasing and other industrial applications.

Chloroform. Chloroform was detected in nine of the 31 wells sampled during the March 2019 sampling event at concentrations ranging from 1.3 J µg/L at MW-5 to 750 µg/L at MW-18. All the detections of chloroform exceeded the minimum groundwater criteria for the site which is the Oregon DEQ RBC of 0.19 µg/L. In addition, all of the concentrations exceeded the EPA RSL of 0.22 µg/L, two of the detections exceeded the EPA Primary Drinking Water Standard and the Oregon Hot Spot Value of 80 µg/L and the Oregon Groundwater MMLs of 100 µg/L. Chloroform is

formed as a byproduct when chlorine is added to the water supply system and is also a breakdown product of the anaerobic degradation of carbon tetrachloride.

cis-1,2-Dichloroethene (cis-1,2-DCE). cis-1,2-DCE was detected in six of the 31 wells sampled during the March 2019 sampling event at concentrations ranging from 0.73 J µg/L at MW-102 to 9.8 µg/L at MW-18. Two of the detections exceed the minimum screening criteria, which is the EPA RSL of 3.6 µg/L. Cis-1,2-DCE is an anaerobic breakdown product of TCE.

Tetrachloroethene (PCE). PCE was detected in three of the 31 wells sampled during the March 2019 sampling event at concentrations ranging from 1.1 J µg/L at MW-22 to 390 µg/L at MW-18. Two of the detections exceeded the minimum groundwater criteria, which is the EPA RSL of 4.1 µg/L. In addition, two of the concentrations exceed the EPA Primary Drinking Water Standard and Oregon Hot Spot Value of 5 µg/L.

trans-1,2-Dichloroethene (trans-1,2-DCE). trans-1,2-DCE was detected in one of the 31 wells sampled during the March 2019 sampling event at a concentration of 1.20 J µg/L at MW-18. The detection did not exceed the minimum groundwater criteria, which is the EPA RSL of 36 µg/L.

Trichloroethene (TCE). TCE was detected in ten of the 31 wells sampled during the March 2019 sampling event at concentrations ranging from 1.30 J µg/L at MW-17 to 3100 µg/L at MW-15. All of the TCE detections exceeded the minimum groundwater criteria, which is the EPA RSL of 0.28 µg/L. In addition, all of the detections exceed the Oregon DEQ RBC of 0.43 µg/L and eight of the detections exceed the Oregon MML, the Oregon Hot Spot Value and EPA Primary Drinking Water Standard of 5 µg/L. TCE is an industrial solvent used in degreasing and other industrial applications.

4.2 Metals

Twenty metals — aluminum, antimony, arsenic, barium, beryllium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, sodium, thallium, vanadium, and zinc were detected during the March 2019 sampling event.

Aluminum. Aluminum was detected in 5 of the 14 wells sampled during the March 2019 sampling event. The EPA Secondary Drinking Water Standard is 0.05 mg/L.

Antimony. Antimony was detected in two of the 14 wells sampled during the March 2019 sampling event.

Arsenic. Arsenic was detected in 14 of the 14 wells sampled during the March 2019 event, at concentrations ranging from 0.00031J mg/L at MW-14 to 0.35 mg/L at MW-16. All detections exceed the minimum groundwater criteria, which is the Oregon DEQ RBC of 0.000038 mg/L. In addition, the detected concentrations exceed the EPA RSL of 0.000052 mg/L and one detected concentration exceeds the EPA Primary Drinking Water Standard and Oregon Hot Spot Value of 0.010 mg/L.

Barium. Barium was detected in all 14 wells sampled during the March 2019 sampling event at concentrations ranging from 0.0031 mg/L at MW-14 to 0.37 mg/L at MW-16. None of the detected concentrations exceed the minimum screening criteria, which is the EPA RSL of 0.38 mg/L.

Beryllium. Beryllium was detected in two of the 14 wells sampled during the March 2019 sampling event. The highest was detected at a concentration of 0.00036 mg/L at MW-16.

Calcium. Calcium was detected in all 14 wells sampled during the March 2019 sampling event at concentrations ranging from 7.5 mg/L at MW-6 and MW-14 to 340 mg/L at MW-15. Screening criteria does not exist for calcium.

Chromium. Chromium was detected in 13 of the 14 wells sampled during the March 2019 sampling event at a concentration of 0.00026 J mg/L at MW-22 to 0.020 mg/L at MW-15. The detected concentrations exceed the minimum groundwater criteria, which is the EPA RSL of 0.000035 mg/L.

Cobalt. Cobalt was detected in 13 wells sampled during the March 2019 sampling event at concentrations ranging from 0.000051 J mg/L at MW-18 to 0.015 mg/L at MW-23. Two of these detections did exceed the minimum groundwater criteria, which is the EPA RSL of 0.0006 mg/L.

Copper. Copper was detected in nine of the 14 wells sampled during the March 2019 sampling event. Copper ranged from 0.00092 J mg/L at MW-17 to 0.010 J mg/L at MW-23.

Iron. Iron was detected in eight of the 14 wells sampled during the March 2019 sampling event at concentrations ranging from 0.15 J mg/L at MW-13 to 210 mg/L at MW-16. Three of the detected concentrations exceed the minimum groundwater criteria, which is the Oregon MML, the Oregon Hot Spot Value and the EPA Secondary Drinking Water Standard of 0.3 mg/L. In addition, one of the detections exceeds the EPA RSL of 1.4 mg/L.

Lead. Lead was detected in seven of the 14 wells sampled during the March 2019 sampling event ranging from 0.00031J mg/L at MW-14 to 0.0024 mg/L at MW-23.

Magnesium. Magnesium was detected in all 14 wells sampled during the March 2019 sampling event at concentrations ranging from 3.6 mg/L at MW-14 to 160 mg/L at MW-15. Screening criteria does not exist for magnesium.

Manganese. Manganese was detected in all of the 14 wells sampled during the March 2019 sampling event at concentrations ranging from 0.0014 J mg/L at MW-18 to 1.6 mg/L at MW-16. Nine of the detected concentrations exceed the minimum groundwater criteria, which is the EPA RSL of 0.043 mg/L. In addition, eight of the detections exceed the EPA Secondary Drinking Water Standard, the Oregon Hot Spot Value and Oregon MML of 0.05 mg/L. Two of the detected concentrations exceed the Oregon DEQ RBC of 0.88 mg/L.

Mercury. Mercury was detected in one of the 14 wells, MW-16 at a concentration of 0.00068 mg/L.

Nickel. Nickel was detected in all of the 14 wells sampled during the March 2019 sampling event at concentrations of 0.00026 J mg/L at MW-17 and 0.013 mg/L at MW-23. These detections do not exceed the minimum groundwater criteria, which is the EPA RSL of 0.22 mg/L.

Potassium. Potassium was detected in 13 of the 14 wells sampled during the March 2019 sampling event at concentrations ranging from 0.46 J mg/L at MW-19 to 4.2 mg/L at MW-15. Screening criteria does not exist for potassium.

Sodium. Sodium was detected in all 14 wells sampled during the March 2019 sampling event at concentrations ranging from 9.5 mg/L at MW-19 to 87 mg/L at MW-15. Screening criteria does not exist for sodium.

Thallium. Thallium was detected in one of the 14 wells, MW-23 at a concentration of 0.000086J mg/L.

Vanadium. Vanadium was detected in all of the 14 wells sampled during the March 2019 event at concentrations ranging from 0.0017 J mg/L at MW-19 to 0.042 mg/L at MW-23. Three of the detected concentrations exceed the minimum groundwater criteria, which is the EPA RSL of 0.0086 mg/L.

Zinc. Zinc was detected in 11 of the 14 wells sampled during the March 2019 sampling event ranging from 0.0019 J mg/L at MW-19 to 0.023 mg/L at MW-16.

4.3 Water Quality Parameters

Table 2 summarizes field parameters recorded at each of the 31 wells, including pH, conductivity, turbidity, DO, temperature, and ORP.

Temperatures ranged from 10.83 degrees Celsius (°C) at MW-28 to 15.74°C at MW-31.

DO was detected in thirty-one of the wells sampled during the March 2019 sampling event.

In March 2019, pH ranged from 5.90 s.u. at MW-11 to 7.54 s.u. at MW-24. Conductivity ranged from 0.111 milliSiemens per centimeter (mS/cm) at MW-6 to 0.89 mS/cm at MW-11. ORP ranged from -124 millivolts (mV) at MW-31 to 196 mV at MW-10.

Twenty of the wells sampled during March 2019 had measurable turbidity once readings stabilized. Turbidity ranged from 0.1 nephelometric turbidity units (NTUs) at MW-25, to 240 NTUs at MW-16.

4.4 Contaminant Trends

Several important trends in the VOC concentrations were noted at 19 locations: MW-3, MW-4, MW-5, MW-6, MW-14, MW-15, MW-17, MW-18, MW-20, MW-22, MW-23, MW-24, MW-27, MW-29, MW-30, MW-100, MW-101, MW-102 and MW-103. Trend plots (Figure 6) support the discussion below.

- *MW-3.* Concentrations of TCE have gone back down to non-detect from previous spike in August 2017, which is consistently lower during wet season events historically. Concentrations of cis-1,2-DCE have declined as compared to the previous wet season sampling event in March 2018 and the previous dry season event in August 2018. Chloroform, and TCE were detected during the August 2017 sampling event but have since gone back to non-detect during the March 2019 event.
- *MW*-4. Carbon tetrachloride remained non-detect from the first detections in April 2016.
- *MW*-5. Concentrations of chloroform from went from 4.8 µg/l in August 2017 to 1.9 µg/l in March 2018, above the previous high recorded in April 2017 and above historical high in August 2009. Concentrations of carbon tetrachloride were elevated at 3.4 µg/l during the August 2018 sampling event but decreased to non-detect in March 2019.
- *MW*-6. Concentrations of cis-1,2-DCE continue to fluctuate, with higher concentrations reported during the dry season. Carbon tetrachloride, chloroform, and PCE continued to be non-detect during the March 2019 sampling event. TCE was non-detect for March 2019.
- *MW-14.* Concentrations of chloroform continue to fluctuate with lower concentrations reported during the dry season. The chloroform dropped back to 2.0 µg/L in March 2019. Concentrations of carbon tetrachloride, cis-1,2-DCE, TCE, and PCE remain non-detected during the March 2019 sampling event.
- *MW-15.* Concentrations of TCE increased after a period of decrease. TCE was recorded at an all-time high of 3100 µg/L. Concentrations of carbon tetrachloride and chloroform decreased with respect to the prior wet season sampling event (March 2018) and are slightly elevated with the prior dry season sampling event (August 2018) indicating a possible upward trend. Concentrations of cis-1,2.-DCE fluctuate, decreased with respect to the prior sampling event (August 2018) and the prior wet season sampling event (March 2018). Concentrations of PCE remain non-detected.
- *MW-17.* TCE, was reported at concentrations at a decreased level compared with the previous sampling event (August 2018). Concentrations of carbon tetrachloride and TCE were reported at concentrations lower than previous dry season sampling event (August 2018). Concentrations of cis-1,2-DCE and chloroform were reported at concentrations higher than the prior wet season sampling event (March 2018). Concentrations of PCE remain non-detected during the August 2018 and March 2019 sampling events.
- *MW-18.* Four of the primary VOCs (carbon tetrachloride, chloroform, TCE, and PCE) show seasonal trends, returning to typical higher concentrations during the wet season. Concentrations of cis-1,2-DCE are consistent with prior sampling events.
- *MW-20.* Concentrations of carbon tetrachloride fluctuate seasonally and increased as compared to the previous dry season sampling event (August 2018). PCE concentrations also decreased with respect to the prior two season sampling events. TCE and chloroform concentrations fluctuate seasonally, with concentrations remaining consistent with previous sampling events with a very slight upward trend. Concentrations of cis-1,2-DCE decreased from the prior wet season sampling event (March 2018) and return to non-detect.
- *MW-22.* Concentrations of carbon tetrachloride increased slightly with respect to the prior two sampling events (March 2018 and August 2018). Concentrations of TCE increased slightly with respect to prior two sampling events. PCE and cis-1,2-DCE remained at typical levels with little fluctuation during past sampling events. Concentrations of chloroform remain consistent with the prior sampling event (August 2018).
- *MW-23.* Concentrations of chloroform are consistent with previous events. Carbon tetrachloride concentrations are consistent with the prior sampling event (August 2018) and are slightly higher than the

prior wet season sampling event (March 2018). TCE show seasonal fluctuations with lower concentrations reported during the dry season. PCE and cis-1,2-DCE remain at non-detected concentrations.

- *MW-24.* TCE, carbon tetrachloride and chloroform decreased slightly. In addition, concentrations of PCE and cis-1,2-DCE decreased from prior sampling events after reported at maximum concentrations (August 2015).
- *MW*-27. Carbon tetrachloride has varied seasonally from a high of 190 µg/L (Feb 2014) to a low of 53 µg/L (September 2016), but has maintained a slight upward trend since 2016.
- *MW-29.* Carbon tetrachloride was detected for the first time in September 2016 but have since gone back to non-detect.
- *MW*-30. Concentrations of cis-1,2-DCE decreased from the prior sampling event (August 2018), while TCE remained non-detect. Concentrations of PCE and chloroform remain non-detect. Carbon Tetrachloride was detected for the first time at 0.50 µg/L but returned to non-detect for March 2019.
- *MW-100.* Concentrations of carbon tetrachloride and TCE continue to fluctuate seasonally, with concentrations consistent with the previous wet season sampling event. Concentrations of chloroform, cis-1,2-DCE and PCE remain non-detect.
- *MW*-101. TCE was detected for the second time at 1.5 J µg/L for March 2019.
- *MW-102*. Concentrations of carbon tetrachloride, chloroform, cis-1,2-DCE and TCE continue to fluctuate seasonally. Concentrations of TCE are fluxuating very slightly since approximately February 2014. Carbon tetrachloride and chloroform were non-detect during this event. Concentrations of PCE remain non-detect.
- *MW*-103. Concentrations of TCE, carbon tetrachloride, chloroform, cis-1,2-DCE and PCE remain non-detect.

Results from Event 39 groundwater sampling were used to evaluate the extent and stability of the primary constituents of concern. Primary constituents of concern are VOCs, including carbon tetrachloride, chloroform, TCE, cis-1,2-DCE and PCE. Concentration data are presented in isopleth maps for carbon tetrachloride, chloroform, TCE, and PCE in the Gravel Aquifer (Figure 7 through Figure 10). The concentrations of carbon tetrachloride in the perched aquifer is presented in Figure 11 for this sampling event.

Contour maps of chemical concentrations were contoured by hand, scanned, and digitized into ArcGIS. A discussion of the maps is presented below.

Carbon Tetrachloride. Carbon tetrachloride was detected in eight of the 21 wells in the Gravel Aquifer and two of the nine wells sampled in the Perched Aquifer. Figure 7 shows the distribution of carbon tetrachloride in the Gravel Aquifer. The pattern of contamination depicts a carbon tetrachloride plume extending off site to the northwest.

The highest detected carbon tetrachloride concentration (4,900 µg/L) was in well MW-18, located near the suspected primary source area. The concentrations at MW-20 are typically the location of the highest concentrations in dry season and, as shown by concentration trends in Figure 6, these concentrations have been steadily increasing. Concentrations in MW-24 at the northern property boundary have been steadily increasing, while concentrations at MW-20 have been increasing steadily since approximately March 2006. Carbon tetrachloride had also been increasing in MW-23, but concentrations in MW-23 are low and appear to have stabilized since March 2011.

Well MW-103, downgradient of the eastern limit of carbon tetrachloride contamination, has never had a detectable concentration. To the southwest, MW-22 had a concentration of 20 µg/L during Event 39. This well shows an overall decreasing trend in carbon tetrachloride concentrations except for the August 2015 detection, which had increased from the prior two sampling events. The data indicate that the extent of contamination may have migrated offsite to the southwestern area and the eastern area, however, concentrations are decreasing in off-site wells east of the Site.

Well MW-29 showed a detection of carbon tetrachloride for the first time (0.64 µg/L) in 2016 but has gone back to non-detect in March 2019. It was the second of the perched wells to show carbon tetrachloride in this area of the site (MW-27 as the other).

Chloroform. Chloroform is an early breakdown product of carbon tetrachloride in the reductive dechlorination and denitrification biological breakdown processes. Chloroform was detected in 8 of the 22 wells in the Gravel Aquifer and one of the wells in the Perched Aquifer. The extent of chloroform in the Gravel Aquifer (Figure 8) follows the same general trend as carbon tetrachloride, but at much lower concentrations. The highest chloroform concentration (750

µg/L) is at MW-18 which is located near the primary source area. Trends in chloroform concentration (Figure 6) show that it tracks closely with carbon tetrachloride. Chloroform concentrations in the east-central part of the Site, specifically MW-14, have fluctuated greatly since March 2009. Concentrations to the north of the release area, specifically MW-24 show a slow increase in concentrations over time. Concentrations at MW-20 have also increased with the exception of the August 2015 sampling event in which concentrations decreased. Concentrations to the southwest (MW-22), have decreased since June 2007, with the exception of the August 2015 and March 2015 sampling events, in which results increased. Delineation of concentrations is not completed further to the southwest beyond MW-22.

Trichloroethene. Figure 9 shows contours of TCE concentrations in the Gravel Aquifer. TCE was detected in10 of the 22 wells in the Gravel Aquifer and no wells in the Perched Aquifer.. Concentrations of TCE are highest in MW-15 at 3100 µg/L. Concentrations are typically highest in MW-18 and MW-15. Concentrations in MW-15 have increased again during Event 39 while concentrations in MW-18 continue to fluctuate with higher concentrations reported during the wet season. TCE concentrations continue to increase in the northern part of the site at MW-24 over time. Concentrations appear to be decreasing in the southwest part of the site. TCE concentrations in MW-100, MW-102, and MW-103, in the eastern area of contamination, have consistently been above detection limits, but concentrations are low and decreasing and currently not detected in MW-103. Concentrations at MW-102 are generally decreasing since approximately August 2015.

Tetrachloroethene. PCE concentration contours are shown on Figure 10. During Event 39, PCE was detected in three of the 22 wells in the Gravel Aquifer and none in the Perched Aquifer. The highest concentration (39 µg/L) was at MW-18, which is consistent with the previous wet season events. It would appear likely that PCE sources near MW-18 would be transported off site to the northwest (near MW-20) along with other VOCs.

PCE concentrations to the southwest, at MW-22, are generally stable and consistent with previous sampling events. Concentrations to the northwest at MW-20 have fluctuated significantly since 2010. Concentrations along the northern site boundary by MW-24 have fluctuated greatly since 2012 and are reported at their highest concentration since sampling began but went back to non-detect in September 2016, whereas concentrations at MW-23 have remained non-detect since August 2012. PCE has not been detected at the eastern perimeter of the Site, nor has PCE been detected in the monitoring wells east of the Site.

5.0 Summary

This section summarizes USSE2's observations on the results of the 39th periodic sampling event conducted in March 2019.

5.1 Groundwater Flow

- Groundwater levels were measured in 35 of the 35 existing wells and piezometers in March 2019. Groundwater depths ranged from 2.0 feet bgs at MW-7 to 19.20 feet bgs at MW-1. Groundwater elevations ranged from 205.96 feet amsl at MW-6 to 222.28 feet amsl at MW-10.
- The average March 2019 groundwater elevation was approximately 4.59 feet higher than the average elevation during the previous dry season (August 2018) and 0.04 feet lower than the previous wet season (March 2018).
- Groundwater elevations from wells in the Perched Aquifer (Figure 3) measured during the March 2019 event show a flow to the north in the northern portion of the site (from MW-10 to MW-11) and to the south/southwest and to the east away from a topographic high near MW-28.
- In the Gravel Aquifer, groundwater elevation data show a potentiometric high near monitoring well MW-14. Groundwater flows radially away from the high located around MW-14 (Figure 4).

5.2 Groundwater Quality

- Carbon tetrachloride, chloroform, cis-1,2-dichloroethene (cis-1,2-DCE), tetrachloroethene (PCE), 1,2-dichloropropane, and trichloroethene (TCE) were detected during the March 2019 sampling event.
- Detections of carbon tetrachloride (11), chloroform (9), PCE (2), and TCE (10) in groundwater exceeded minimum screening criteria.

5.3 Contaminant Trends

Concentrations in many wells are stable or decreasing.

- Contaminant concentrations fluctuate seasonally without obvious trends in MW-3, MW-6, MW-14, MW-18, and MW-100.
- Concentrations of chloroform, carbon tetrachloride and TCE have stabilized since approximately August 2013 in MW-22.
- MW-30 concentrations of cis-1,2-DCE and TCE are stable.
- Concentrations of TCE in MW-103 are decreasing and have remained non-detect for the eighth sampling event in a row.
- Carbon Tetrachloride was detected for the first time in MW-29 at 0.64 µg/l in September 2016 (above the screening criteria of 0.45 µg/l) but has since gone back to non-detect. This will continue to be monitored.

There are detections of VOCs at concentrations greater than screening criteria near the site boundary and notable increases in VOC concentrations in some wells. In particular, VOC concentrations have increased substantially in the Gravel Aquifer in MW-20 and MW-24, located in the northwest corner of the site.

- Concentrations of chloroform and carbon tetrachloride have increased since approximately August 2013. Concentrations of TCE are stable.
- MW-5 returned to chloroform detection in September 2016 after a reported a concentration of chloroform higher than prior sampling events. The detection exceeds the minimum applicable screening criteria.

- Concentrations of carbon tetrachloride, chloroform, TCE, and cis-1,2-DCE at MW-102 have been decreasing since approximately February 2014.
- Concentration of carbon tetrachloride in MW-17 were reported consistent with the previous dry sampling event (August 2018) and lower than all respective wet season sampling events since April 2016 event. TCE has shown a slight decrease since the last wet season event (March 2018).
- MW-15 concentrations fluctuate seasonally with concentrations of carbon tetrachloride decreasing and TCE increasing. Chloroform and cis-1,2-DCE concentrations remain stable.
- MW-20 concentrations of carbon tetrachloride show the highest concentration recorded at 2,400 µg/L and the highest recorded at MW-24 at 110 ug/l during the previous wet sampling event (March 2018). TCE and chloroform concentrations remain stable. Concentration of PCE are also seasonal at MW-20 and are trending higher (all-time high of 8.6 µg/l in April 2017).
- Carbon tetrachloride, chloroform, and TCE concentrations are increasing in MW-24. In addition, concentrations of PCE and cis-1,2-DCE have increased since the prior sampling event and are reported at their highest concentrations since sample began at the well.
- Concentrations of carbon tetrachloride, chloroform, and TCE are greater than screening criteria at locations near the north-northwestern (MW-24, MW-23, and MW-20), southwestern (MW-22) and eastern (MW-17) property boundaries.
- Concentrations of PCE greater than the minimum screening criteria occur near the suspected source area (MW-18).
- TCE is detected at concentrations greater than the minimum screening criteria at offsite wells MW-100, MW-101, and MW-102 east of the site.
- TCE was detected for the first time in seven years at MW-101 in March 2018 but returned to non-detect in August 2018. TCE was detected again at 1.5 J during March 2019. This will continue to be monitored.

6.0 References

Oregon Department of Environmental Quality, *Numerical Groundwater Quality Reference Levels, Interim Standards for Maximum Measurable Levels of Contaminants in Groundwater, and Permanent Standards for Maximum Measurable Levels of Contaminants in Groundwater*, as delineated by Oregon Administrative Rules 340-40-020 and 090: November 14, 1997.

Oregon Department of Environmental Quality, *Pre-Calculated Hot Spot Look-Up Tables*, as delineated by Oregon Administrative Rules 340-122-010 through 115: October 20, 1998. Tables updated June 7, 2012. Latest version can be found at http://www.deq.state.or.us/lq/pubs/docs/RBDMHotSpotTable.pdf.

Oregon Department of Environmental Quality, *Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites*, as delineated by Oregon Administrative Rules 340-122-0205 through 0360: Electronic spreadsheets updated June 7, 2012. Latest version available at http://www.deq.state.or.us/lq/rbdm.htm.

U.S. Environmental Protection Agency regions 3, 6, and 9, *Regional Screening Levels for Chemical Contaminants at Superfund Sites*, as downloaded from http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm. Tables updated May 2018.

USSE2, *Groundwater Monitoring Plan for the National Energy Technology Laboratory-Albany, Revision 13, Albany, Oregon.* January 2018.

USSE2, *Technical Memorandum: Conceptual Site Model Report for the National Energy Technology Laboratory (Formerly Albany Research Center), U.S. Department of Energy- Albany, Oregon.* July 2017.

USSE2, *National Energy Technology Laboratory, Albany Groundwater Sampling Event 39 Work Plan Memo.* February 2019.

Tables

Table 1
Monitoring Well Construction

Groundwater Sampling Event 39
Albany NETL, Albany, OR

Well Number	Total Depth	Screen Depth	Blank Casing	Filter Pack Depth
MW-1	30	15-30	0-15	12.1-30
MW-3	24	9-24	0-9	7-24
MW-4	20	10-20	0-10	8-20
MW-5	30	14.5-29.5	0-14.5	11-30
MW-6	30	14-29	0-14	12-30
MW-7	20	10-20	0-10	7-20
MW-8	20	10-20	0-10	7-20
MW-9	25	10-25	0-10	7.2-25
MW-10	25	10-25	0-10	6.5-25
MW-11	20	9.5-19.5	0-9.5	6.5-20
MW-13	25	10-25	0-10	7.3-25
MW-14	28	8-28	0-8	6.7-28
MW-15	35	25-35	0-25	23.1-36
MW-16	33	23-33	0-23	20.8-35.5
MW-17	30	20-30	0-20	18.1-38
MW-18	32	22-32	0-22	20-33
MW-19	31.5	21.5-31.5	0-21.5	19.5-32
MW-20	35	25-35	0-25	23-36
MW-21	31	20-30	0-20	18-31
MW-22	53	40-50	0-40	38-50.5
MW-23	41	27-37	0-27	25-37.5
MW-24	46	35.5-43.5	0-33.5	31.5-44
MW-25	36	19-29	0-19	17-29.5
MW-26	30	20-30	0-20	18-30
MW-27	15	10-15	0-10	8-15
MW-28	14	9-14	0-9	7-14
MW-29	29	24-29	0-24	22-29
MW-30	38	28-38	0-28	26-38
MW-31	38	28-38	0-28	26-38
MW-100	27	17-27	0-17	14.5-27.5
MW-101	27	17-27	0-17	17-30
MW-102	37	27-37	0-27	24.5-37.5
MW-103	45	35-45	0-35	34.5-47.5
PZ-1A	13	13-18	0-13	12-18.2
PZ-1B	26	21-26	0-21	20-26.2

Notes:

All measurements in feet below ground surface

All wells are completed with flush mount monuments

Table 2
Groundwater Depth, Elevation, and Water Quality Measurements

Groundwater Monitoring Event 39
NETL Albany, Albany, OR

Well Number	Sample Date	Measuring Point Elevation	Depth to Water (ft)	Groundwater Elevation (ft AMSL)	Water Quality Measurements					
					pH	Specific Conductivity (mS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	ORP (mV)	Temperature (°C)
MW-1	3/25/19	228.10	19.20	208.90	-	-	-	-	-	-
MW-3	3/25/19	219.61	9.17	210.44	6.71	0.269	1.0	4.69	189	12.94
MW-4	3/26/19	218.28	2.73	215.55	6.93	0.420	7.0	1.48	106	11.80
MW-5	3/26/19	217.08	10.45	206.63	6.92	0.397	17.0	1.60	53	15.20
MW-6	3/26/19	219.48	13.51	205.97	6.30	0.111	0.0	4.90	195	13.85
MW-7	3/28/19	216.85	2.00	214.85	6.43	0.372	11.0	2.40	178	13.26
MW-8	3/27/19	220.23	7.78	212.45	6.57	0.184	0.0	1.30	184	11.82
MW-9	3/27/19	224.00	2.47	221.53	6.31	0.126	16.0	9.92	191	10.37
MW-10	3/27/19	225.41	2.73	222.68	6.35	0.150	7.9	2.87	196	12.04
MW-11	3/28/19	227.73	7.10	220.63	5.90	0.89	68.0	3.66	173	11.60
MW-13	3/25/19	223.31	10.41	212.9	6.58	0.204	7.8	4.40	166	12.20
MW-14	3/25/19	224.77	14.78	209.99	6.65	0.163	0.0	8.30	134	15.02
MW-15	3/26/19	222.96	12.59	210.37	6.72	0.361	5.0	1.72	112	13.11
MW-16	3/28/19	217.57	6.76	210.81	6.71	0.407	240	0.33	137	13.14
MW-17	3/25/19	218.84	8.35	210.49	7.17	0.312	1.8	3.43	174	12.85
MW-18	3/28/19	224.00	13.72	210.28	7.25	0.386	2.9	2.15	193	11.75
MW-19	3/27/19	224.20	14.00	210.20	6.57	0.180	0.5	0.79	162	11.07
MW-20	3/27/19	225.62	16.05	209.57	7.18	0.414	6.2	2.66	157	12.03
MW-21	3/25/19	216.60	6.15	210.45	-	-	-	-	-	-
MW-22	3/25/19	216.57	6.40	210.17	7.16	0.329	0.0	2.54	77	11.43
MW-23	3/25/19	227.87	19.00	208.87	7.47	0.388	40.1	6.03	149	12.56
MW-24	3/28/19	227.49	18.60	208.89	7.54	0.353	1.3	1.68	147	13.15
MW-25	3/27/19	220.38	9.70	210.68	6.78	0.213	0.1	3.90	178	11.40
MW-26	3/25/19	220.63	11.47	209.16	6.93	0.293	0.0	3.12	71	13.68
MW-27	3/26/19	222.80	9.02	213.78	7.06	0.469	0.0	6.15	135	13.30
MW-28	3/28/19	223.52	4.07	219.45	7.21	0.116	6.2	5.15	194	10.83
MW-29	3/26/19	217.93	7.62	210.31	7.23	0.600	40.0	0.95	34	11.08
MW-30	3/26/19	219.26	12.51	206.75	7.35	0.361	0.0	0.82	-118	14.02
MW-31	3/26/19	216.78	10.00	206.78	7.46	0.389	0.0	1.77	-124	15.74
MW-100	3/27/19	218.37	7.88	210.49	7.17	0.495	0.5	1.83	169	14.54
MW-101	3/27/19	218.54	8.08	210.46	7.27	0.589	0.0	2.31	169	14.79
MW-102	3/27/19	217.64	7.17	210.47	7.26	0.801	0.0	0.82	173	14.74
MW-103	3/27/19	216.51	6.35	210.16	7.24	0.327	0.0	2.41	172	13.54
PZ-1A	3/28/19	220.10	9.73	210.37	-	-	-	-	-	-
PZ-1B	3/28/19	220.05	9.65	210.40	-	-	-	-	-	-

Notes:
ft = feet
AMSL = Above Mean Sea Level
- = Not sampled
mS/cm = MilliSiemens per centimeter
NTUs = Nephelometric Turbidity Units
mg/L = Milligrams per liter
ORP = Oxidation-Reduction Potential
°C = Degrees Celsius
mV = Millivolts

Table 3
Current and Historical Groundwater Elevations

Groundwater Monitoring Event 39
NETL Albany, Albany, OR

Well Number	Measuring Point Elevation	Depth to Water (ft)	Groundwater Elevation (ft AMSL)																																							
		3/25/2019		8/20/2018	3/19/2018	9/1/2017	4/10/2017	9/16/2016	4/3/2016	8/20/2015	3/19/2015	8/21/2014	2/15/2014	8/19/2013	3/25/2013	8/13/2012	3/26/2012	8/30/2011	3/21/2011	8/23/2010	03/22/10	09/01/09	03/16/09	10/10/08	03/10/08	10/15/07	06/25/07	03/05/07	10/02/06	02/27/06	09/26/05	02/21/05	10/04/04	05/10/04	02/23/04	11/17/03	08/25/03	05/27/03	02/10/03	11/07/02	07/16/02	02/26/02
MW-1	228.10	19.20	208.90	207.20	208.90	207.38	210.45	207.18	209.98	207.37	209.05	207.70	208.02	207.34	208.62	207.88	207.92	207.92	209.49	207.93	208.91	207.06	206.99	206.85	208.73	206.95	208.16	209.06	207.03	208.92	207.00	207.72	206.75	208.10	208.34	206.21	206.99	208.75	207.64	206.17	207.40	206.55
MW-3	219.61	9.17	210.44	207.01	210.44	206.98	211.56	207.44	211.03	207.76	210.24	208.27	209.78	207.77	210.16	208.38	211.30	208.58	211.28	208.51	213.42	207.57	209.70	207.21	210.07	207.84	209.10	211.06	207.72	210.42	207.49	208.98	207.32	209.04	209.96	206.34	207.00	209.57	209.20	206.04	207.67	207.49
MW-4	218.28	2.73	215.55	210.10	215.55	210.63	216.46	209.85	215.86	210.28	216.57	212.27	216.55	210.78	216.00	212.73	217.08	212.69	216.72	211.76	215.95	210.90	216.14	211.58	216.23	210.66	213.47	215.83	210.18	215.68	210.78	215.54	212.63	214.85	216.04	211.68	209.86	214.41	214.52	209.65	211.38	213.88
MW-5	217.08	10.45	206.63	201.26	206.63	200.71	207.75	200.41	206.59	200.08	205.95	200.93	207.27	200.88	206.53	202.23	208.66	202.51	207.62	201.54	205.87	200.50	205.47	200.29	205.18	201.48	202.73	206.94	199.66	206.22	200.77	204.59	201.35	204.23	206.58	200.48	199.92	204.78	205.51	199.87	201.17	203.34
MW-6	219.48	13.51	205.97	200.03	205.97	199.93	207.05	199.48	205.96	199.40	205.64	200.17	206.37	200.13	205.93	200.93	208.40	202.03	206.82	199.52	203.97	198.63	204.40	198.50	203.26	199.43	200.27	205.56	197.28	204.17	197.77	202.38	198.12	202.07	205.00	197.44	197.46	202.79	204.22	197.44	199.17	200.96
MW-7	216.85	2.00	214.85	207.75	214.85	208.02	215.68	206.90	215.61	206.39	215.25	209.84	215.41	208.50	215.05	210.95	NM	210.44	215.53	209.66	214.81	207.16	214.88	206.53	214.44	208.38	209.98	214.99	205.90	214.90	207.60	213.52	209.17	213.13	214.84	206.67	206.88	212.73	213.52	205.46	207.00	212.29
MW-8	220.23	7.78	212.45	207.25	212.45	207.98	213.73	207.61	213.34	207.78	213.13	209.28	213.01	208.25	212.81	209.75	213.78	209.87	213.83	209.27	212.96	208.51	213.07	210.40	213.23	214.17	210.70	219.18	216.35	218.53	216.38	218.38	217.42	218.22	218.99	218.52	216.93	218.19	218.82	217.05	217.26	219.53
MW-9	224.00	2.47	221.53	210.78	221.53	213.00	222.45	209.63	221.88	210.39	222.19	211.92	224.00	212.73	221.58	212.47	223.05	212.00	222.57	211.85	218.74	207.74	220.89	207.55	216.65	210.89	209.01	214.77	207.14	211.33	207.04	210.34	207.80	210.12	210.83	207.20	207.37	209.57	209.16	206.36	207.80	208.07
MW-10	225.41	2.73	222.68	213.60	222.68	214.15	223.56	212.28	223.18	213.76	223.71	215.79	224.91	214.95	223.09	217.36	224.16	217.52	223.86	216.80	222.96	214.96	223.76	214.65	222.40	222.11	218.80	223.28	211.89	221.36	212.45	220.93	214.05	220.39	222.30	214.16	214.44	220.34	220.23	209.61	215.77	221.83
MW-11	227.73	7.10	220.63	212.58	220.63	213.42	221.30	212.42	220.57	212.82	221.13	214.43	222.86	214.08	220.62	215.99	220.86	215.79	221.28	216.64	219.99	215.41	219.97	217.58	219.73	219.48	221.01	221.55	217.68	220.43	215.46	218.89	213.83	219.37	221.25	215.53	216.84	220.23	221.03	211.85	216.85	219.85
MW-13	223.31	10.41	212.9	207.96	212.90	208.01	214.51	208.58	214.19	209.26	213.23	209.65	210.99	209.44	213.23	210.19	213.28	210.14	214.39	209.94	210.11	209.00	212.85	208.16	209.96	207.44	210.59	214.00	208.71	212.67	208.61	211.51	209.34	211.01	212.22	205.31	208.43	211.82	211.30	207.84	209.08	210.50
MW-14	224.77	14.78	209.99	207.44	209.99	207.52	211.52	207.54	211.14	207.90	209.89	208.26	208.95	207.77	209.61	208.42	NM	208.50	210.86	208.59	210.15	207.62	209.09	207.30	209.77	207.65	209.06	210.47	207.72	210.09	207.48	208.58	207.24	208.89	209.51	206.53	207.35	209.62	208.66	206.43	207.87	207.12
MW-15	222.96	12.59	210.37	206.24	210.37	206.51	211.65	207.41	211.08	207.71	210.53	208.31	210.01	207.93	210.41	208.58	211.41	208.55	211.41	208.48	210.49	207.55	209.83	207.26	210.15	207.93	209.09	211.15	207.65	210.50	207.47	209.08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-16	217.57	6.76	210.81	205.17	210.81	205.12	211.82	204.87	211.37	204.21	211.12	205.89	211.33	205.34	210.99	206.47	212.46	206.65	212.07	205.98	210.52	204.90	210.56	204.68	210.18	206.15	207.21	211.47	204.42	210.52	204.90	209.21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-17	218.84	8.35	210.49	206.42	210.49	206.74	211.66	207.41	211.39	207.64	213.46	208.28	210.10	207.76	210.34	208.48	211.41	208.53	211.31	208.40	210.44	207.46	209.72	207.07	210.03	207.76	209.02	211.10	207.64	210.49	207.41	209.07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-18	224.00	13.72	210.28	206.42	210.28	206.51	211.77	207.25	211.11	207.70	210.33	208.30	209.65	207.77	210.30	208.51	211.28	208.53	211.34	208.50	210.45	207.56	209.80	207.30	210.19	207.96	209.09	211.06	207.64	210.15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-19	224.20	14.00	210.20	206.22	210.20	206.65	212.00	206.93	210.63	207.18	210.30	208.09	209.96	207.87	210.00	208.23	211.06	208.10	211.34	208.08	210.45	207.06	210.79	207.07	211.14	208.85	208.75	212.02	207.17	210.45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-20	225.62	16.05	209.57	206.75	209.57	207.09	211.21	206.94	210.52	207.20	209.64	207.69	208.67	207.21	209.31	207.83	210.25	208.08	210.47	207.87	209.59	206.92	208.85	206.90	209.41	207.31	208.38	210.01	206.99	209.47	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-21	216.60	6.15	210.45	204.43	210.45	204.26	211.25	203.82	210.60	203.67	210.35	204.69	210.46	204.41	210.15	205.51	NM	205.95	211.72	205.46	210.14	204.33	210.17	204.45	209.78	205.79	206.69	210.89	203.92	209.86	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-22	216.57	6.40	210.17	204.25	210.17	204.02	210.98	203.50	210.31	203.31	210.08	204.65	210.37	204.09	209.92	205.15	211.69	205.64	211.55	205.16	209.87	204.04	209.98	204.19	209.53	205.52	206.41	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-23	227.87	19.00	208.87	207.17	208.87	207.37	210.45	207.19	209.98	207.39	209.01	207.71	208.02	207.34	208.61	207.90	209.47	207.92	209.53	207.96	208.92	207.09	207.98	206.85	208.73	206.96	208.17	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-24	227.49	18.60	208.89	207.13	208.89	207.34	210.70	207.17	209.87	207.28	209.21	207.54	208.28	207.22	208.79	207.83	214.64	208.04	209.87	207.87	209.04	206.99	208.18	206.88	208.88	207.11	208.22	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-25	220.38	9.70	210.68	206.05	210.68	206.48	212.28	206.53	211.44	206.86	211.41	207.86	211.43	207.16	211.40	208.40	212.52	208.45	212.32	207.93	211.45	207.03	214.23	207.80	211.51	209.10	209.33	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-26	220.63	11.47	209.16	207.58	209.16	207.51	210.85	206.88	210.46	207.73	209.72	208.36	208.60	207.63	209.47	208.26	210.51	208.48	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-27	222.80	9.02	213.78	208.57	213.78	209.02	214.55	208.48	214.05	208.94	213.75	210.35	214.17	208.85	213.67	211.62	211.29	209.44	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-28	223.52	4.07	219.45	217.40	219.45	217.55	220.32	216.91	219.92	217.37	220.82	218.06	222.92	212.92	220.00	217.72	220.65	217.77	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-29	217.93	7.62	210.31	206.03	210.31	205.38	211.63	206.93	210.98	207.75	210.91	208.46	209.95	207.74	210.35	208.49	210.80	206.71	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-30	219.26	12.51	206.75	202.16	206.75	201.68	207.76	200.55	206.88	200.34	206.29	201.19	206.95	201.07	206.42	202.22	208.70	203.23	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-31	216.78	10.00	206.78	201.34	206.78	200.66	207.80	200.51	206.81	200.42	206.38	201.24	206.97	201.31	206.83	202.47	208.89	202.59	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-100	218.37	7.88	210.49	206.47	210.49	207.02	211.69	207.06	210.95	207.62	210.51	208.13	210.56	207.67	210.28	208.39	211.22	208.48	211.50	208.31	210.36	207.37	209.65	207.15	209.93	207.71	208.89	211.07	208.14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-101	218.54	8.08	210.46	206.14	210.46	206.84	211.72	206.58	210.92	207.53	210.54	208.07	210.67	207.61	210.35	208.29	211.29	208.41	211.50	208.20	210.35	207.25	209.48	207.05	209.93	207.64	208.82	211.10	207.72	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-102	217.64	7.17	210.47	206.76	210.47	207.16	211.66	207.29	210.92	207.56	210.48	208.04	210.68	207.63	210.33	208.32	211.25	208.34	211.42	208.14	210.24	207.18	209.64	206.77	209.78	207.50	208.71	211.60	206.54	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-103	216.51	6.35	210.16	-	NM	207.33	211.21	207.28	210.86	207.51	210.24	207.96	210.61	207.50	210.05	208.09	210.95	208.06	210.99	207.92	209.80	207.01	209.32	206.61	209.31	207.15	208.40	210.77	207.21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PZ-1A	220.10	9.73	210.37	206.30	210.37	207.00	211.78	207.48	207.09	207.64	197.05	208.29	210.55	207.44	210.30	211.43	211.43	208.58	211.39	NM	213.86	208.64	209.90	208.20	210.29	208.00	209.17	211.05	207.74	218.70	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PZ-1B	220.05	9.65	210.40	206.41	210.40	207.13	211.87	207.68	207.13	207.68	197.00	207.99	210.60	207.71	210.37	211.46	211.46	208.66	211.17	NM	210.93	207.40	209.55	207.81	210.19	207.95	209.65	211.10	198.49	210.64	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
ft = feet
AMSL = Above Mean Sea Level
NM = Not Measured
NA = Not Applicable, before well installation

Table 4
Hydraulic Gradient Calculations

Groundwater Monitoring Event 39
NETL Albany, Albany, OR

Horizontal Gradient Locations	Aquifer Zone Screened	Elevation (ft AMSL)	Elevation Difference	Horizontal Distance	Gradient
MW-10 to MW-11					
MW-10	Perched	222.68	2.05	500.9	4.09E-03
MW-11		220.63			
MW-10 to MW-8					
MW-10	Perched	222.68	10.23	744.9	1.37E-02
MW-8		212.45			
MW-10 to MW-4					
MW-10	Perched	222.68	7.13	1205.8	5.91E-03
MW-4		215.55			
MW-28 to MW-8					
MW-28	Perched	219.45	7.00	289.4	2.42E-02
MW-8		212.45			
MW-16 to MW-6					
MW-16	Gravel	210.81	4.84	463.6	1.04E-02
MW-6		205.97			
MW-16 to MW-31					
MW-16	Gravel - Silt/Gravel	210.81	4.03	661.4	6.09E-03
MW-31		206.78			
MW-23 to MW-24					
MW-23	Gravel	208.87	-0.02	321.5	-6.22E-05
MW-24		208.89			
MW-25 to MW-23					
MW-25	Gravel	210.68	-1.81	1320.8	-1.37E-03
MW-23		208.87			

Notes:

ft AMSL = Feet Above Mean Sea Level

Table 5
Detection Summary

Groundwater Monitoring Event 39
NETL Albany, Albany, OR

Analyte	Minimum Applicable Criteria*	Detection Frequency	Minimum Criteria Exceedance Frequency	Maximum Detected Concentration	Location of Maximum Detection	Minimum Detected Concentration
Volatile Organics (µg/L)						
Benzene	0.39	0/31	0/31	NA	NA	NA
Carbon tetrachloride	0.41	10/31	9/31	4900	MW-18	0.30 J
Chloroform	0.19	9/31	9/31	750	MW-18	0.69 J
cis-1,2-Dichloroethene	3.6	6/31	2/31	9.8	MW-18	0.72 J
Naphthalene	0.14	0/31	0/31 **	NA	NA	NA
Tetrachloroethene (PCE)	4.1	3/31	2/31	390	MW-18	1.1 J
trans-1,2-Dichloroethene	36	1/31	0/31	1.20 J	MW-18	1.20 J
Trichloroethene (TCE)	0.28	10/31	10/31	3100	MW-15	1.3 J

Notes:

µg/L = micrograms per Liter

J = Analyte concentration is an estimate. Analyte was detected below Method Reporting Limit, but above the Method Detection Limit

* = Minimum Applicable Criteria are the minimium criteria presented in Table 7

** = Method Detection Limits are above the minimum applicable screening criteria. Additional concentrations may exceed minimum applicable screening criteria

Table 6
Analytical Results for Detected Constituents - Volatile Organics

Groundwater Monitoring Event 39
NETL Albany, Albany, OR

Sample Location	Sample ID	Sample Date	Volatile Organic Concentrations							
			Benzene	Carbon tetrachloride	Chloroform	cis-1,2-Dichloroethene	Naphthalene	Tetrachloroethene (PCE)	trans-1,2-Dichloroethene	Trichloroethene (TCE)
MW-3	MW3-032519	3/25/19	0.53 U	0.30 U	0.50 U	0.69 U	0.93 U	0.41 U	0.39 U	0.85 U
MW-4	MW4-032619	3/26/19	0.53 U	0.30 U	0.50 U	0.69 U	0.93 U	0.41 U	0.39 U	0.85 U
MW-5	MW5-032619	3/26/19	0.53 U	0.30 U	**0.69 J**	0.69 U	0.93 U	0.41 U	0.39 U	0.85 U
MW-6	MW6-032619	3/26/19	0.53 U	0.30 U	0.50 U	0.69 U	0.93 U	0.41 U	0.39 U	0.85 U
MW-7	MW7-032819	3/28/19	0.53 U	0.30 U	0.50 U	0.69 U	0.93 U	0.41 U	0.39 U	0.85 U
MW-8	MW8-032719	3/27/19	0.53 U	0.30 U	0.50 U	0.69 U	0.93 U	0.41 U	0.39 U	0.85 U
MW-9	MW9-032719	3/27/19	0.53 U	0.30 U	0.50 U	0.69 U	0.93 U	0.41 U	0.39 U	0.85 U
MW-10	MW10-032719	3/27/19	0.53 U	**1.0 J**	0.50 U	0.69 U	0.93 U	0.41 U	0.39 U	0.85 U
MW-11	MW11-032819	3/28/19	0.53 U	0.30 U	0.50 U	0.69 U	0.93 U	0.41 U	0.39 U	0.85 U
MW-13	MW13-032519	3/25/19	0.53 U	0.30 U	0.50 U	0.69 U	0.93 U	0.41 U	0.39 U	0.85 U
MW-14	MW14-032519	3/25/19	0.53 U	0.30 U	**2.0 J**	0.69 U	0.93 U	0.41 U	0.39 U	0.85 U
MW-15	MW15-032619	3/26/19	0.53 U	**19**	**4.9 J**	**1.6 J**	0.93 U	0.41 U	0.39 U	**3100**
MW-16	MW16-032819	3/28/19	0.53 U	0.30 U	0.50 U	0.69 U	0.93 U	0.41 U	0.39 U	0.85 U
MW-17	MW17-032519	3/25/19	0.53 U	0.30 U	0.50 U	0.69 U	0.93 U	0.41 U	0.39 U	**1.3 J**
MW-18	MW18-032819	3/28/19	0.53 U	**4,900**	**750**	**9.8**	0.93 U	**390**	**1.2 J**	**410**
MW-19	MW19-032719	3/27/19	0.53 U	0.30 U	0.50 U	0.69 U	0.93 U	0.41 U	0.39 U	0.85 U
MW-20	MW20-032719	3/27/19	0.53 U	**1,800**	**210**	**0.72 J**	0.93 U	**13.0**	0.39 U	**270**
MW-22	MW22-032519	3/25/19	0.53 U	**20**	**3.2 J**	**1.7 J**	0.93 U	**1.1 J**	0.39 U	**7.5**
MW-23	MW23-032519	3/25/19	0.53 U	**3.6**	**4.6 J**	0.69 U	0.93 U	0.41 U	0.39 U	**2.5 J**
MW-24	MW24-032819	3/28/19	0.53 U	**120**	**15**	0.69 U	0.93 U	0.41 U	0.39 U	**62**
MW-25	MW25-032719	3/27/19	0.53 U	0.30 U	0.50 U	0.69 U	0.93 U	0.41 U	0.39 U	0.85 U
MW-26	MW26-032519	3/25/19	0.53 U	0.30 U	0.50 U	0.69 U	0.93 U	0.41 U	0.39 U	0.85 U
MW-27	MW27-032619	3/26/19	0.53 U	**74**	**16**	0.69 U	0.93 U	0.41 U	0.39 U	0.85 U
MW-28	MW28-032819	3/28/19	0.53 U	**2.6 J**	0.50 U	0.69 U	0.93 U	0.41 U	0.39 U	0.85 U
MW-29	MW29-032619	3/26/19	0.53 U	0.30 U	0.50 U	0.69 U	0.93 U	0.41 U	0.39 U	0.85 U
MW-30	MW30-032619	3/26/19	0.53 U	0.30 U	0.50 U	**5.8**	0.93 U	0.41 U	0.39 U	0.85 U
MW-31	MW31-032619	3/26/19	0.53 U	0.30 U	0.50 U	0.69 U	0.93 U	0.41 U	0.39 U	0.85 U
MW-100	MW100-032719	3/27/19	0.53 U	0.30 U	0.50 U	0.69 U	0.93 U	0.41 U	0.39 U	**1.4 J**
MW-101	MW101-032719	3/27/19	0.53 U	**0.30 J**	0.50 U	0.69 U	0.93 U	0.41 U	0.39 U	**1.5 J**
MW-102	MW102-032719	3/27/19	0.53 U	0.30 U	0.50 U	**0.73 J**	0.93 U	0.41 U	0.39 U	**20**
MW-103	MW103-032719	3/27/19	0.53 U	0.30 U	0.50 U	0.69 U	0.93 U	0.41 U	0.39 U	0.85 U
Minimum Applicable Screening Criteria			**0.39**	**0.41**	**0.19**	**3.6**	**0.14**	**4.1**	**36**	**0.28**

Notes:
µg/L = Micrograms per liter
U = Analyte was not detected above indicated value
J = Analyte concentration is an estimate. Analyte was detected below Method Reporting Limit, but above the Method Detection Limit
NS = Not Sampled
Bold indicates analyte was detected above the method detection limit
Shading indicates result exceeds the minimum applicable screening criteria (See Table 7).

Table 7
Applicable Screening Criteria

Groundwater Monitoring Event 39
NETL Albany, Albany, OR

Analyte	Minimum Criteria	Oregon - Groundwater MMLs[1]	Oregon - Hot Spot Tables[2]	Oregon - DEQ RBCs [3]	EPA - Primary Drinking Water MCLs[4]	EPA - Secondary Drinking Water MCLs[4]	EPA - Regional Screening Levels[5]
Volatile Organics (µg/L)							
1,1,1,2-Tetrachloroethane	0.57	---	---	---	---	---	0.57
1,1,1-Trichloroethane	200	200	200	9,100	200	---	800
1,1,2,2-Tetrachloroethane	0.076	---	---	---	---	---	0.076
1,1,2-Trichloroethane	0.041	---	5	0.23	5	---	0.041
1,1-Dichloroethane	2.3	---	---	2.3	---	---	2.7
1,1-Dichloroethene	7	7	7	340	7	---	28
1,1-Dichloropropene	---	---	---	---	---	---	---
1,2,3-Trichlorobenzene	0.70	---	---	---	---	---	0.70
1,2,3-Trichloropropane	0.00075	---	---	---	---	---	0.00075
1,2,4-Trichlorobenzene	0.40	---	70	---	70	---	0.40
1,2,4-Trimethylbenzene	1.5	---	---	54	---	---	1.5
1,2-Dibromo-3-chloropropane	0.00033	---	0.2	---	0.2	---	0.00033
1,2-Dichlorobenzene	30	---	600	370	600	---	30
1,2-Dichloroethane (EDC)	0.14	5	5	0.14	5	---	0.17
1,2-Dichloropropane	0.44	---	5	---	5	---	0.44
1,3,5-Trimethylbenzene	12	---	---	50	---	---	12
1,3-Dichlorobenzene	---	---	---	---	---	---	---
1,3-Dichloropropane	37	---	---	---	---	---	37
1,4-Dichlorobenzene	0.42	75	75	0.42	75	---	0.48
2,2-Dichloropropane	---	---	---	---	---	---	---
2-Chlorotoluene	25	---	---	---	---	---	25
4-Chlorotoluene	24	---	---	---	---	---	24
4-Isopropyltoluene	---	---	---	---	---	---	---
Benzene	0.39	5	5	0.39	5	---	0.45
Bromobenzene	6.2	---	---	---	---	---	6.2
Bromoform (THM)	2.7	100 (total THM)	80 (total THM)	2.7	80 (total THM)	---	9.2
Bromomethane	0.75	---	---	8.7	---	---	0.75
Carbon Tetrachloride	0.41	5	5	0.41	5	---	0.45
Chlorobenzene	7.8	---	100	91	100	---	7.8
Chlorobromomethane	---	---	---	---	---	---	---
Chlorodibromomethane (THM)	100	100 (total THM)	---	0.14	---	---	---
Chloroethane	21,000	---	---	21,000	---	---	--
Chloroform (THM)	0.19	100 (total THM)	80 (total THM)	0.19	80 (total THM)	---	0.22
Chloromethane	19	---	---	190	---	---	19
cis-1,2-Dichloroethene	3.6	---	70	73	70	---	3.6
cis-1,3-Dichloropropene	--	---	---	---	---	---	--
Dibromomethane	0.80	---	---	---	---	---	0.80
Dichlorobromomethane (THM)	100	100 (total THM)	---	---	---	---	---
Dichlorodifluoromethane	20	---	---	---	---	---	20
Ethylbenzene	1.5	---	700	1.4	700	---	1.5
Ethylene Dibromide	0.00005	---	0.00005	---	0.00005	---	---
Hexachlorobutadiene	0.30	---	---	---	---	---	0.30
Isopropylbenzene (cumene)	45	---	---	680	---	---	45
Methylene chloride	5	---	5	---	5	---	11
m,p-Xylene	19	---	---	---	---	---	19
Methyl tert-butyl ether (MTBE)	12	---	---	12	---	---	14
Naphthalene	0.14	---	---	0.14	---	---	0.17
n-Butylbenzene	100	---	---	---	---	---	100
n-Propylbenzene	--	---	---	---	---	---	--
o-Xylene	19	---	---	---	---	---	19
sec-Butylbenzene	200	---	---	---	---	---	200
Styrene	100	---	100	1,600	100	---	120
tert-Butylbenzene	69	---	---	---	---	---	69
Tetrachloroethene (PCE)	4.1	---	5	11	5	---	4.1
Toluene	110	---	1,000	2,300	1,000	---	110
trans-1,2-Dichloroethene	36	---	100	110	100	---	36
trans-1,3-Dichloropropene	--	---	---	---	---	---	--
Trichloroethene (TCE)	0.28	5	5	0.43	5	---	0.28
Trichlorofluoromethane	110	---	---	1,300	---	---	110
Vinyl chloride	0.019	2	2	0.025	2	---	0.019

Notes:

--- = No criteria available

µg/L = micrograms per liter

THM = Trihalomethanes, including a group of disinfection byproducts (chloroform, bromodichloromethane, dibromochloromethane, & bromoform).

[1] The Oregon Groundwater Maximum Measurement Levels (MMLs) are provided in Oregon Administrative Rules (OAR) 340-40-020, last updated on November 14, 1997.

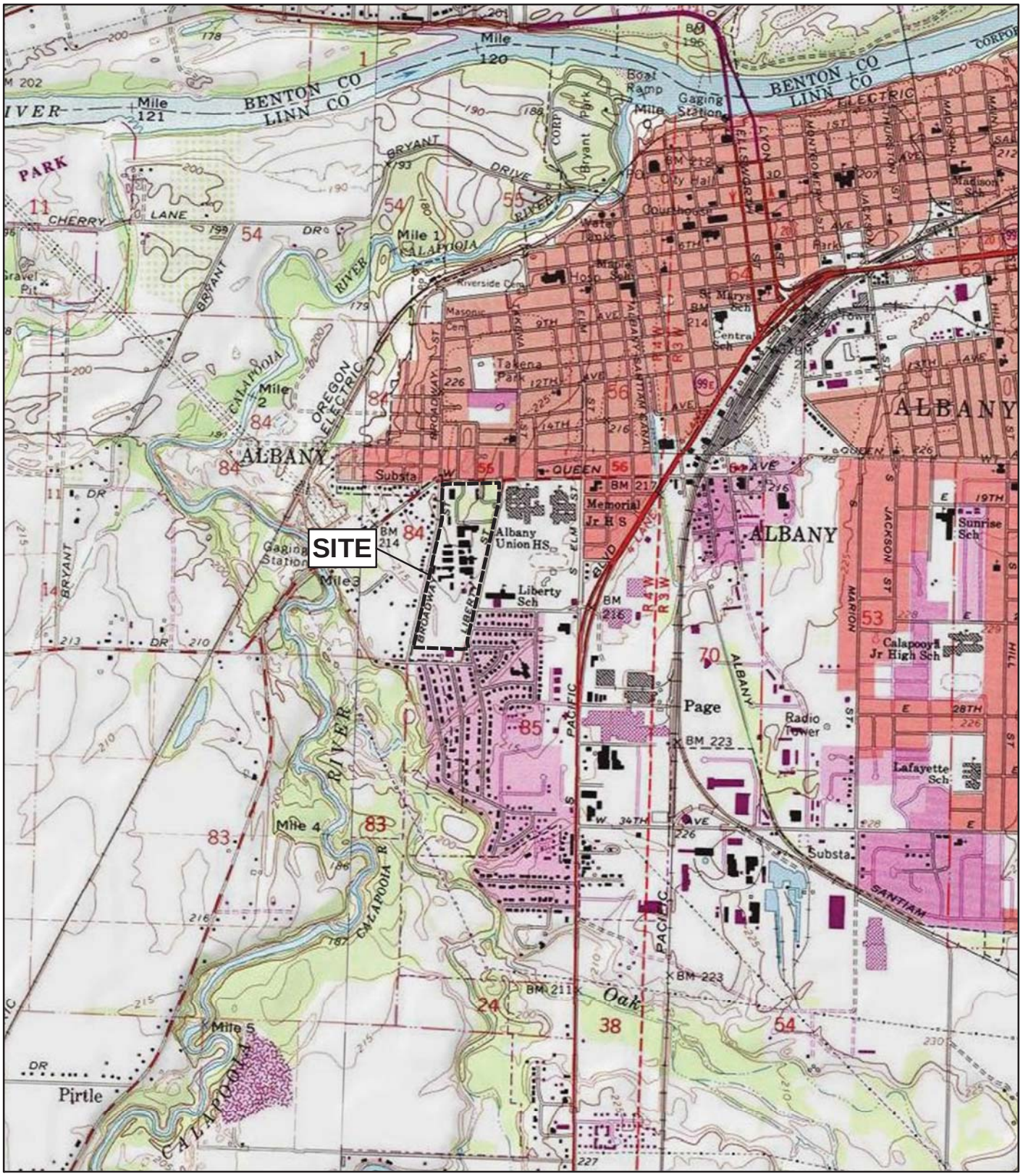
2 The Oregon Hot Spot Tables are provided by the Oregon DEQ under Environmental Cleanup Guidance, [see http://www.deq.state.or.us/pubs/reports.htm]. Values used are revised to reflect Oregon DEQ hierarchy (MCL/MML, RBC, then EPA Regional Screening Levels for Regions 3, 6 and 9). Hot Spot values were modified in 2015 to reflect updates to EPA Regional Screening Levels and subsequently revised Oregon RBDM values.

3 The Oregon Petroleum Risk-Based Concentrations are provided by the Oregon DEQ under Environmental Cleanup Guidance, [see http://www.deq.state.or.us/pubs/reports.htm]. Values used are from Appendix A using Residential Groundwater - Ingestion & Inhalation from Tapwater last updated on November, 2015.

4 The EPA Primary and Secondary Maximum Contaminant Levels (MCLs) are provided by the U.S. Environmental Protection Agency, last updated on June 2013
[see http://www.epa.gov/safewater/contaminants/index.html].

5 The EPA Regional Risk-Based Screening Values for Region 3, 6 and 9, provided by the U.S. Environmental Protection Agency, last updated on November 2017 [see http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm]. Screening levels used are via the pathway of exposure to tapwater.

Figures



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1,000 0 1,000 2,000

SCALE IN FEET

SITE VICINITY

NETL ALBANY
GROUNDWATER SAMPLING
ALBANY, OREGON

MARCH 2019

FIGURE 1

K:\25697357_NETL_Albany\MXD\2Q15\Fig 1 Site Vicinity.mxd



Sources: NAIP, 2012.
Albany GIS, 2007.

150 75 0 150 300
Feet

SITE MAP

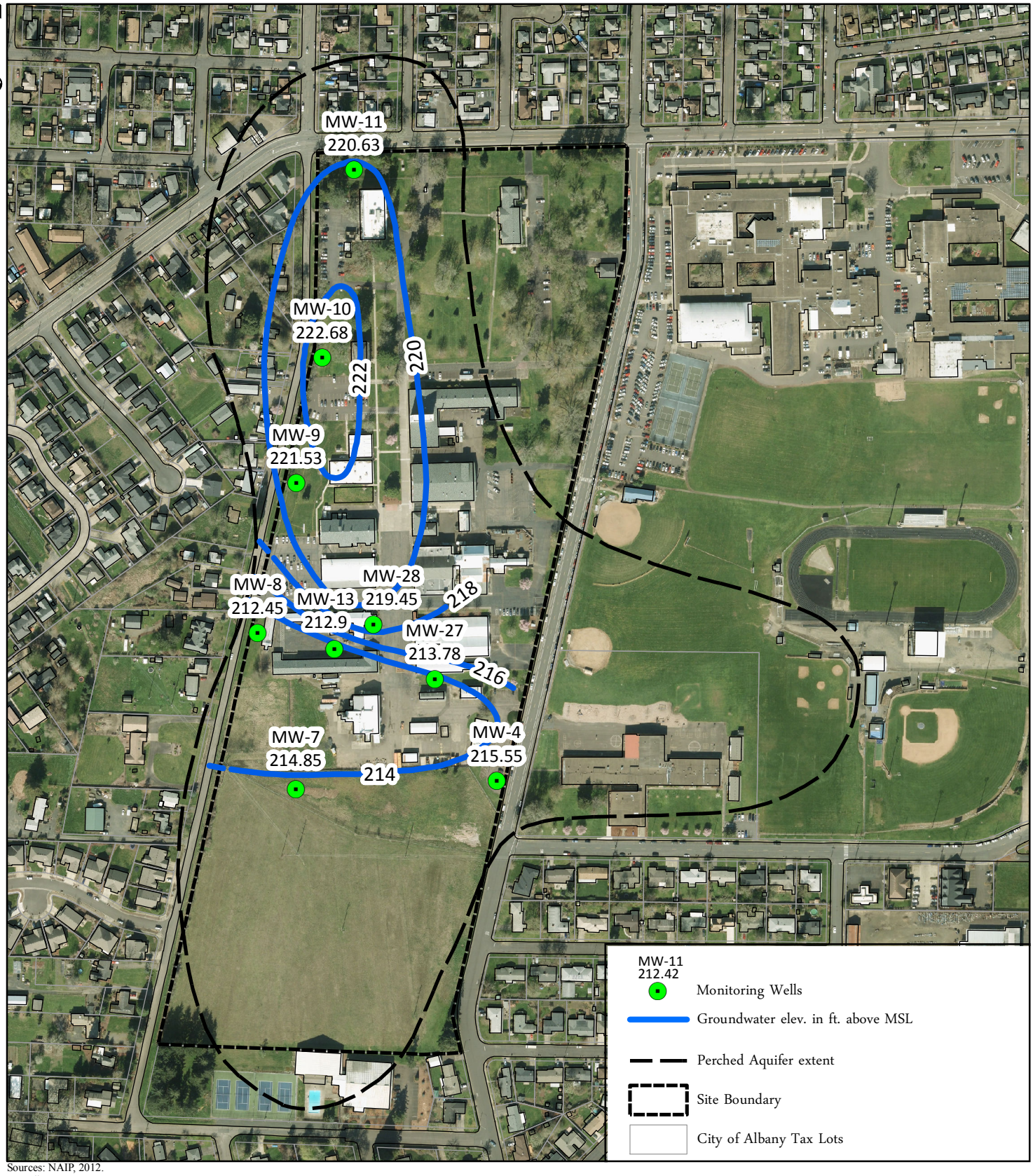
NETL ALBANY

GROUNDWATER SAMPLING

ALBANY, OREGON

MARCH 2019

FIGURE 2



Sources: NAIP, 2012.
Albany GIS, 2007.

150 75 0 150 300
Feet

GROUNDWATER ELEVATION CONTOURS

IN THE PERCHED AQUIFER, MARCH 2019

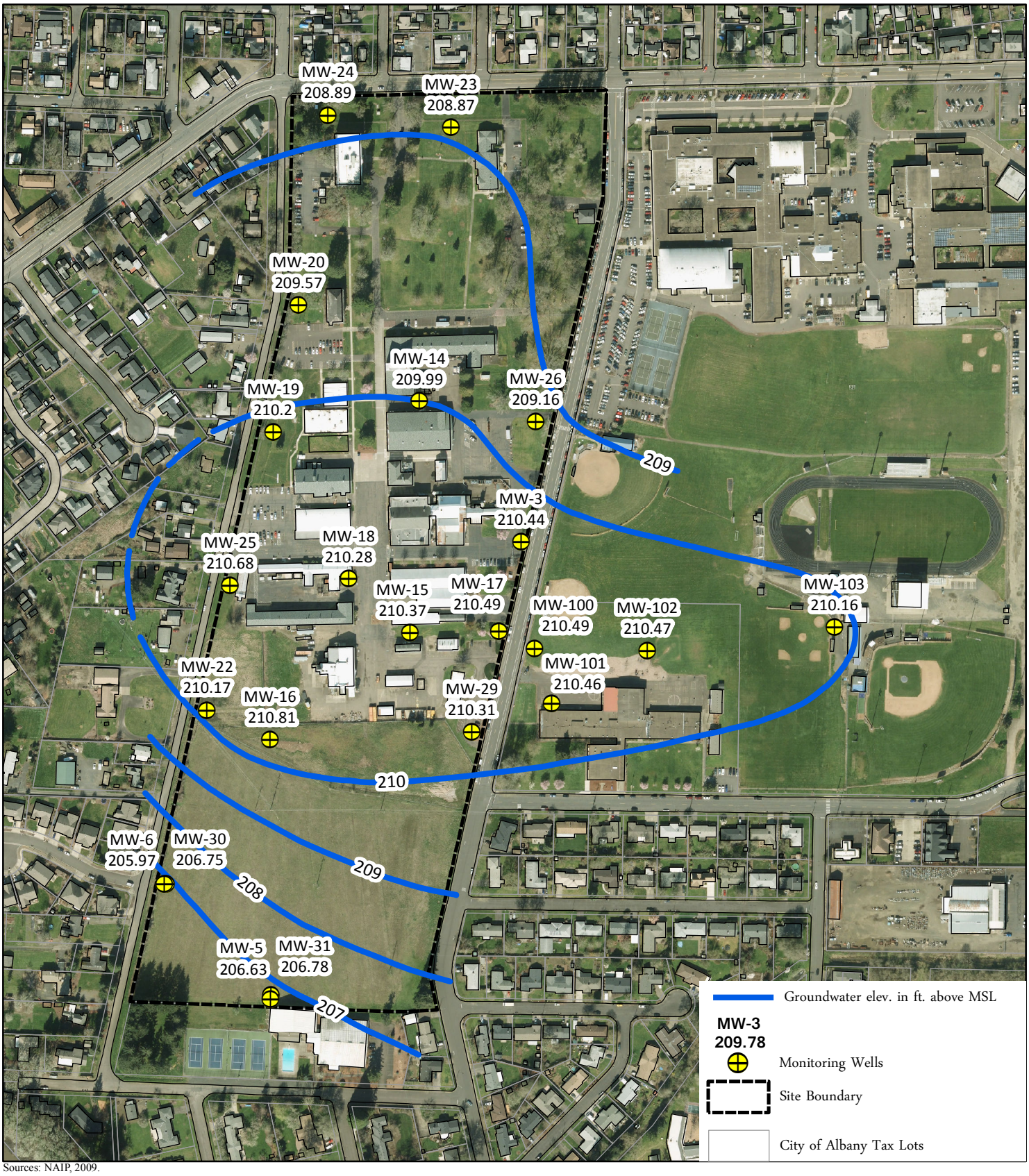
NETL ALBANY

GROUNDWATER SAMPLING

March 2019

ALBANY, OREGON

FIGURE 3



Sources: NAIP, 2009.
Albany GIS, 2007.

GROUNDWATER ELEVATION CONTOURS IN THE GRAVEL AQUIFER, MARCH 2019

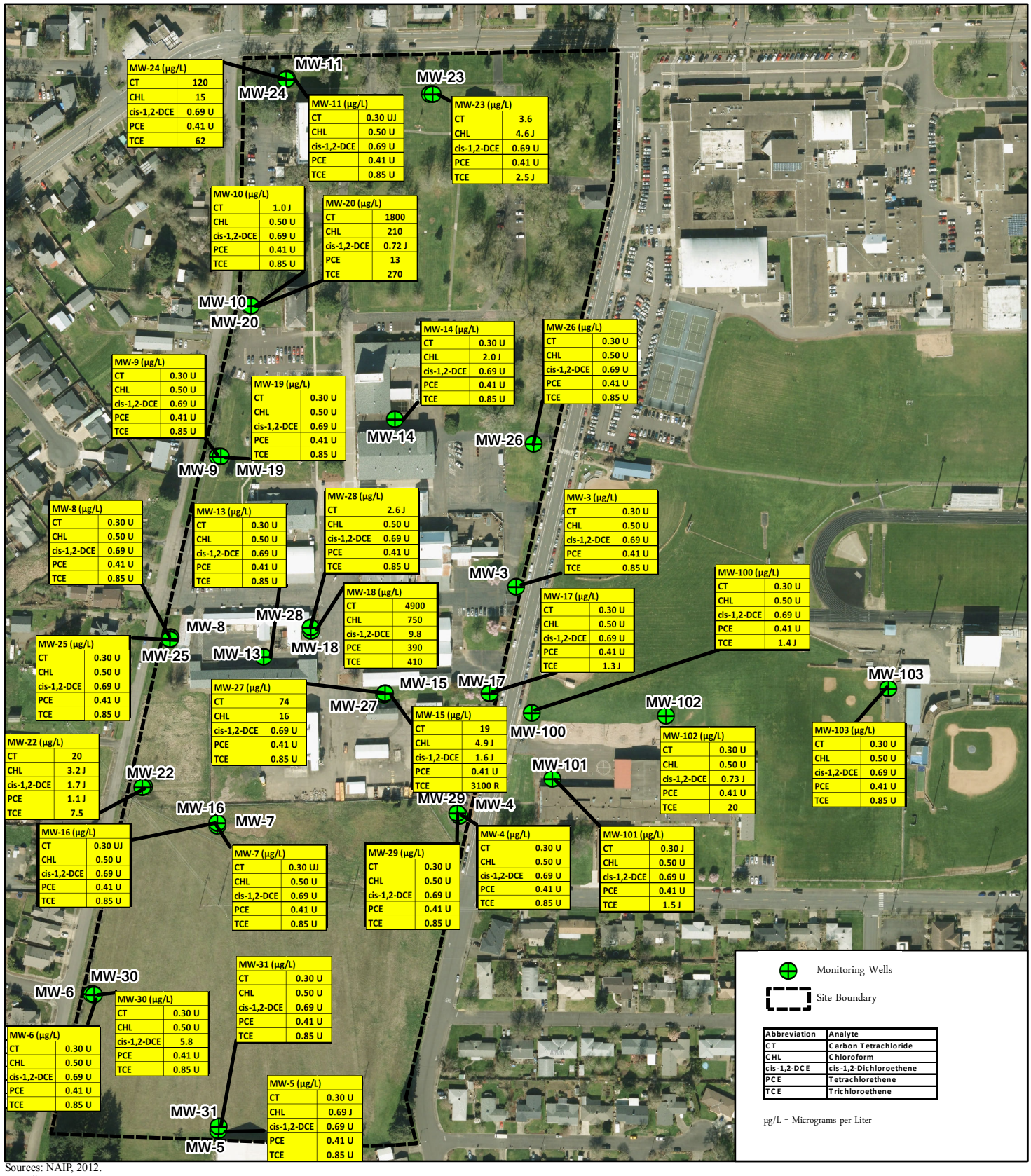
NETL ALBANY

GROUNDWATER SAMPLING

ALBANY, OREGON

March 2019

FIGURE 4



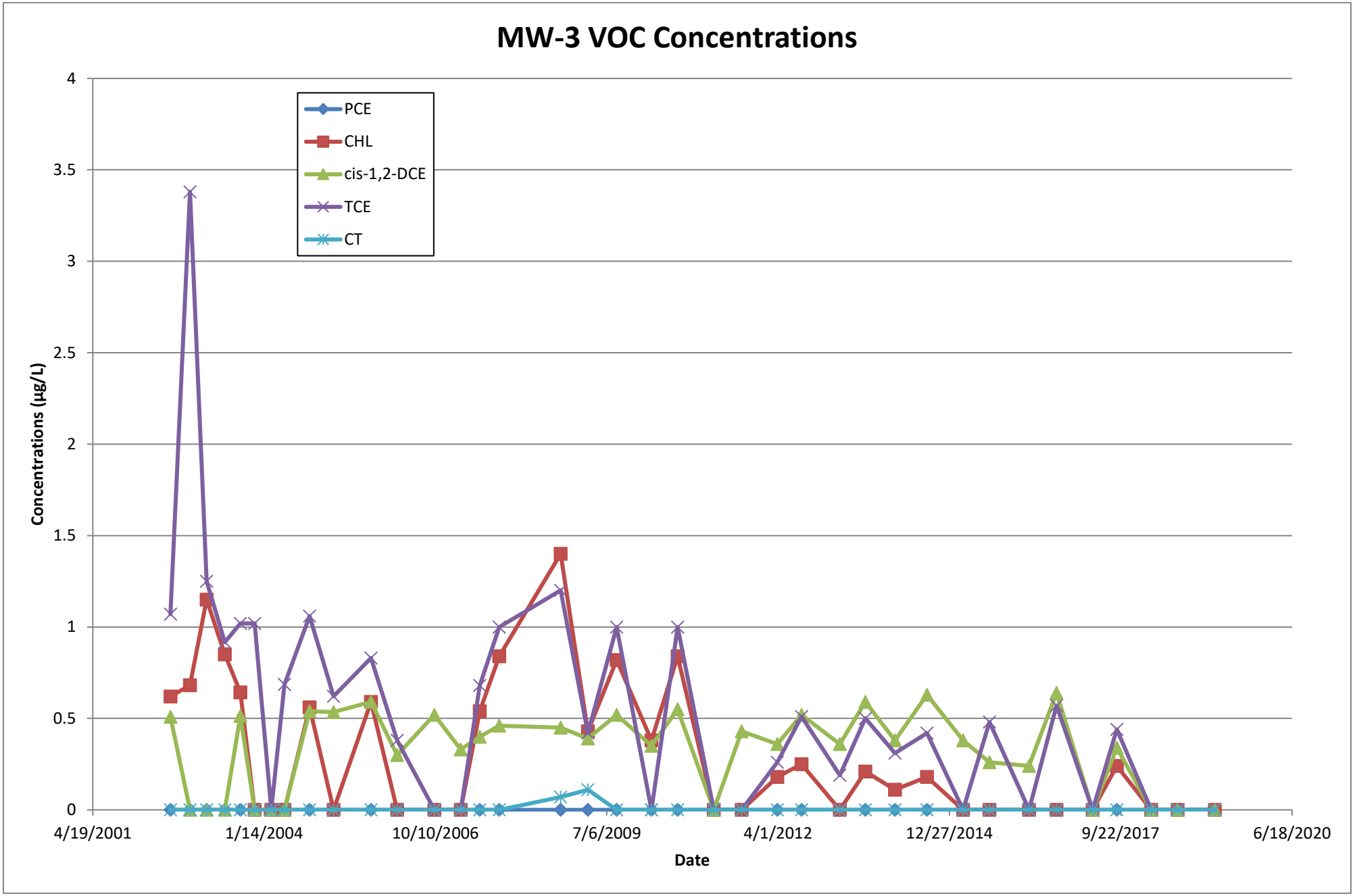
Sources: NAIP, 2012.
Albany GIS, 2007.

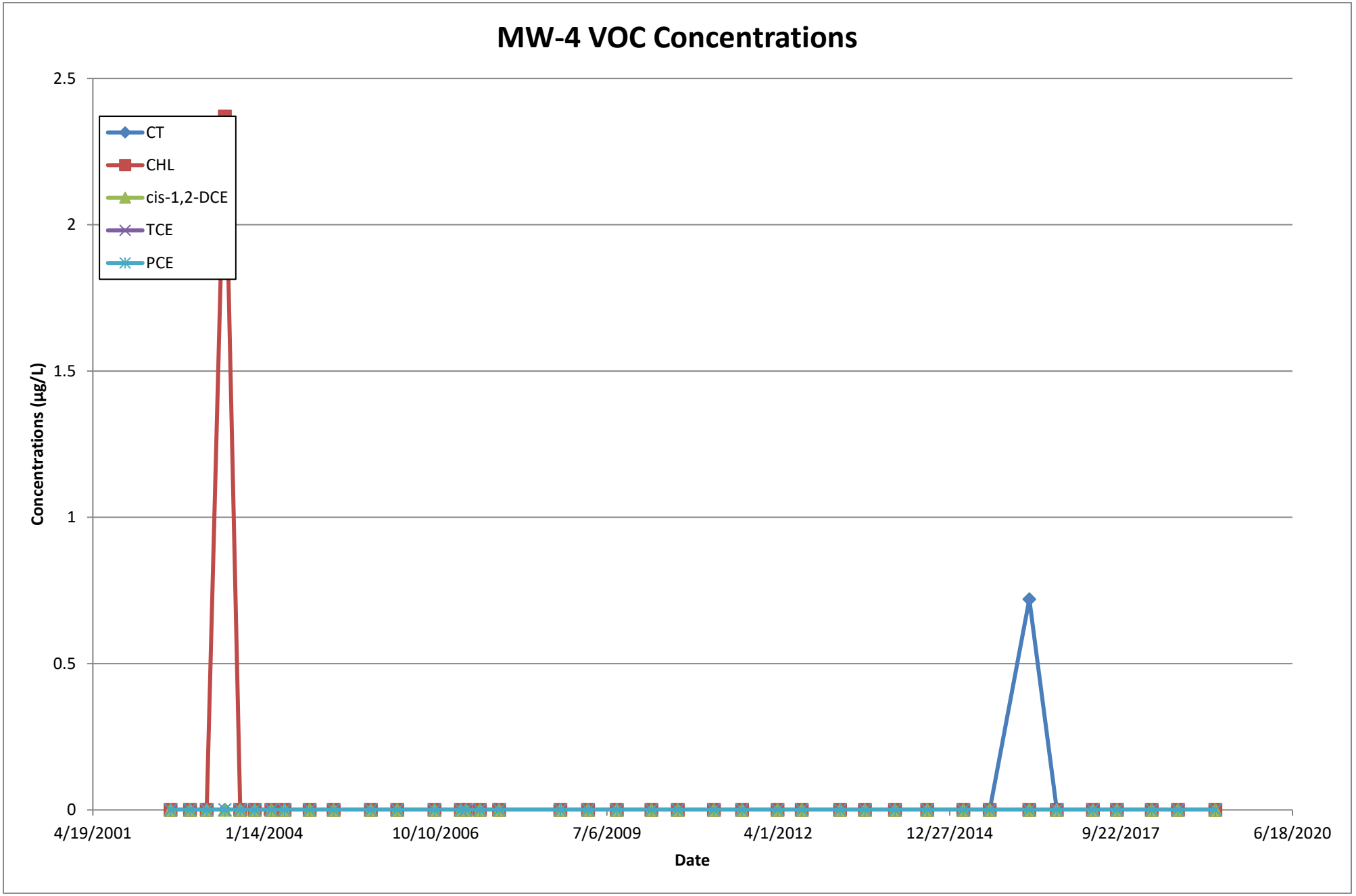
GROUNDWATER ANALYTICAL RESULTS MARCH 2019

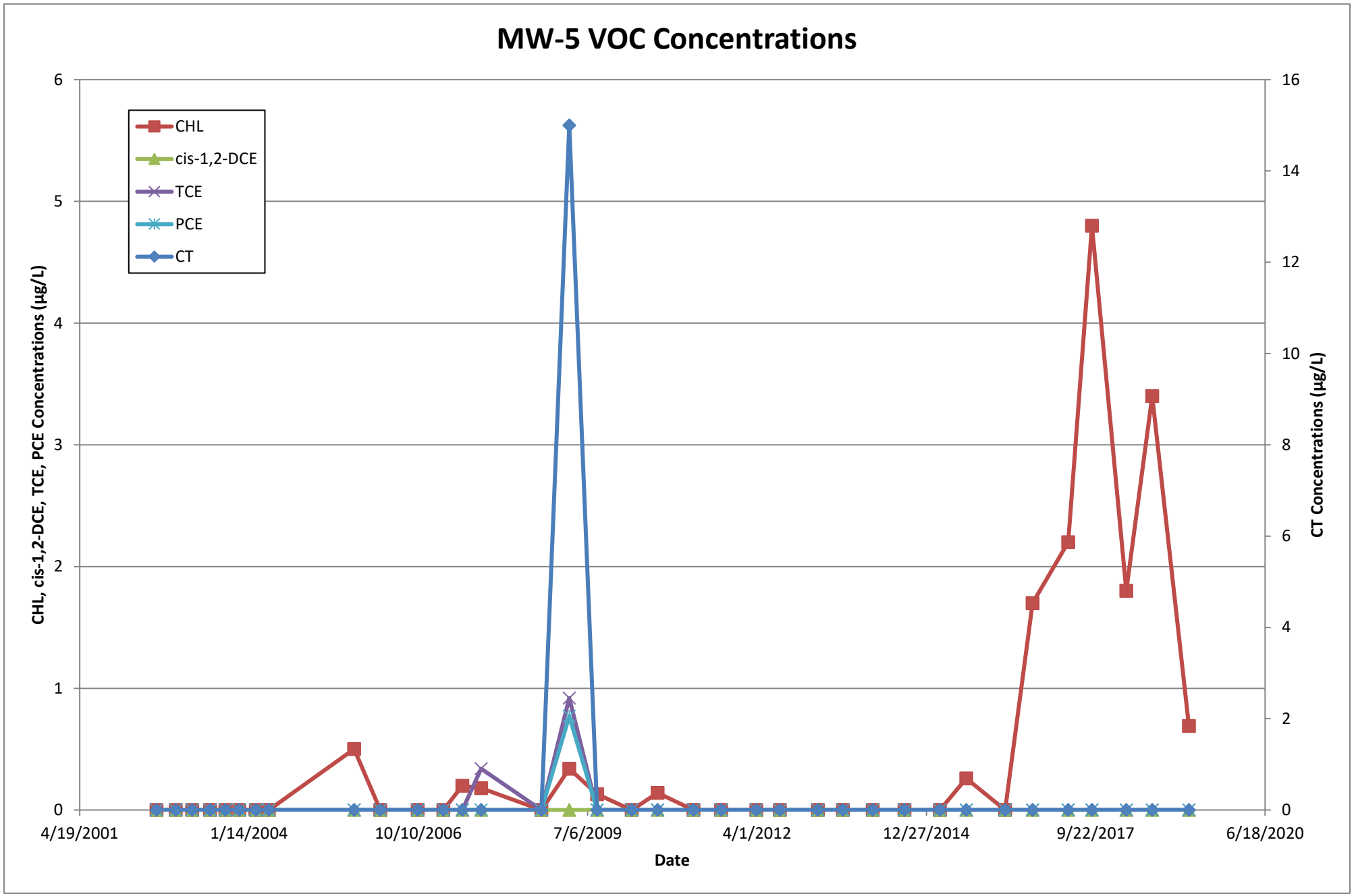
March 2019

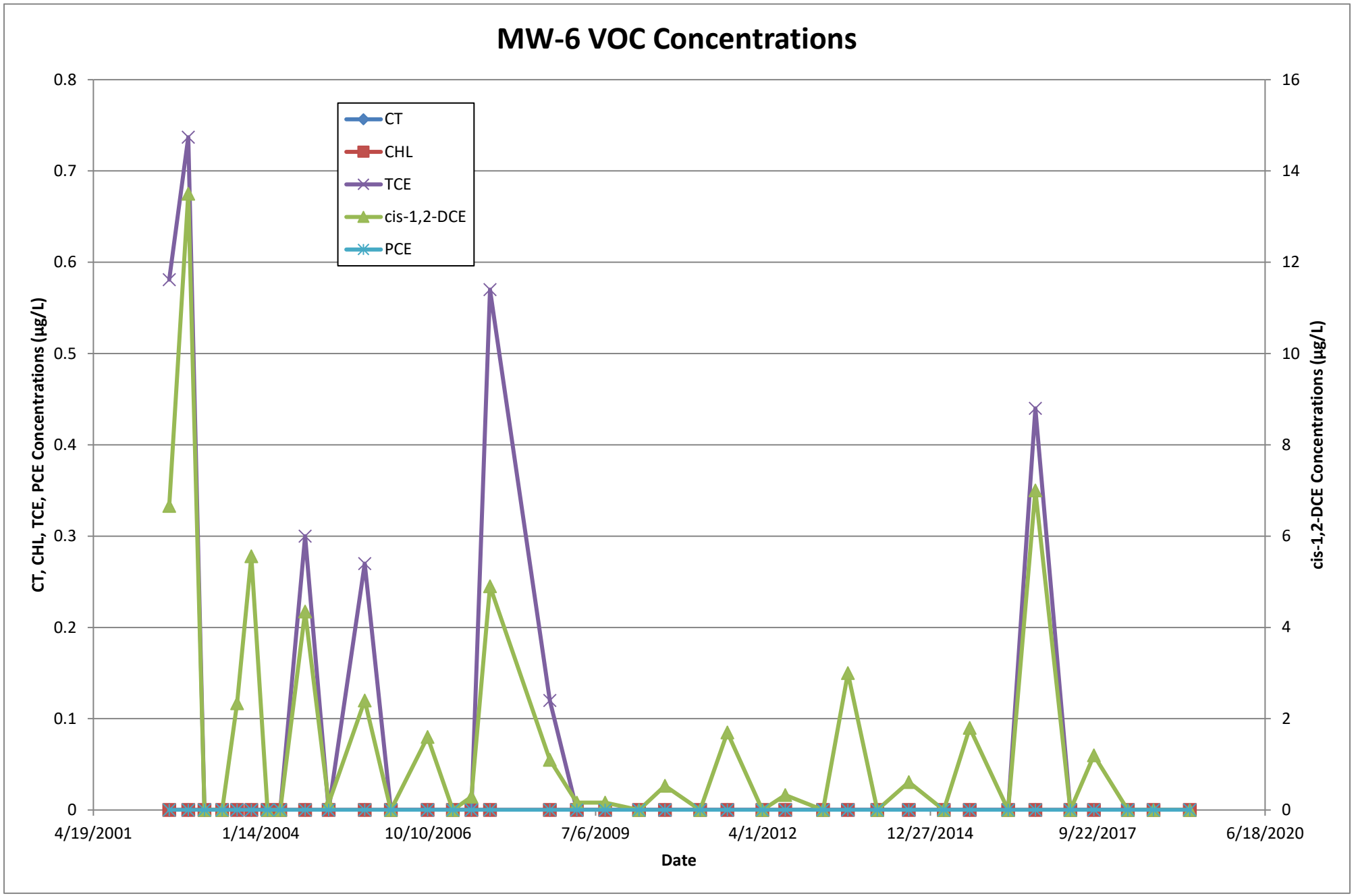
NETL ALBANY
GROUNDWATER SAMPLING
ALBANY, OREGON

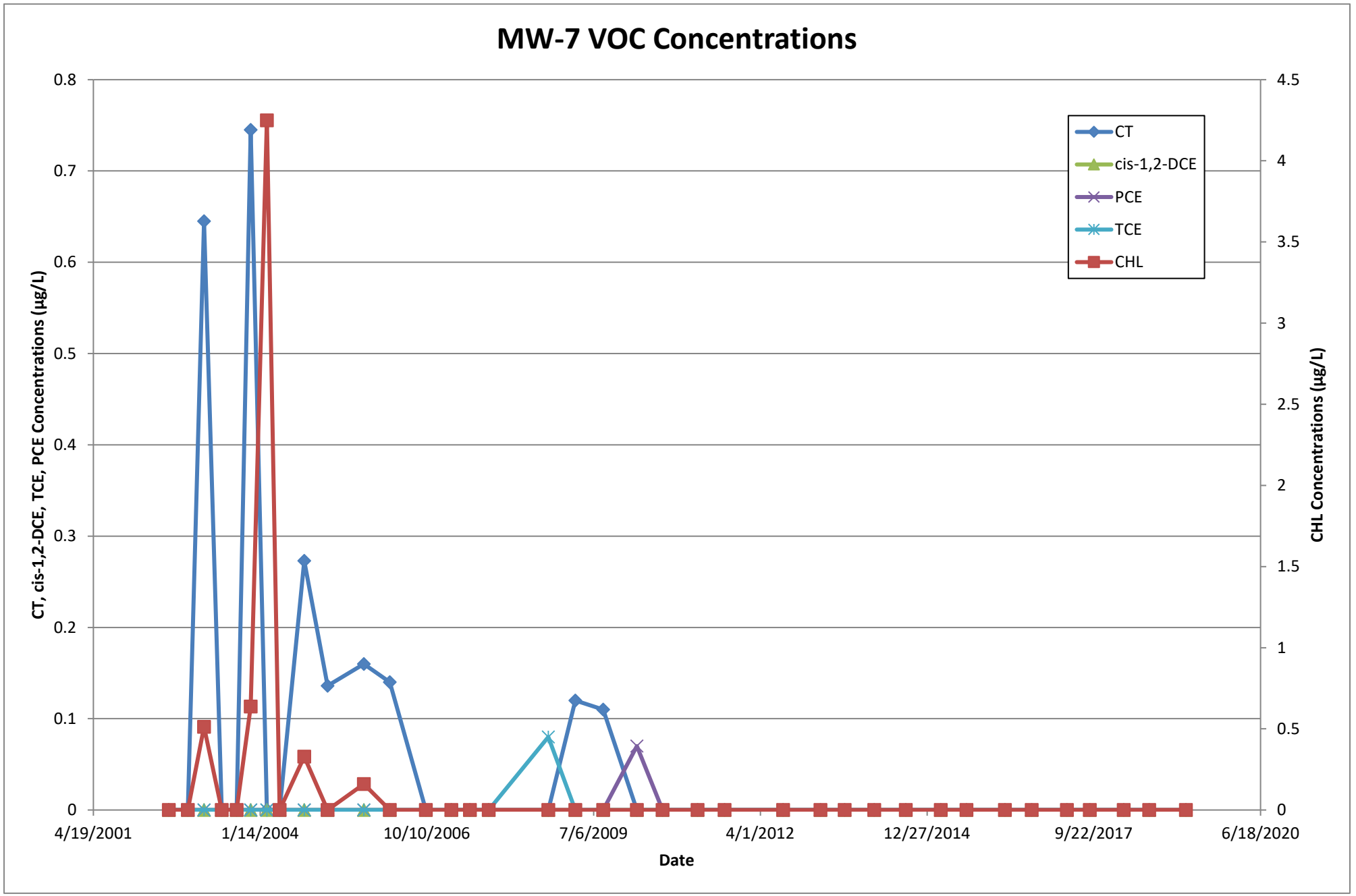
FIGURE 5

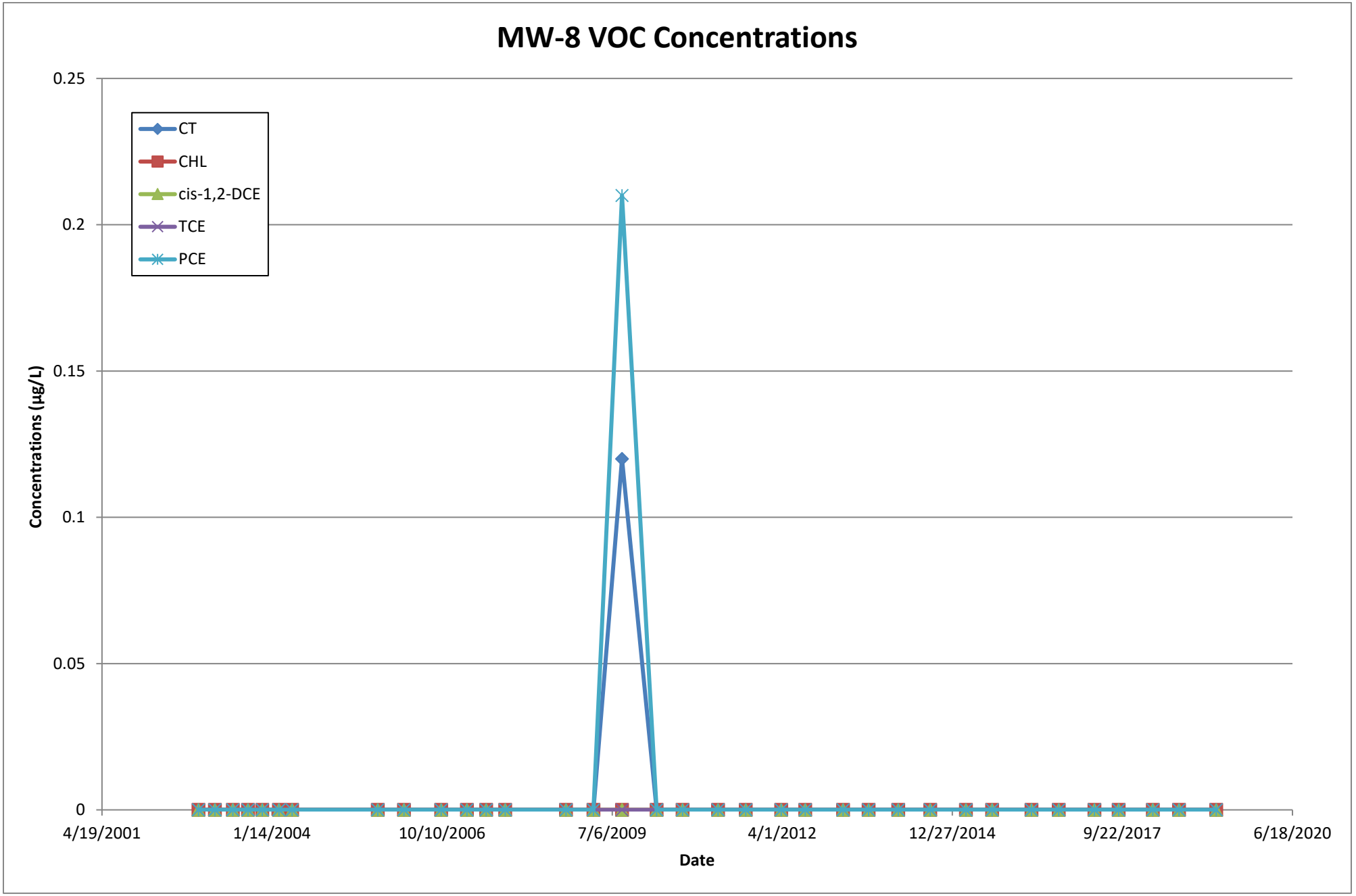

MW-3 VOC Concentrations
PCE
CHL
cis-1,2-DCE
TCE
CT
Concentrations (µg/L)
4
3.5
3
2.5
2
1.5
1
0.5
0
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
9/22/2017
6/18/2020
Date

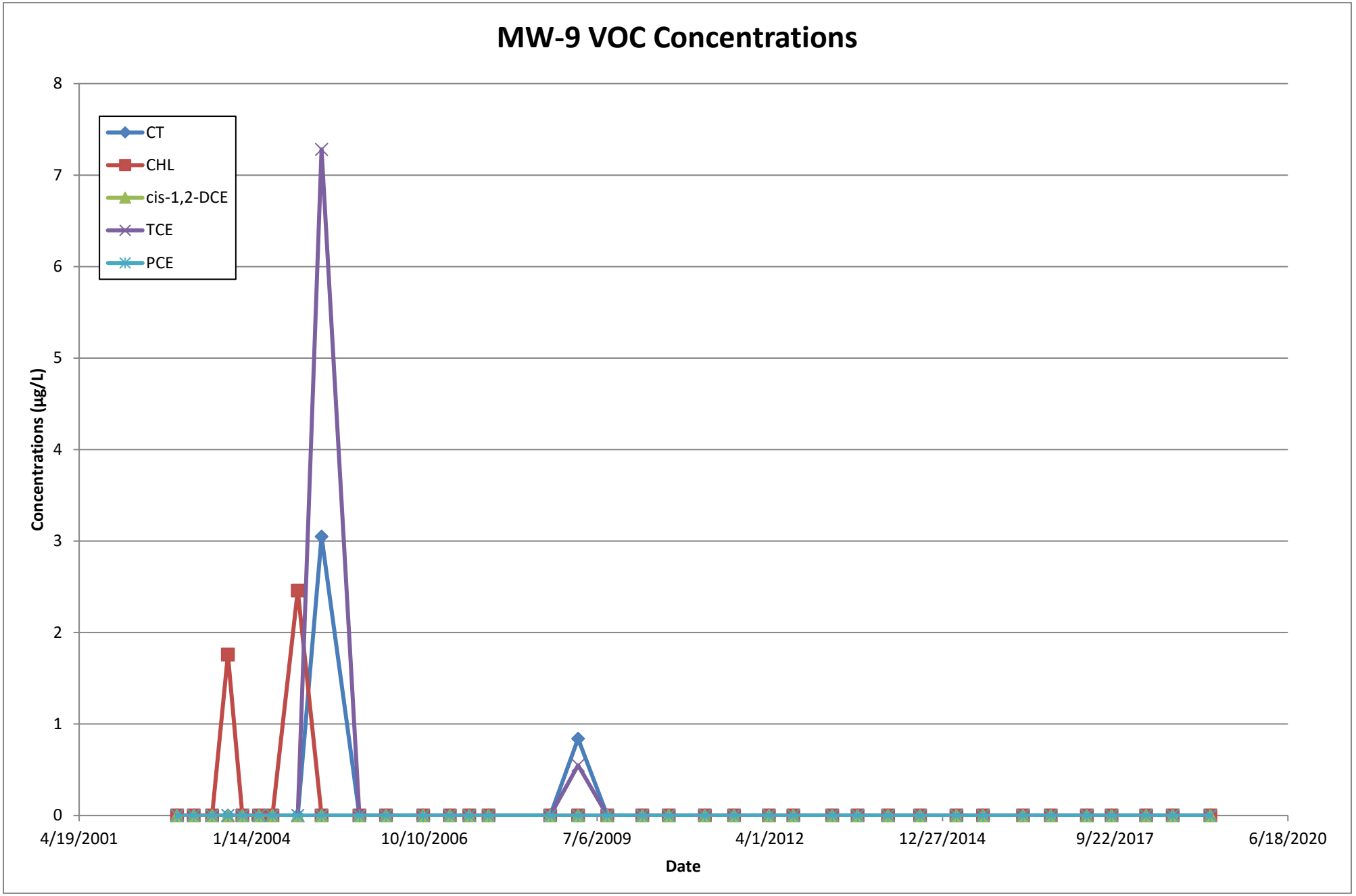

MW-4 VOC Concentrations
2.5
2
1.5
1
0.5
0
Concentrations (µg/L)
CT
CHL
cis-1,2-DCE
TCE
PCE
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
9/22/2017
6/18/2020
Date

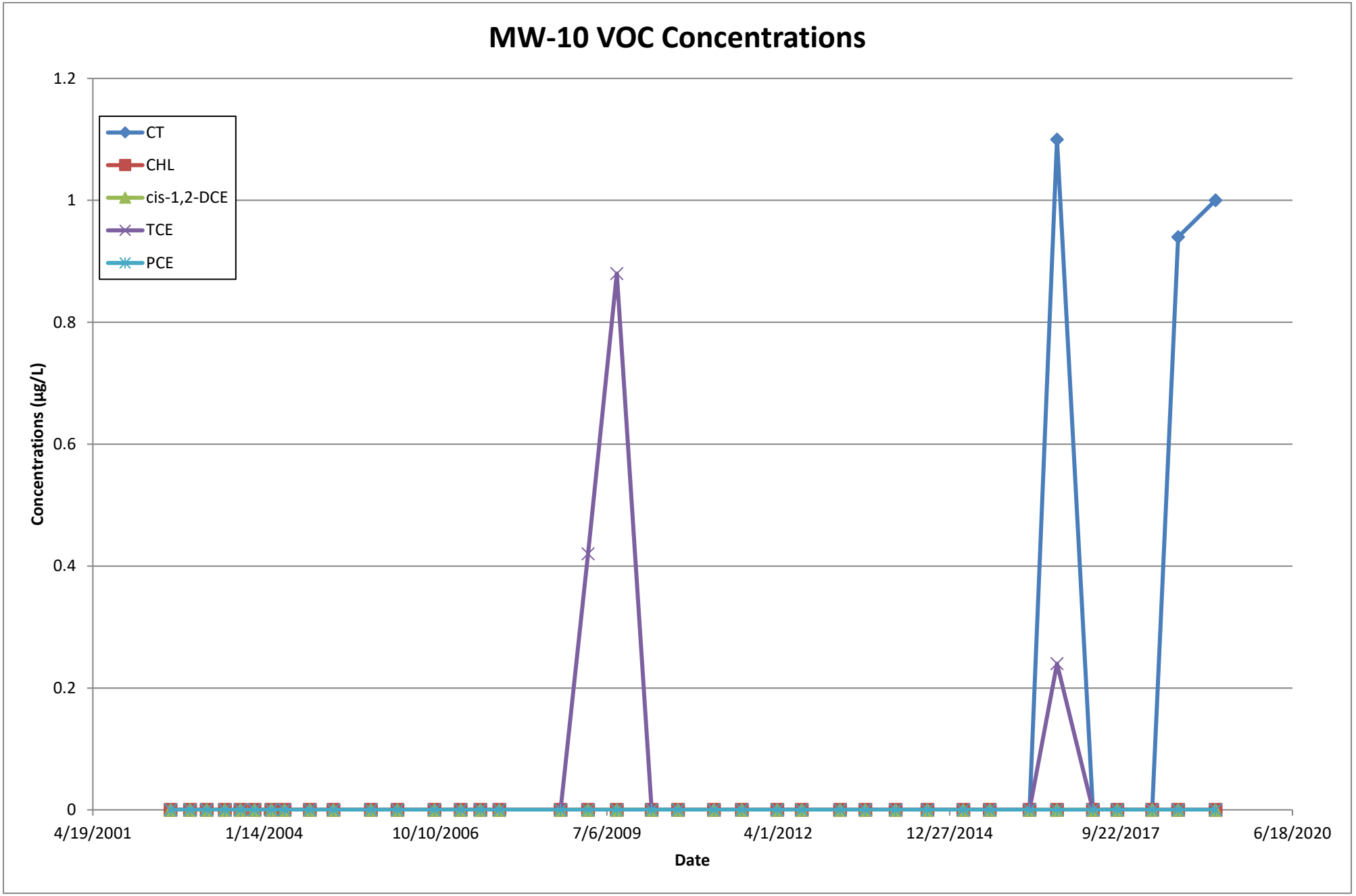

MW-5 VOC Concentrations
CHL
cis-1,2-DCE
TCE
PCE
CT
CHL, cis-1,2-DCE, TCE, PCE Concentrations (µg/L)
CT Concentrations (µg/L)
0
1
2
3
4
5
6
0
2
4
6
8
10
12
14
16
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
9/22/2017
6/18/2020
Date

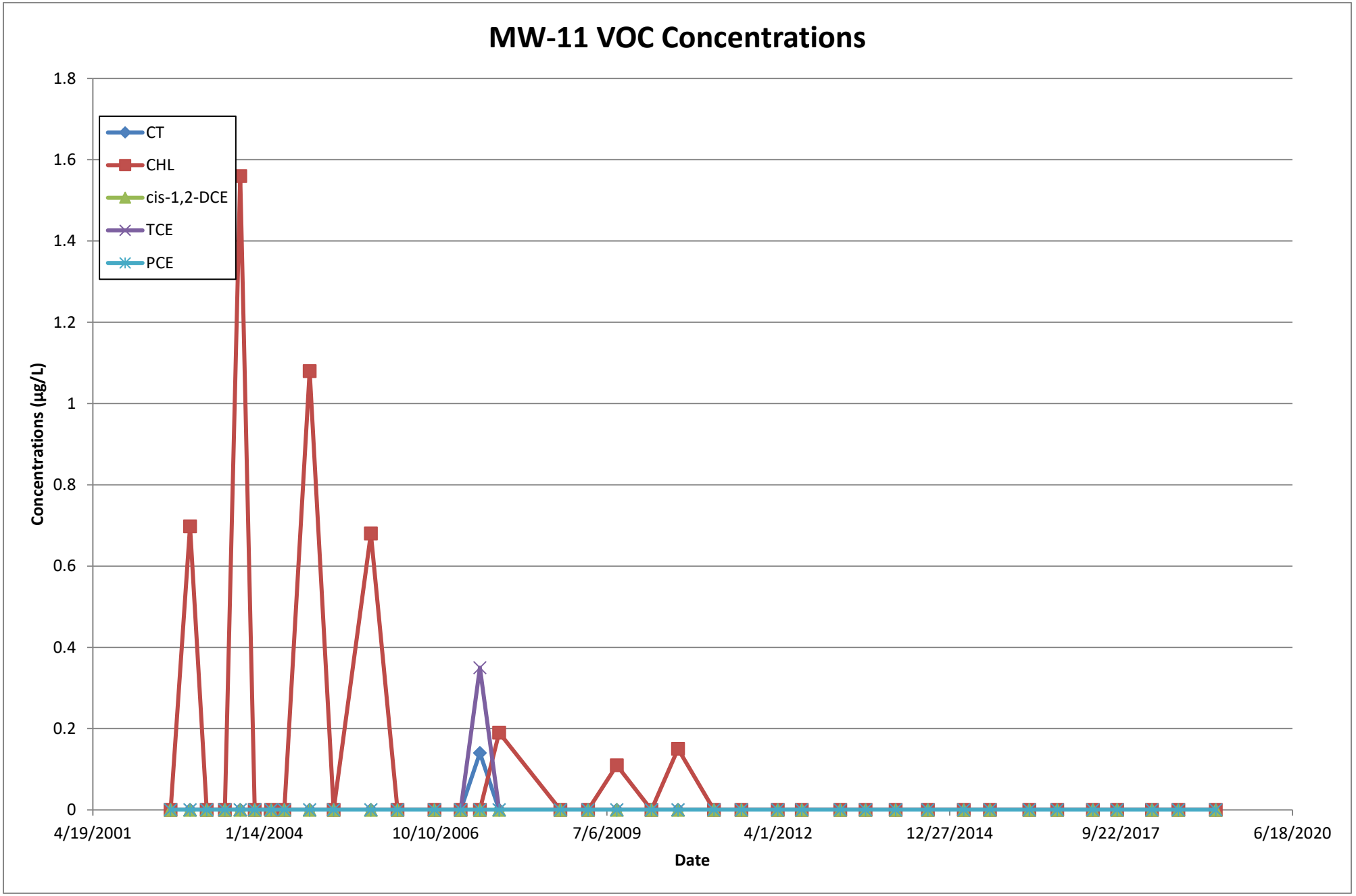

MW-6 VOC Concentrations
CT
CHL
TCE
cis-1,2-DCE
PCE
CT, CHL, TCE, PCE Concentrations (µg/L)
cis-1,2-DCE Concentrations (µg/L)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
16
14
12
10
8
6
4
2
0
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
9/22/2017
6/18/2020
Date

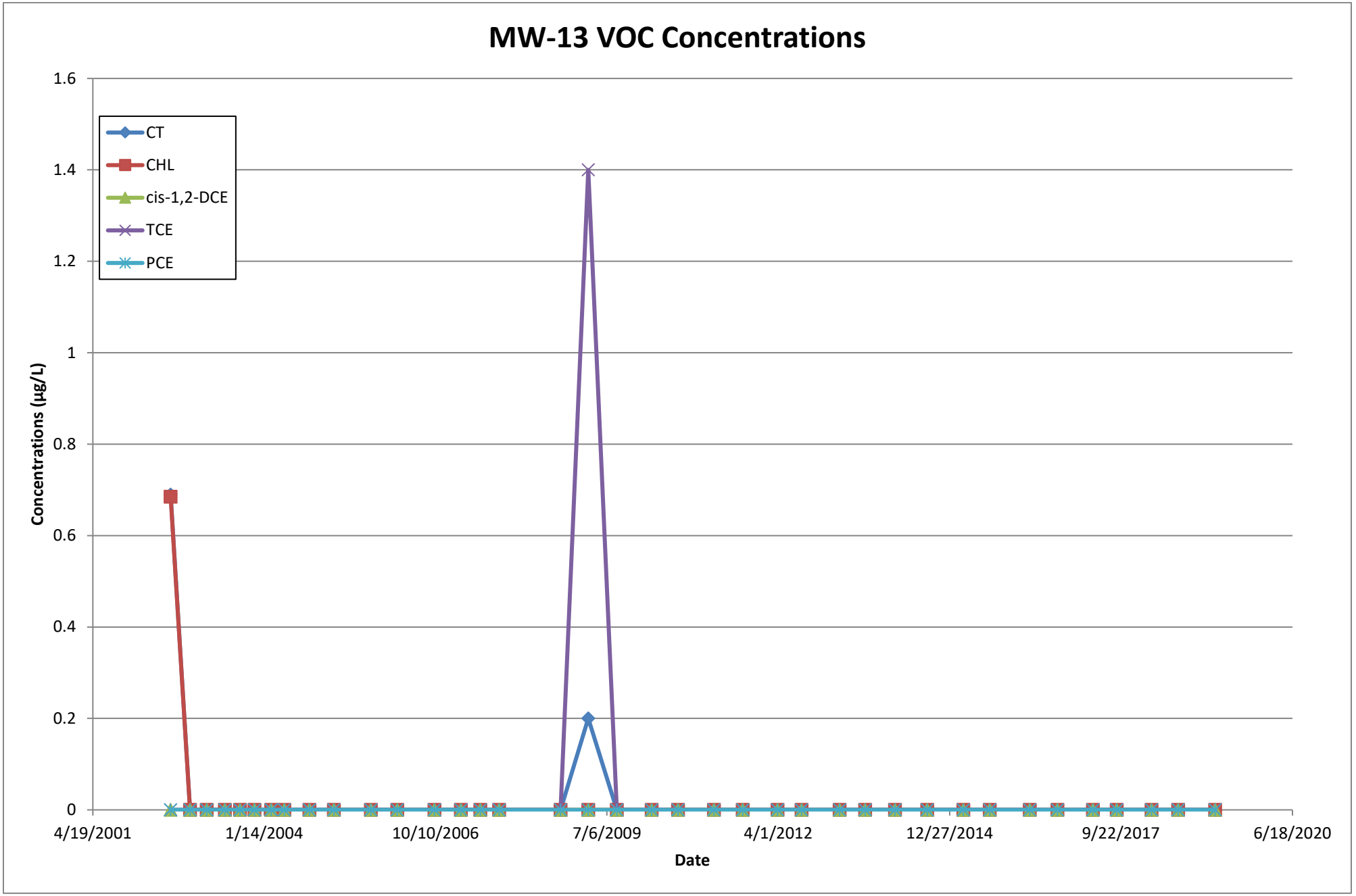

MW-7 VOC Concentrations
CT
cis-1,2-DCE
PCE
TCE
CHL
CT, cis-1,2-DCE, TCE, PCE Concentrations (µg/L)
CHL Concentrations (µg/L)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
9/22/2017
6/18/2020
Date

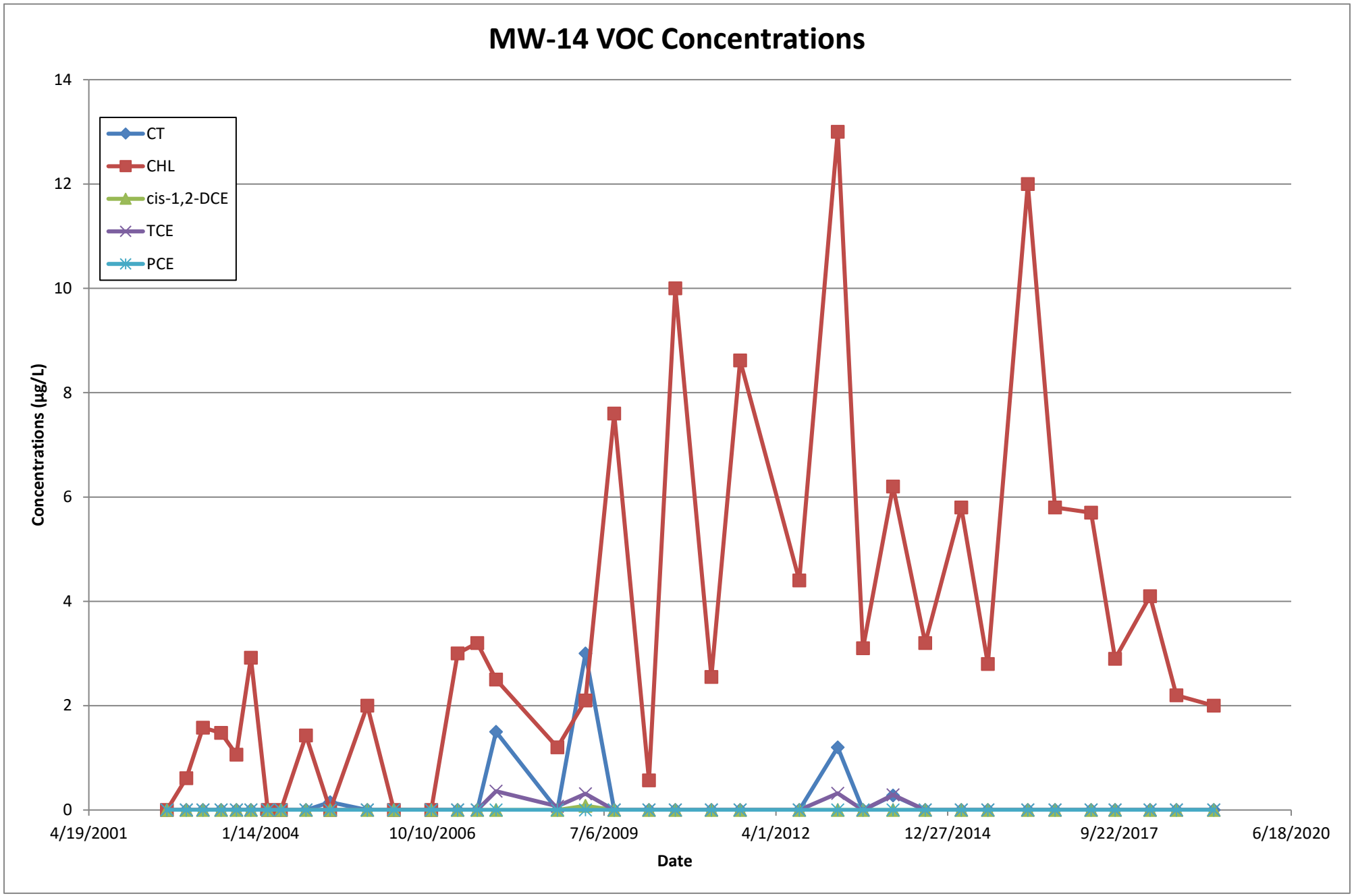

MW-8 VOC Concentrations
0.25
0.2
0.15
0.1
0.05
0
Concentrations (µg/L)
CT
CHL
cis-1,2-DCE
TCE
PCE
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
9/22/2017
6/18/2020
Date

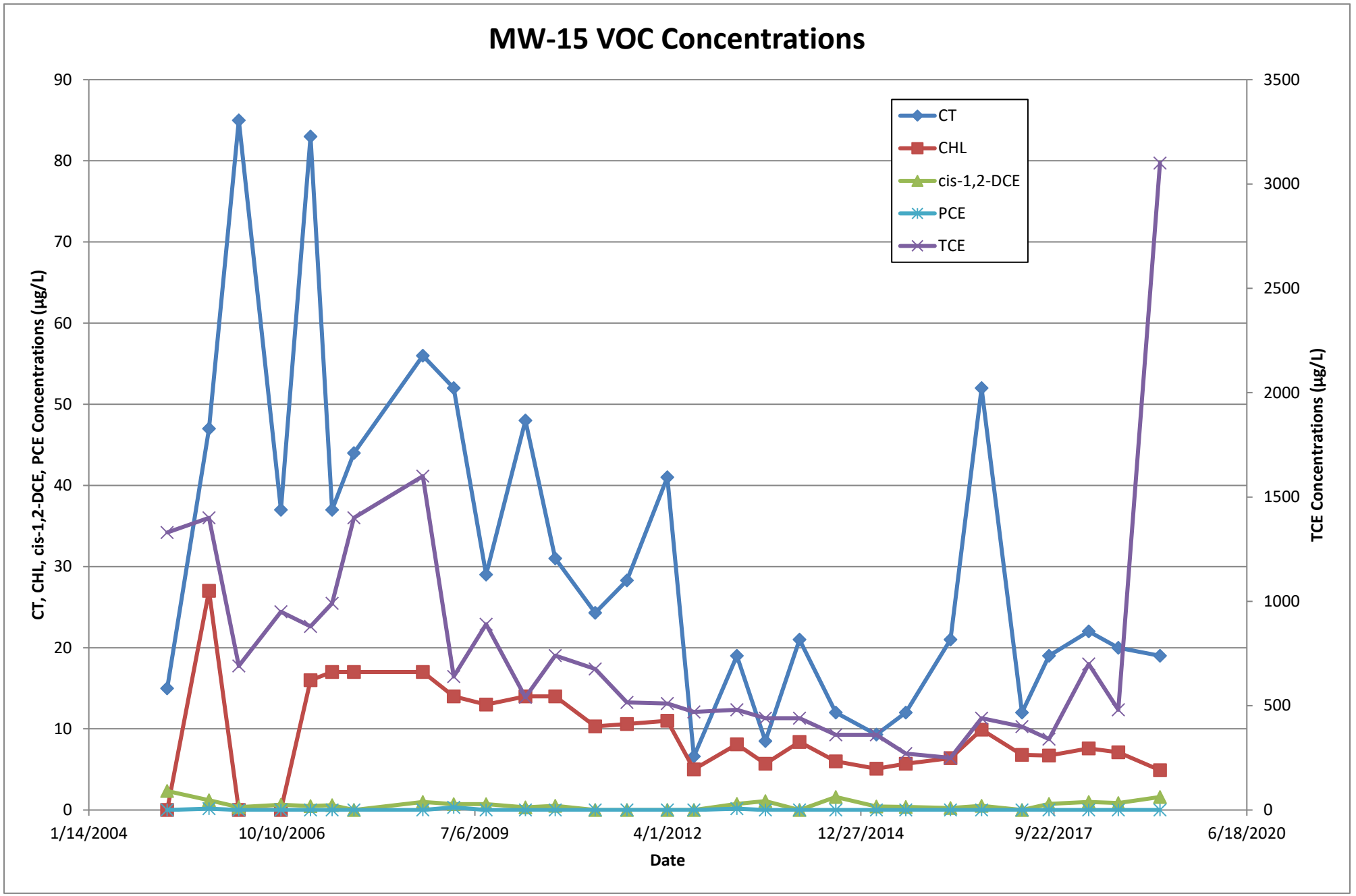

MW-9 VOC Concentrations
CT
CHL
cis-1,2-DCE
TCE
PCE
Concentrations (µg/L)
0
1
2
3
4
5
6
7
8
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
9/22/2017
6/18/2020
Date

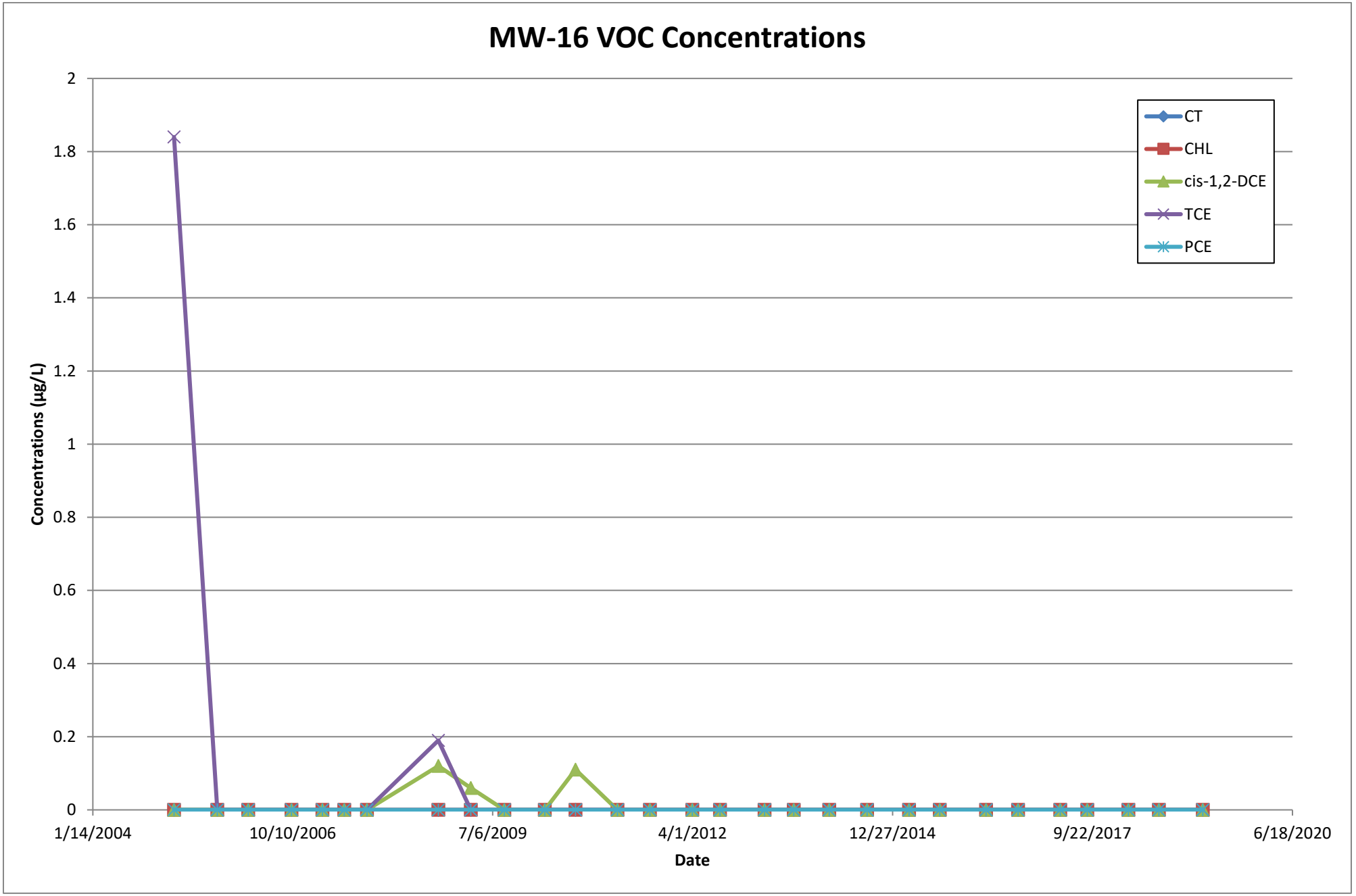

MW-10 VOC Concentrations
1.2
1
0.8
0.6
0.4
0.2
0
Concentrations (µg/L)
CT
CHL
cis-1,2-DCE
TCE
PCE
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
9/22/2017
6/18/2020
Date

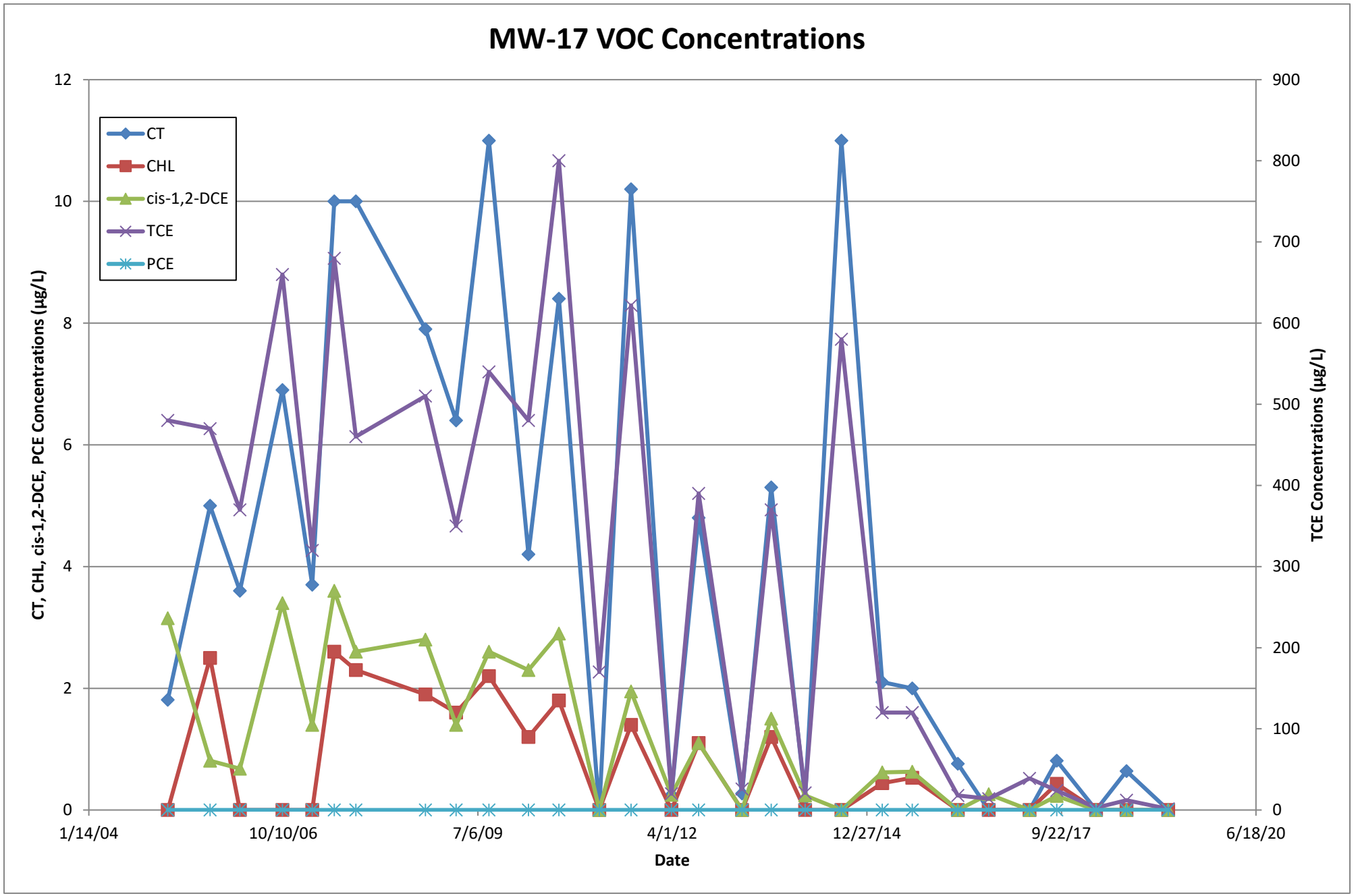

MW-11 VOC Concentrations
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Concentrations (µg/L)
CT
CHL
cis-1,2-DCE
TCE
PCE
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
9/22/2017
6/18/2020
Date

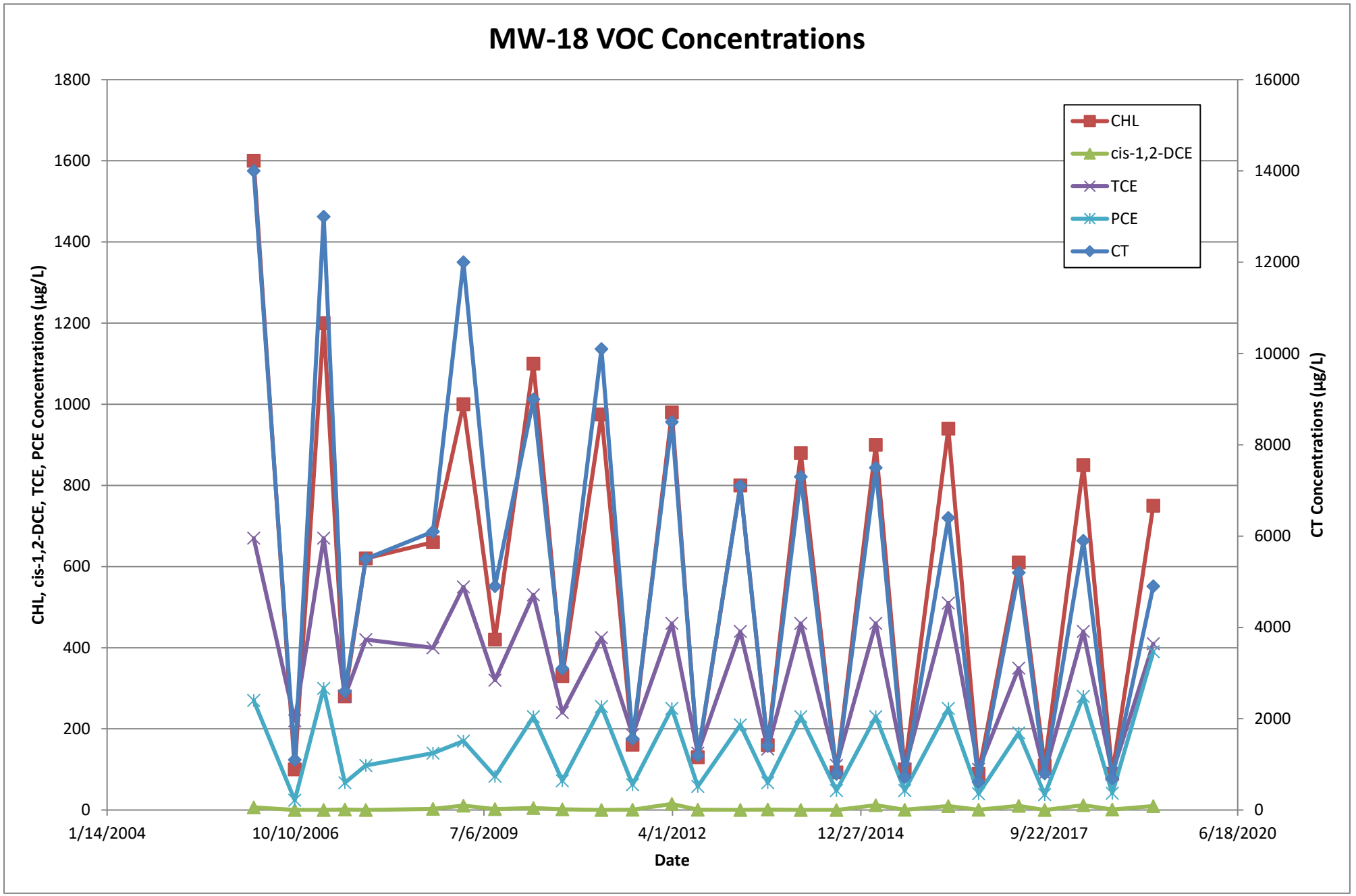

MW-13 VOC Concentrations
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Concentrations (µg/L)
CT
CHL
cis-1,2-DCE
TCE
PCE
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
9/22/2017
6/18/2020
Date

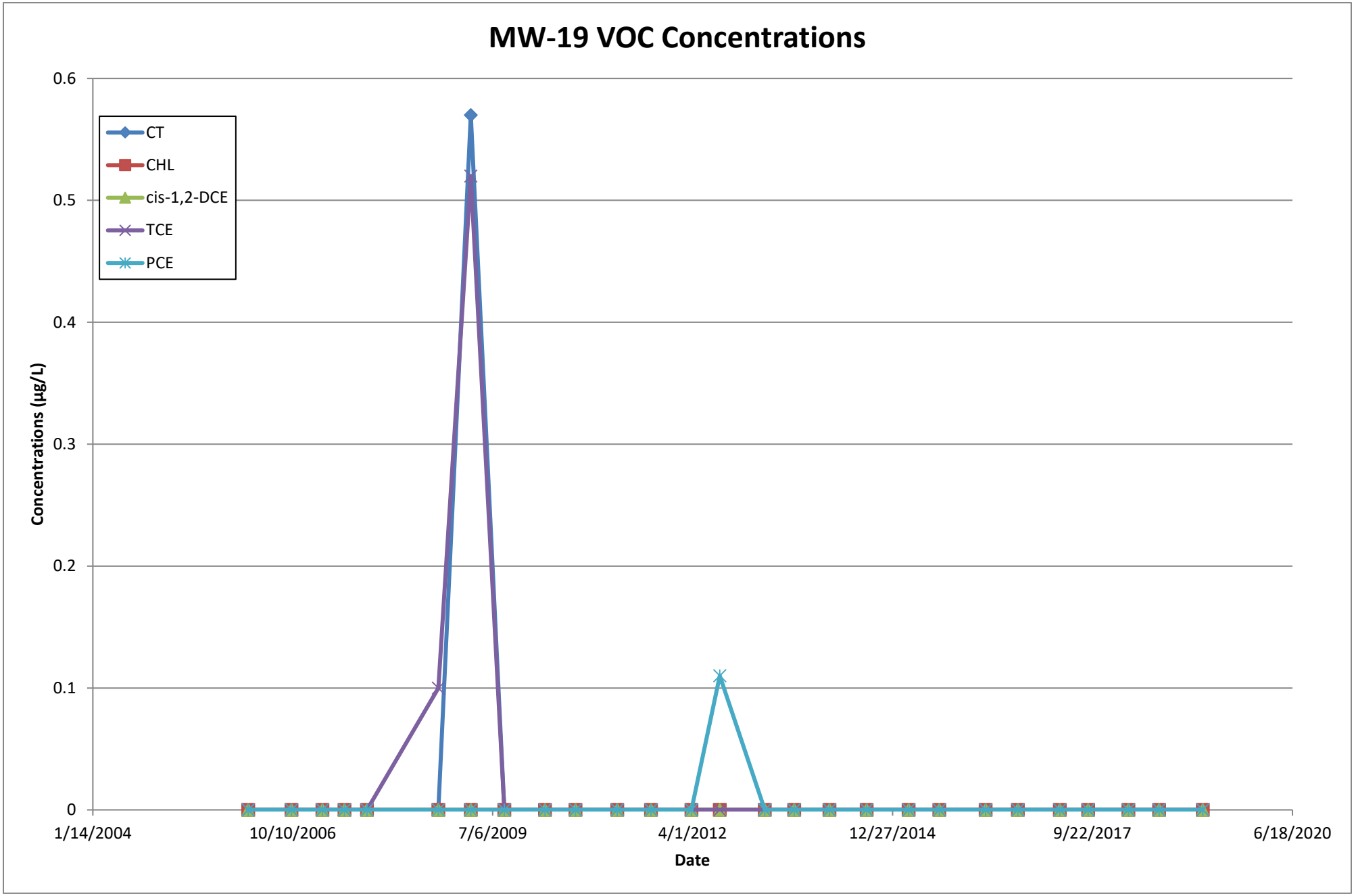

MW-14 VOC Concentrations
14
12
10
8
6
4
2
0
Concentrations (µg/L)
CT
CHL
cis-1,2-DCE
TCE
PCE
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
9/22/2017
6/18/2020
Date

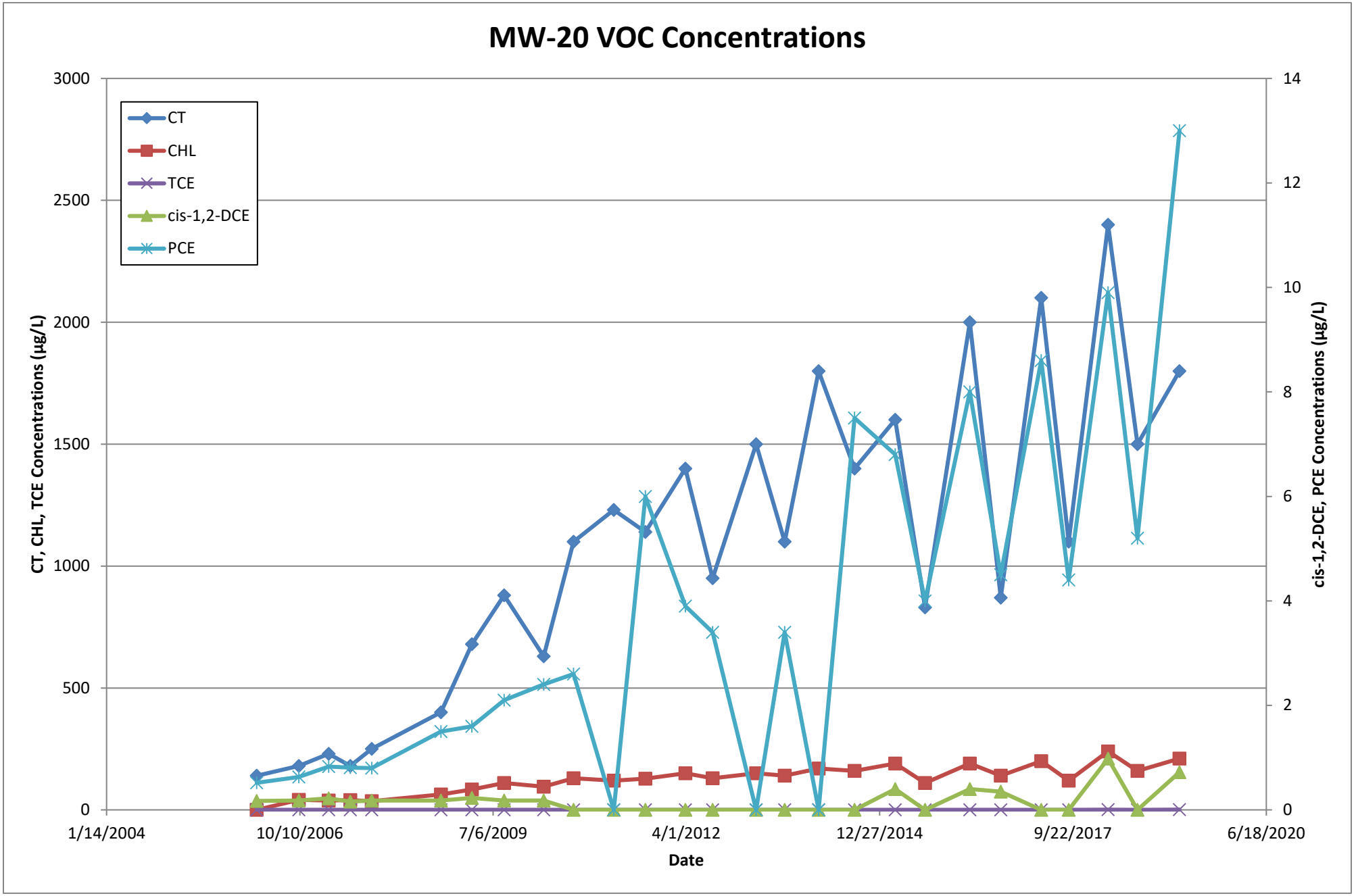

MW-15 VOC Concentrations
CT
CHL
cis-1,2-DCE
PCE
TCE
CT, CHL, cis-1,2-DCE, PCE Concentrations (µg/L)
TCE Concentrations (µg/L)
Date
0
10
20
30
40
50
60
70
80
90
0
500
1000
1500
2000
2500
3000
3500
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
9/22/2017
6/18/2020

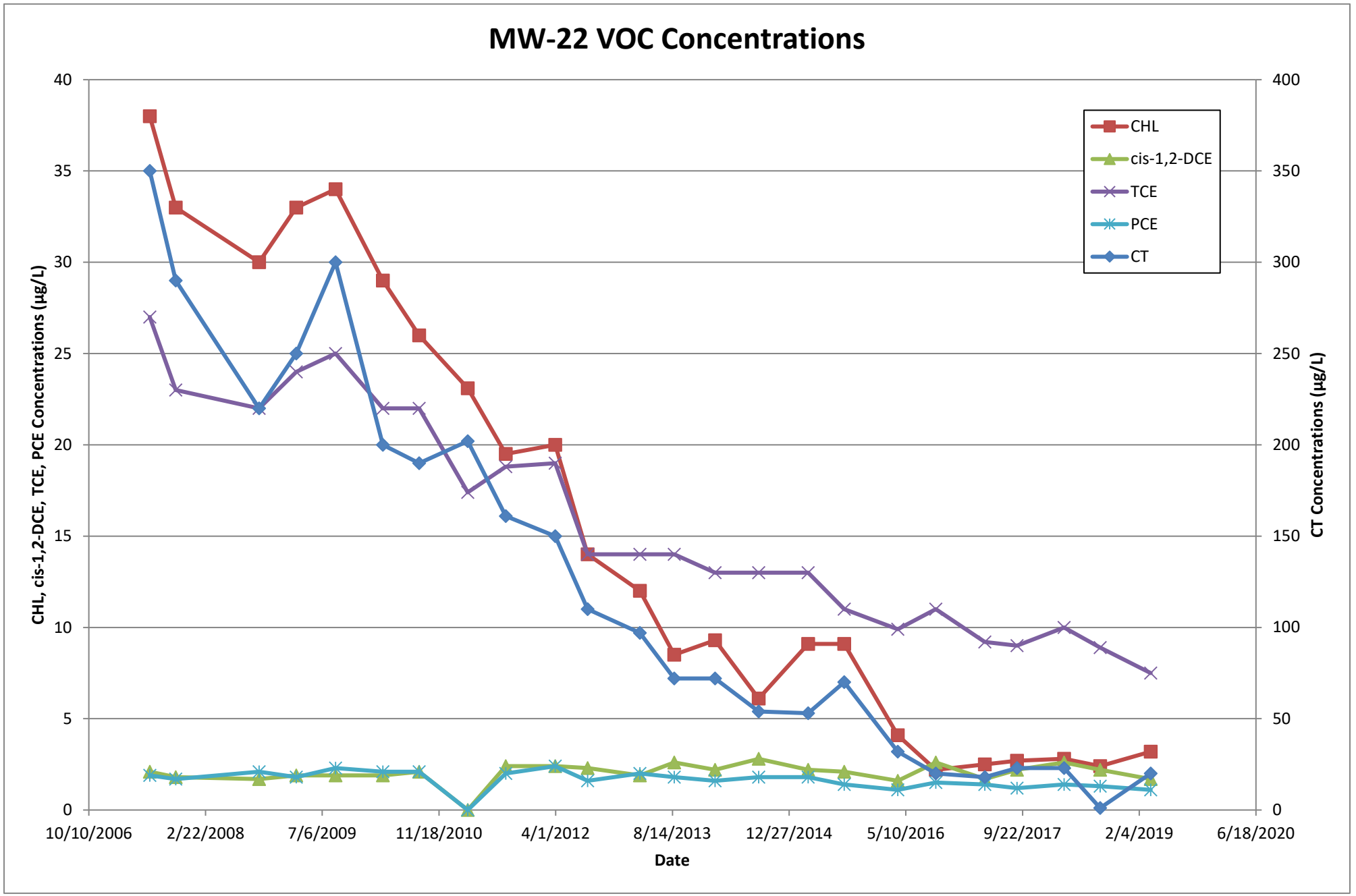

MW-16 VOC Concentrations
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Concentrations (µg/L)
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
9/22/2017
6/18/2020
Date
CT
CHL
cis-1,2-DCE
TCE
PCE

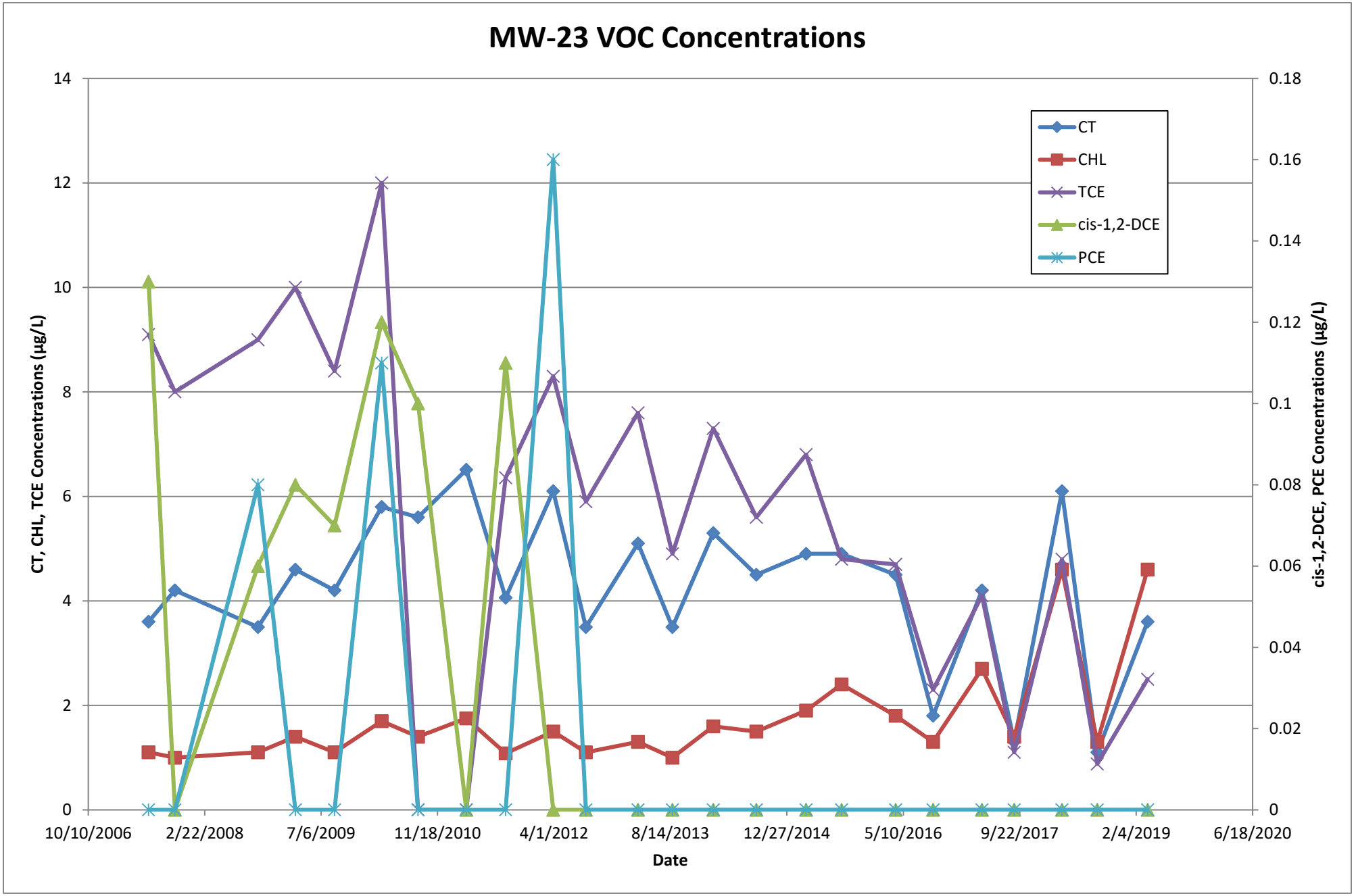

MW-17 VOC Concentrations
CT
CHL
cis-1,2-DCE
TCE
PCE
CT, CHL, cis-1,2-DCE, PCE Concentrations (µg/L)
TCE Concentrations (µg/L)
0
2
4
6
8
10
12
0
100
200
300
400
500
600
700
800
900
1/14/04
10/10/06
7/6/09
4/1/12
12/27/14
9/22/17
6/18/20
Date

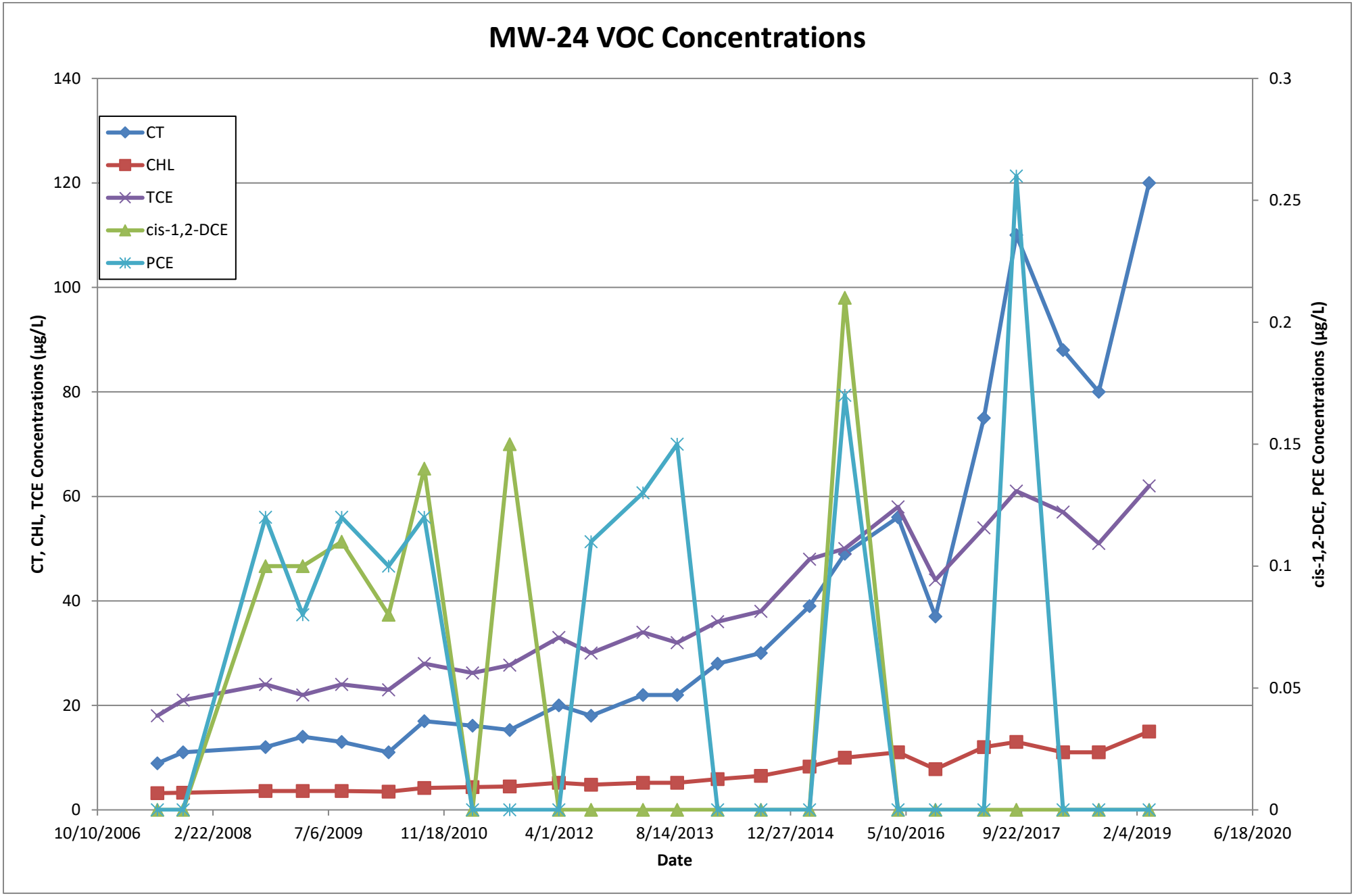

MW-18 VOC Concentrations
CHL
cis-1,2-DCE
TCE
PCE
CT
CHL, cis-1,2-DCE, TCE, PCE Concentrations (µg/L)
CT Concentrations (µg/L)
Date
1800
1600
1400
1200
1000
800
600
400
200
0
16000
14000
12000
10000
8000
6000
4000
2000
0
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
9/22/2017
6/18/2020

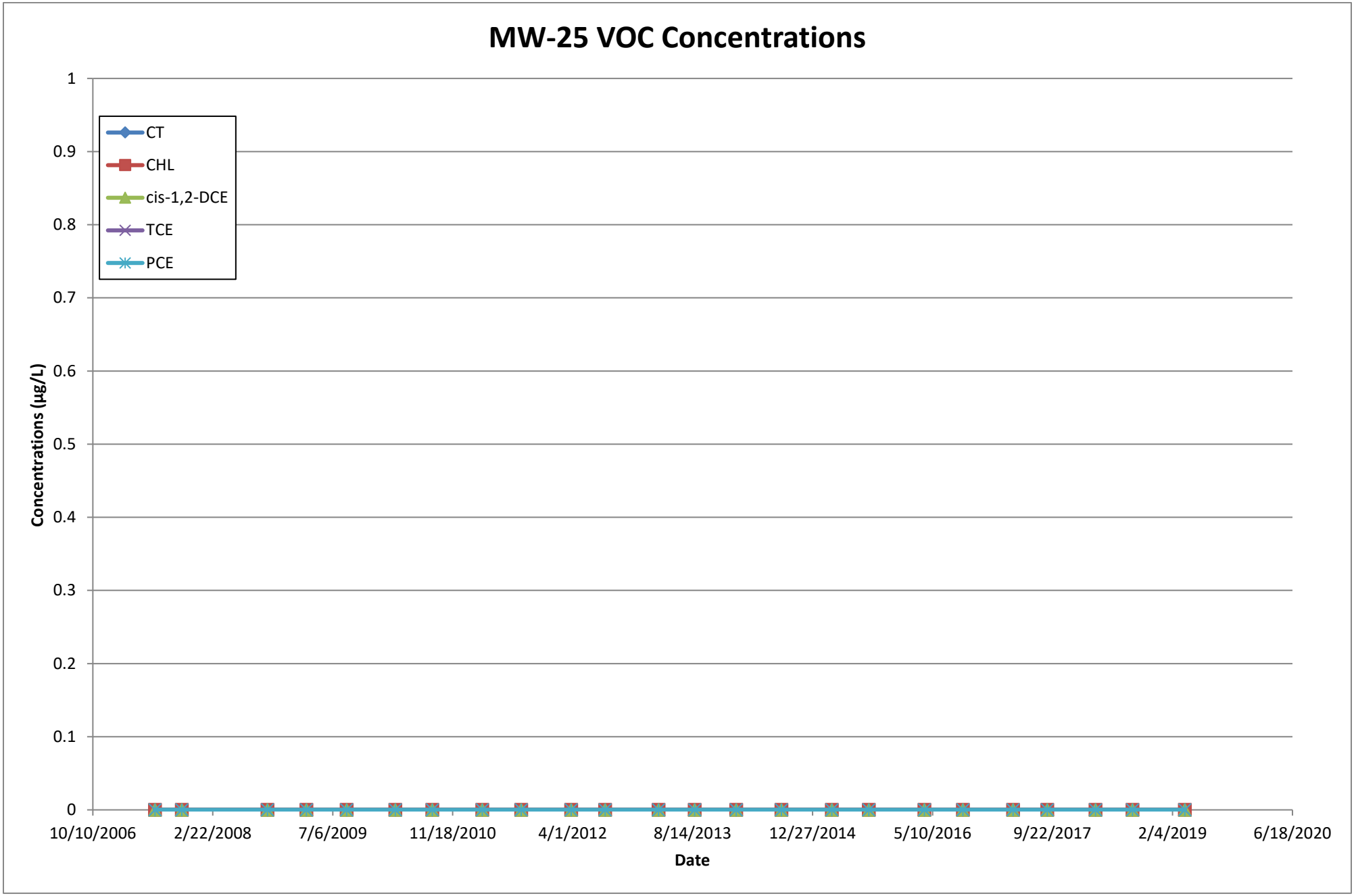

MW-19 VOC Concentrations
0.6
0.5
0.4
0.3
0.2
0.1
0
Concentrations (µg/L)
CT
CHL
cis-1,2-DCE
TCE
PCE
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
9/22/2017
6/18/2020
Date

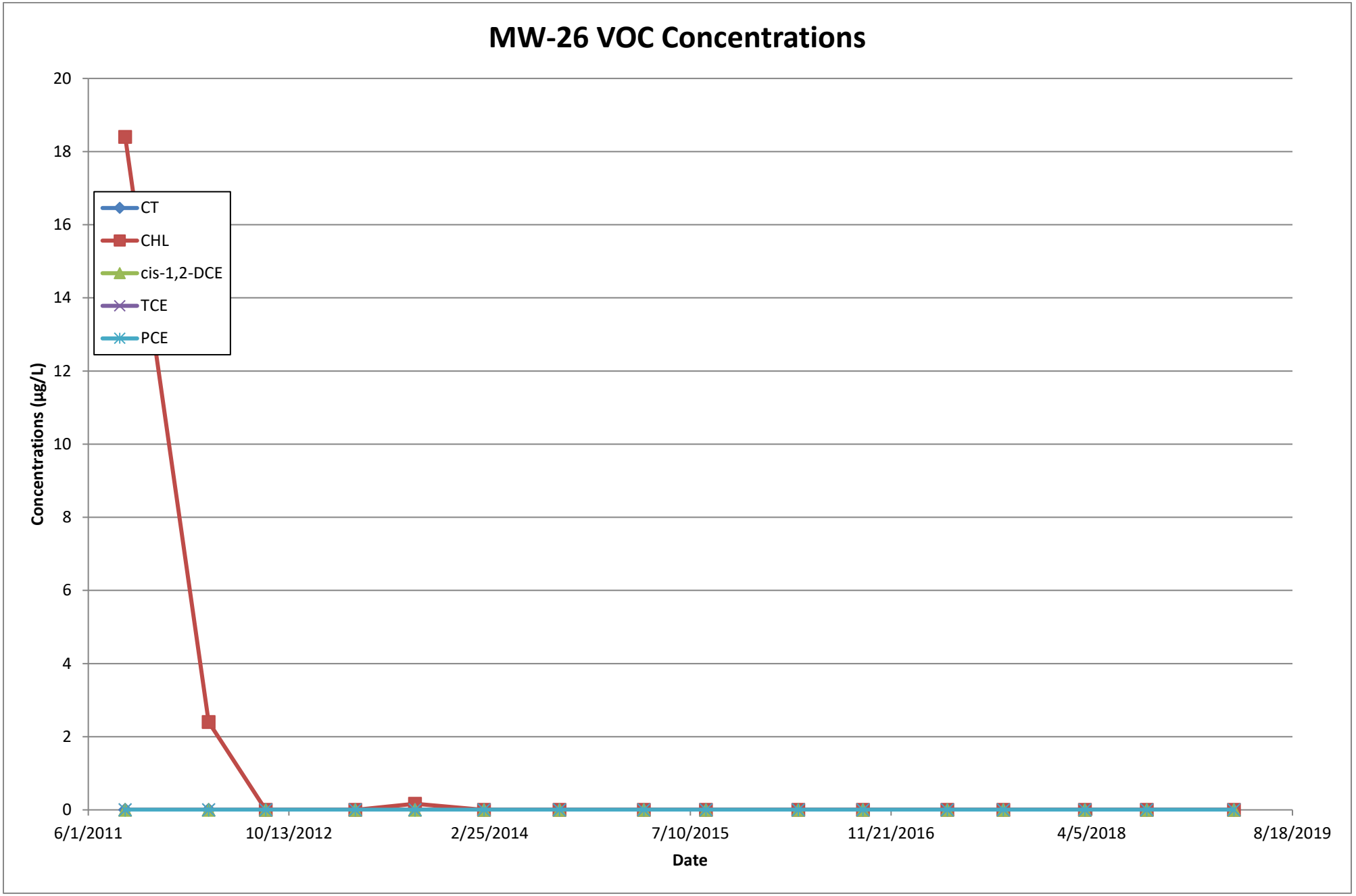

MW-20 VOC Concentrations
CT
CHL
TCE
cis-1,2-DCE
PCE
CT, CHL, TCE Concentrations (µg/L)
cis-1,2-DCE, PCE Concentrations (µg/L)
3000
2500
2000
1500
1000
500
0
14
12
10
8
6
4
2
0
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
9/22/2017
6/18/2020
Date

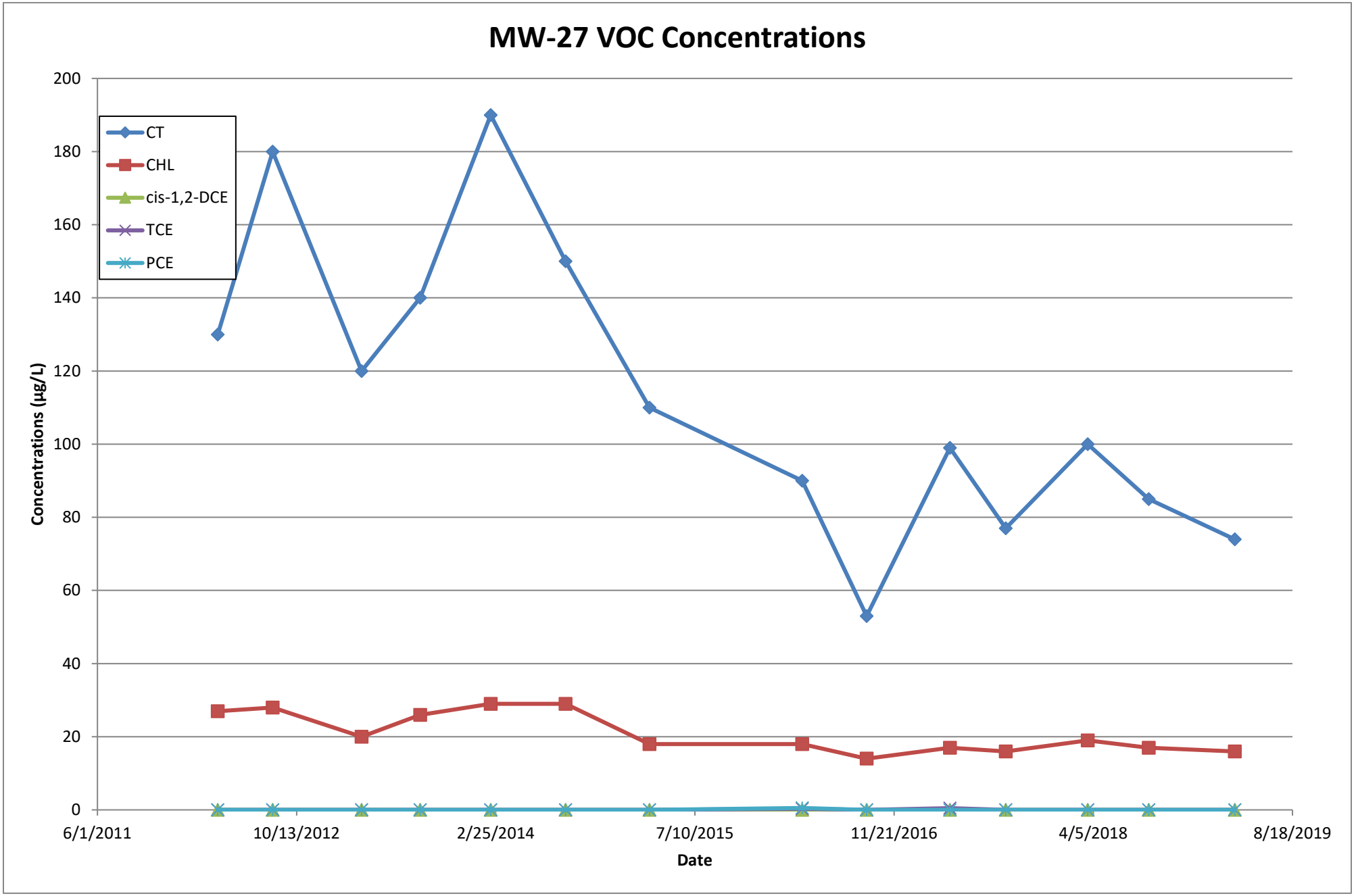

MW-22 VOC Concentrations
CHL, cis-1,2-DCE, TCE, PCE Concentrations (µg/L)
CT Concentrations (µg/L)
Date
CHL
cis-1,2-DCE
TCE
PCE
CT
0
5
10
15
20
25
30
35
40
0
50
100
150
200
250
300
350
400
10/10/2006
2/22/2008
7/6/2009
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020

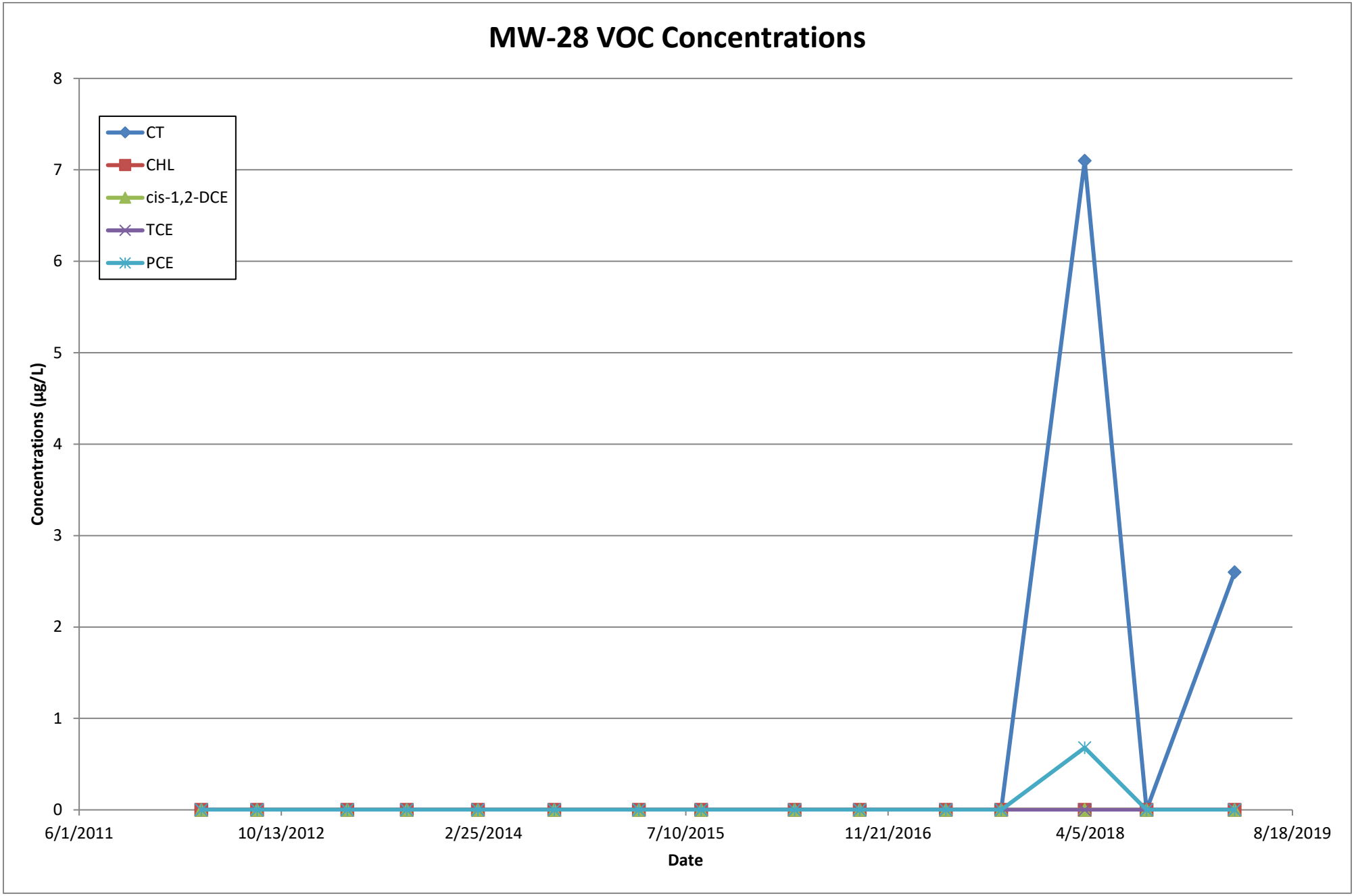

MW-23 VOC Concentrations
CT
CHL
TCE
cis-1,2-DCE
PCE
CT, CHL, TCE Concentrations (µg/L)
cis-1,2-DCE, PCE Concentrations (µg/L)
Date
0
2
4
6
8
10
12
14
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
10/10/2006
2/22/2008
7/6/2009
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020

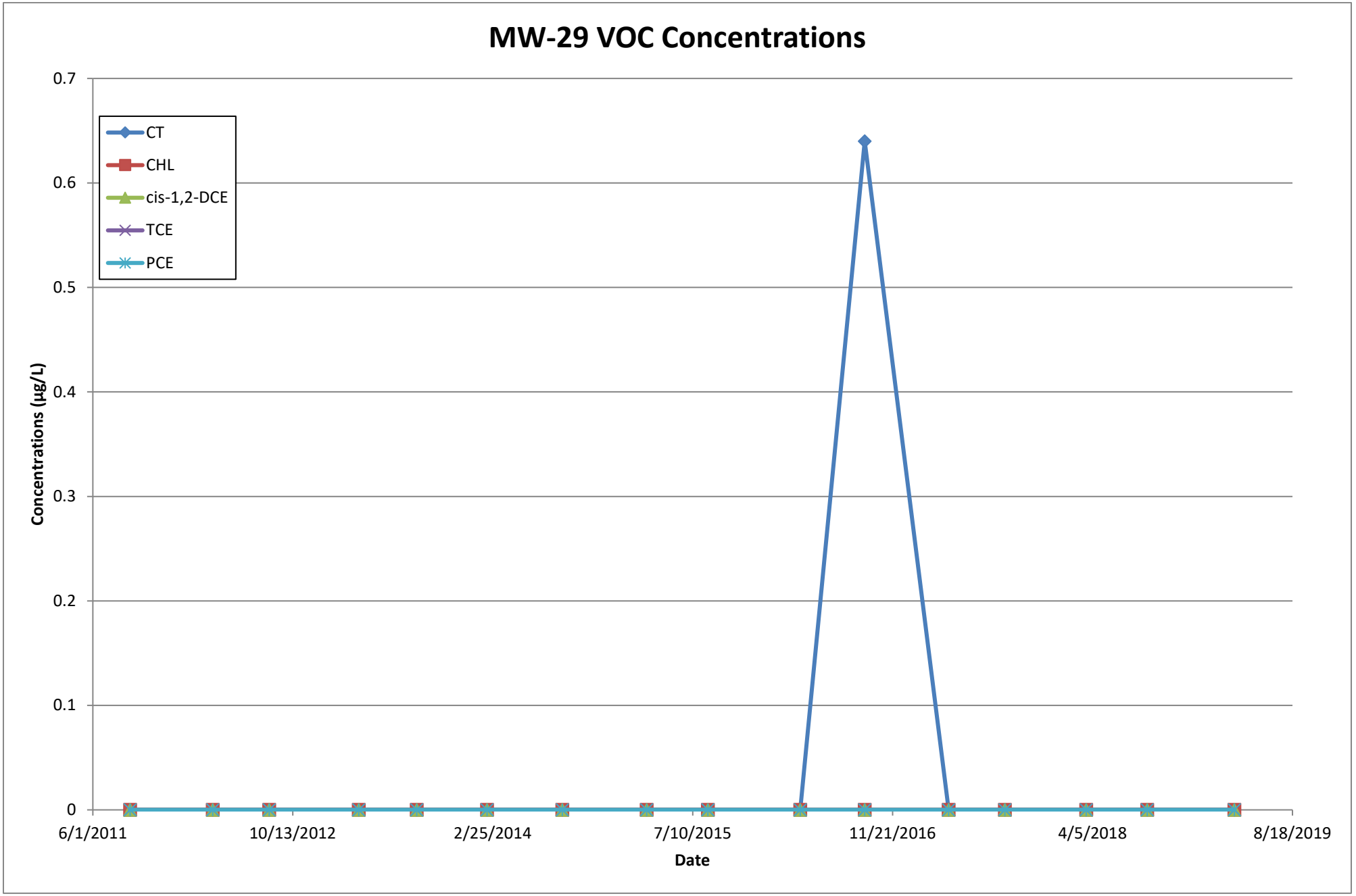

MW-24 VOC Concentrations
CT
CHL
TCE
cis-1,2-DCE
PCE
CT, CHL, TCE Concentrations (µg/L)
cis-1,2-DCE, PCE Concentrations (µg/L)
Date
140
120
100
80
60
40
20
0
0.3
0.25
0.2
0.15
0.1
0.05
0
10/10/2006
2/22/2008
7/6/2009
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020

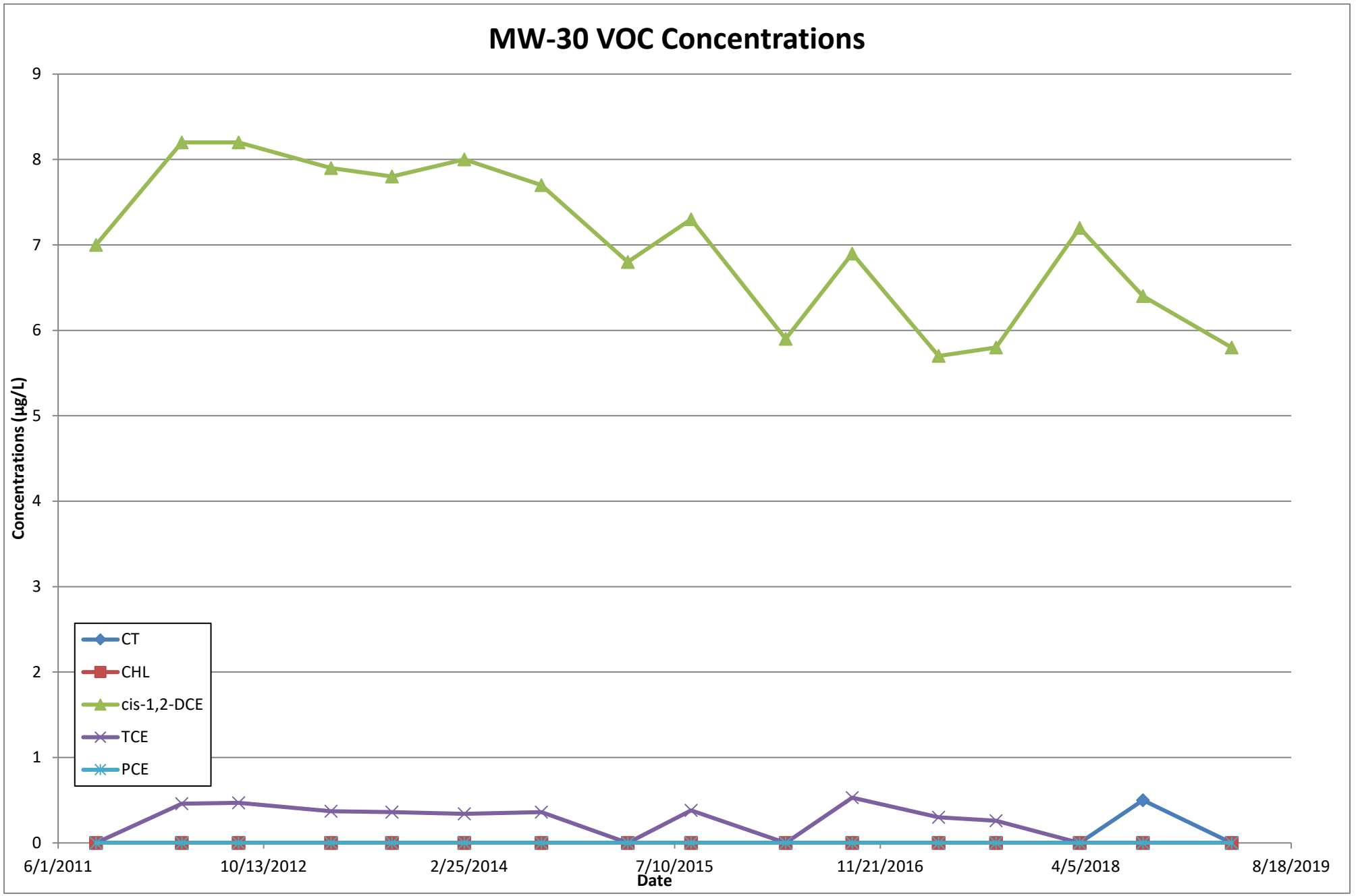

MW-25 VOC Concentrations
CT
CHL
cis-1,2-DCE
TCE
PCE
Concentrations (µg/L)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
10/10/2006
2/22/2008
7/6/2009
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
Date

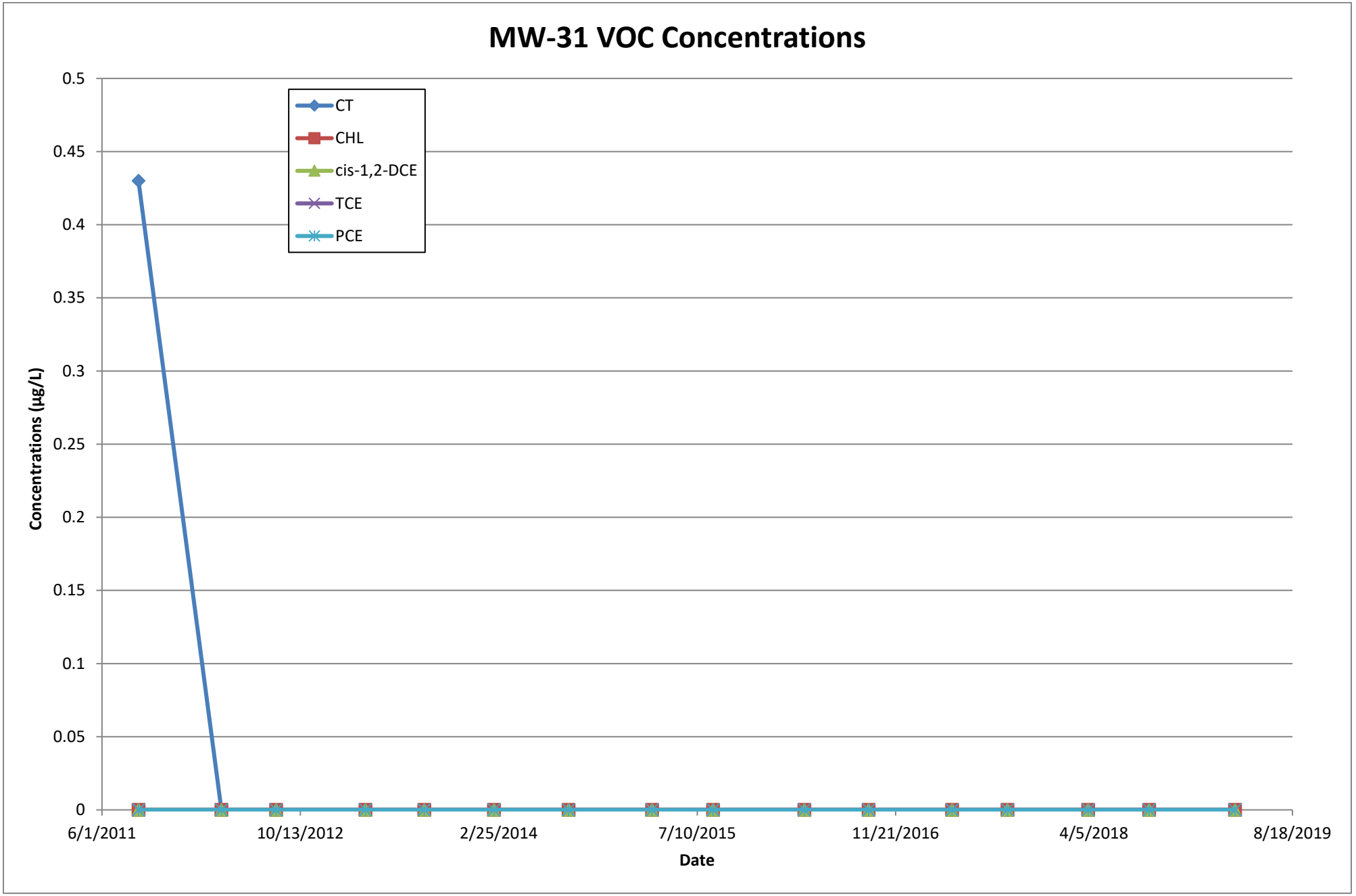

MW-26 VOC Concentrations
20
18
16
14
12
10
8
6
4
2
0
Concentrations (µg/L)
CT
CHL
cis-1,2-DCE
TCE
PCE
6/1/2011
10/13/2012
2/25/2014
7/10/2015
11/21/2016
4/5/2018
8/18/2019
Date

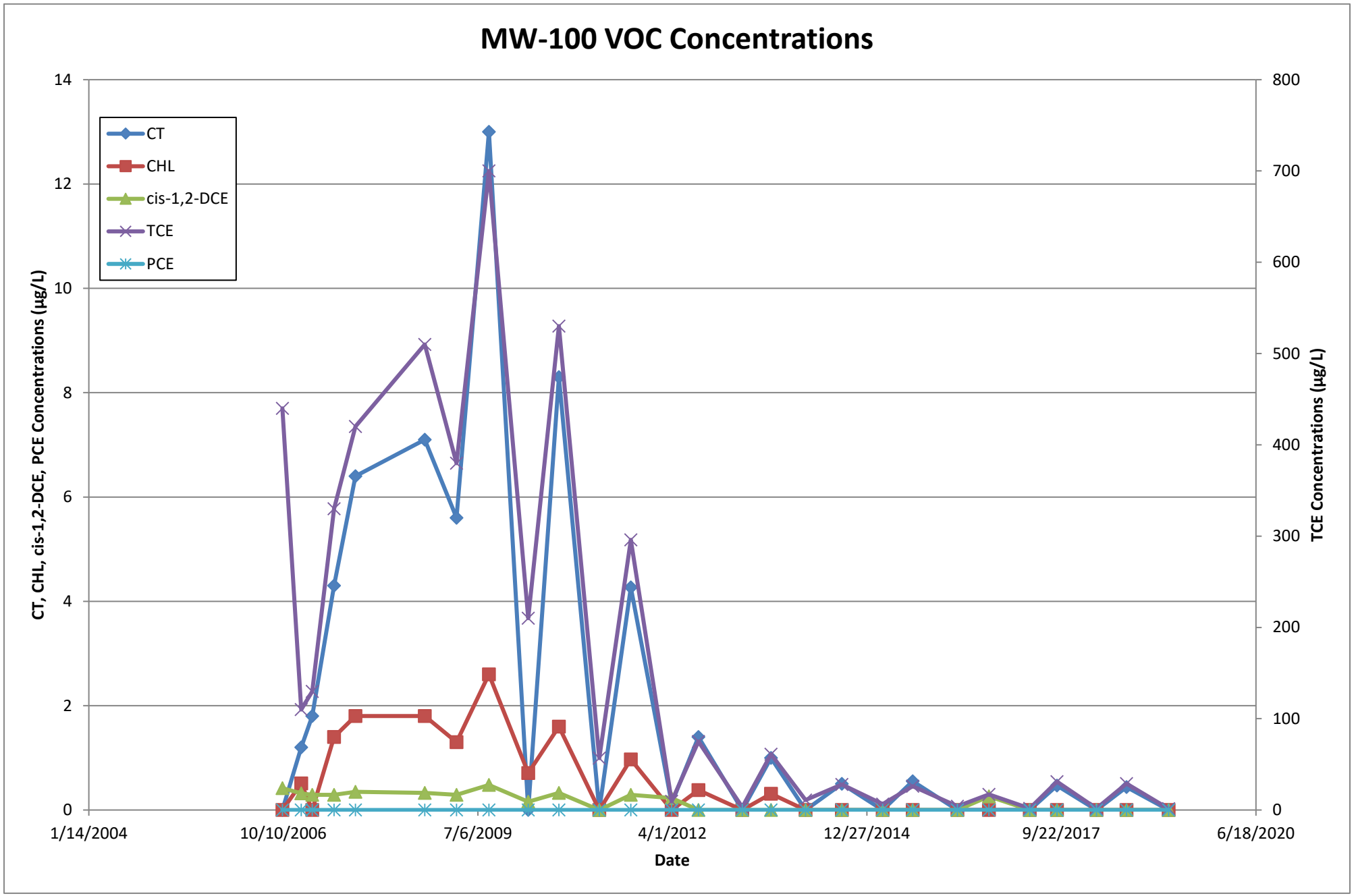

MW-27 VOC Concentrations
200
180
160
140
120
100
80
60
40
20
0
Concentrations (µg/L)
CT
CHL
cis-1,2-DCE
TCE
PCE
6/1/2011
10/13/2012
2/25/2014
7/10/2015
11/21/2016
4/5/2018
8/18/2019
Date

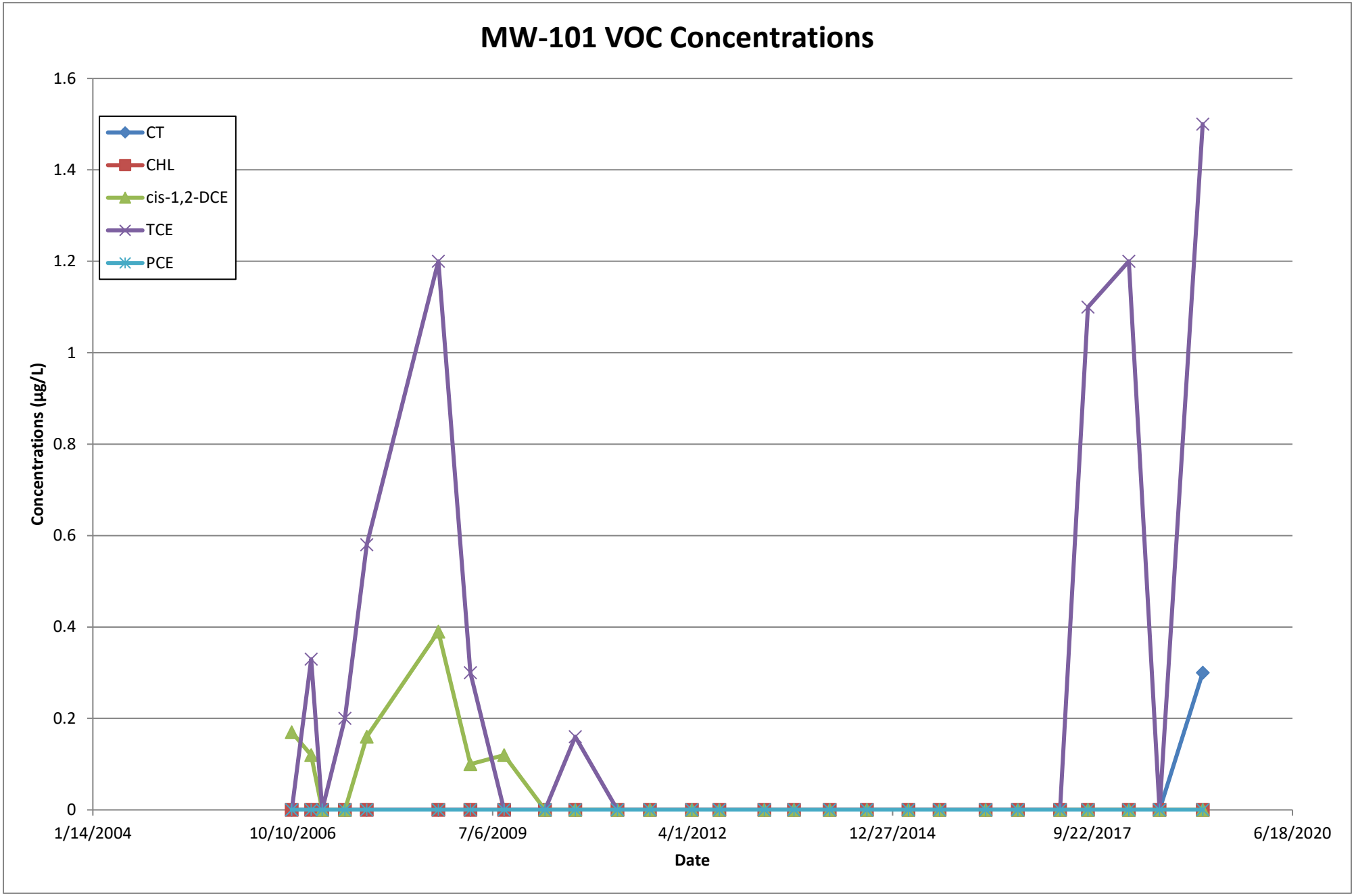

MW-28 VOC Concentrations
CT
CHL
cis-1,2-DCE
TCE
PCE
Concentrations (µg/L)
0
1
2
3
4
5
6
7
8
6/1/2011
10/13/2012
2/25/2014
7/10/2015
11/21/2016
4/5/2018
8/18/2019
Date

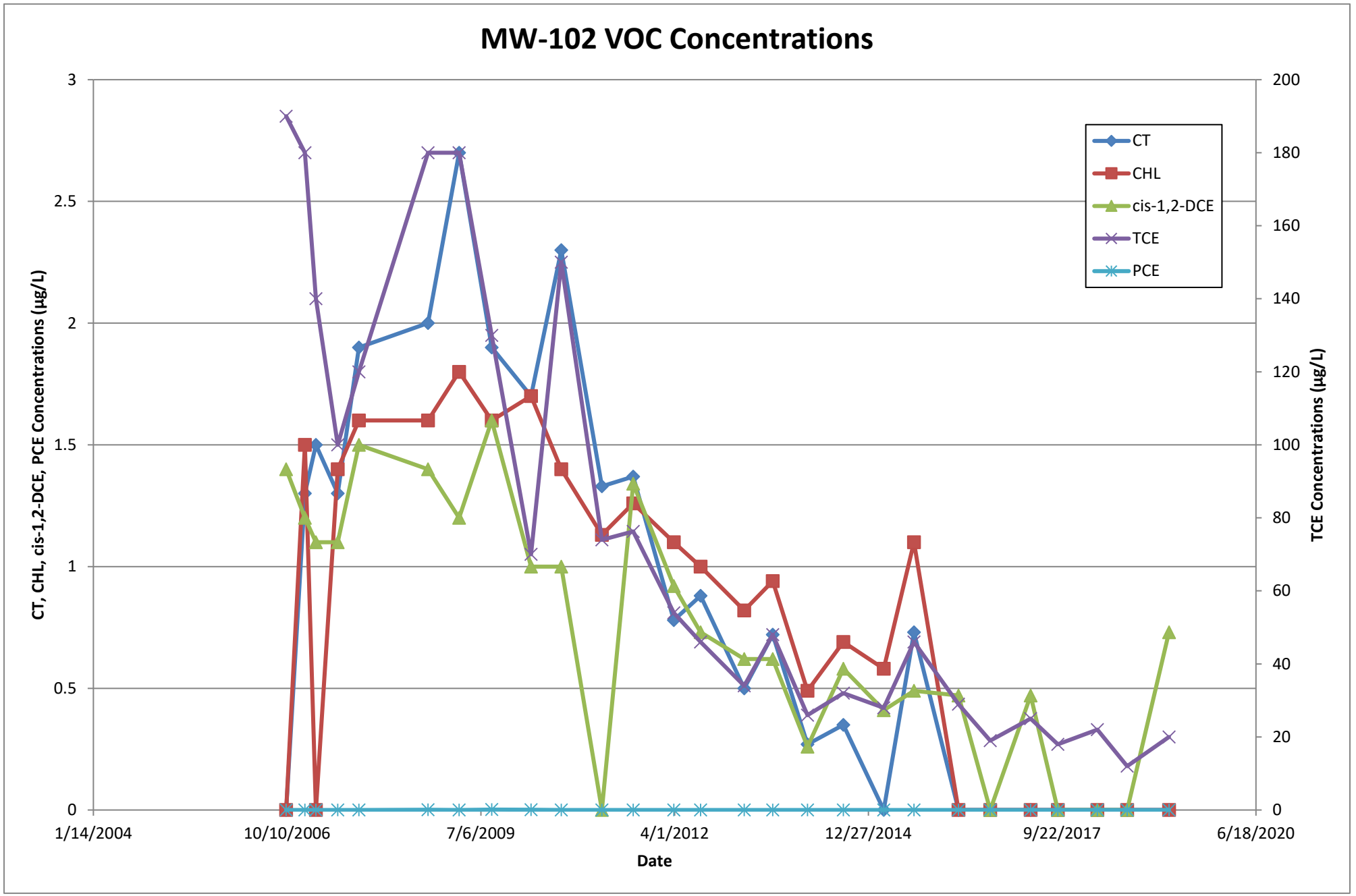

MW-29 VOC Concentrations
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Concentrations (µg/L)
CT
CHL
cis-1,2-DCE
TCE
PCE
6/1/2011
10/13/2012
2/25/2014
7/10/2015
11/21/2016
4/5/2018
8/18/2019
Date

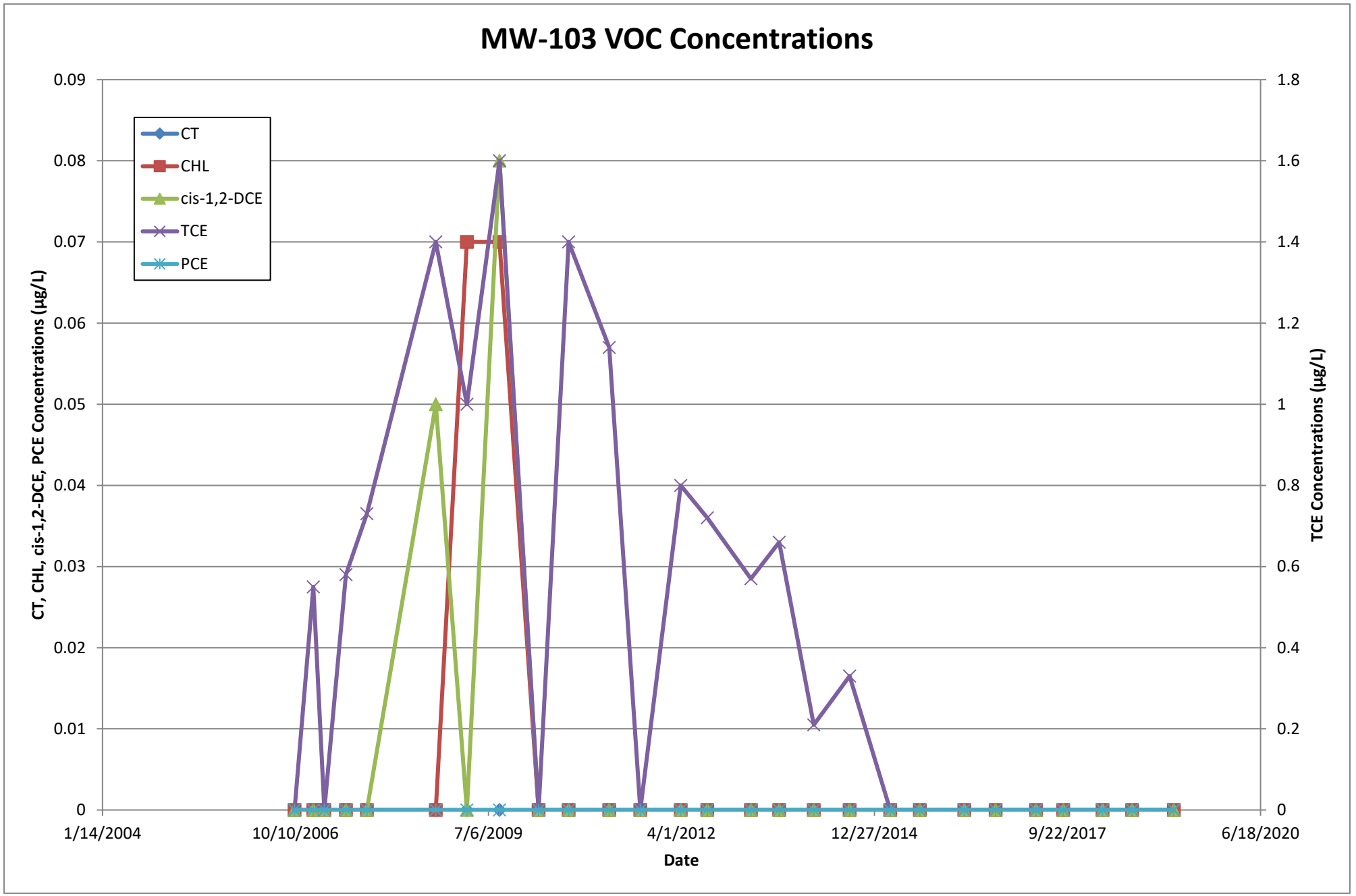

MW-30 VOC Concentrations
Concentrations (µg/L)
9
8
7
6
5
4
3
2
1
0
CT
CHL
cis-1,2-DCE
TCE
PCE
6/1/2011
10/13/2012
2/25/2014
7/10/2015
11/21/2016
4/5/2018
8/18/2019
Date

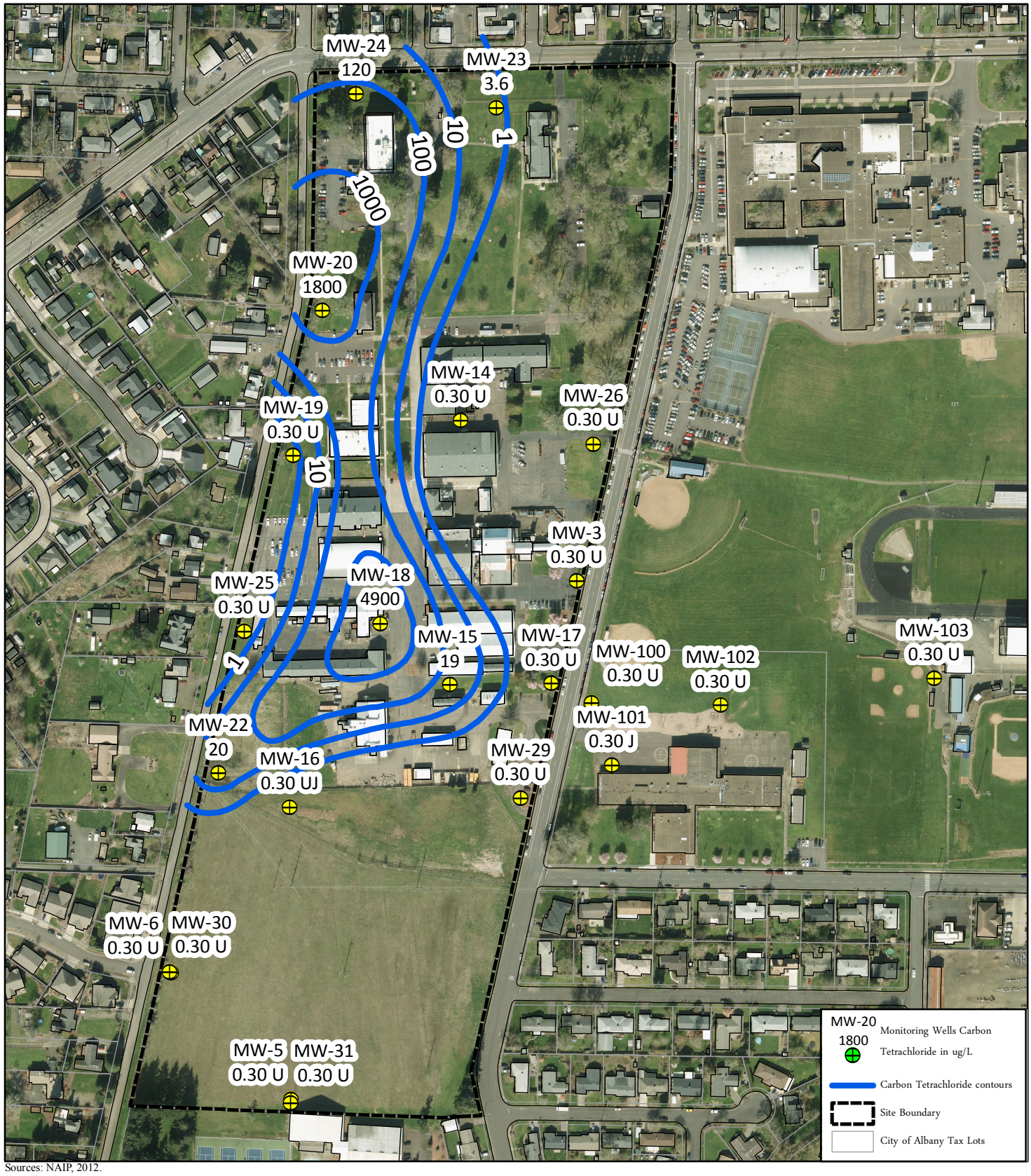

MW-31 VOC Concentrations
CT
CHL
cis-1,2-DCE
TCE
PCE
Concentrations (µg/L)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
6/1/2011
10/13/2012
2/25/2014
7/10/2015
11/21/2016
4/5/2018
8/18/2019
Date


MW-100 VOC Concentrations
CT
CHL
cis-1,2-DCE
TCE
PCE
CT, CHL, cis-1,2-DCE, PCE Concentrations (µg/L)
TCE Concentrations (µg/L)
Date
0
2
4
6
8
10
12
14
0
100
200
300
400
500
600
700
800
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
9/22/2017
6/18/2020


MW-101 VOC Concentrations
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Concentrations (µg/L)
CT
CHL
cis-1,2-DCE
TCE
PCE
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
9/22/2017
6/18/2020
Date


MW-102 VOC Concentrations
CT, CHL, cis-1,2-DCE, PCE Concentrations (µg/L)
TCE Concentrations (µg/L)
Date
CT
CHL
cis-1,2-DCE
TCE
PCE
0
0.5
1
1.5
2
2.5
3
0
20
40
60
80
100
120
140
160
180
200
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
9/22/2017
6/18/2020


MW-103 VOC Concentrations
CT
CHL
cis-1,2-DCE
TCE
PCE
CT, CHL, cis-1,2-DCE, PCE Concentrations (µg/L)
TCE Concentrations (µg/L)
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
9/22/2017
6/18/2020
Date



Sources: NAIP, 2012.
Albany GIS, 2007.

150 75 0 150 300
Feet

CONCENTRATION OF CARBON TETRACHLORIDE

IN THE GRAVEL AQUIFER, MARCH 2019

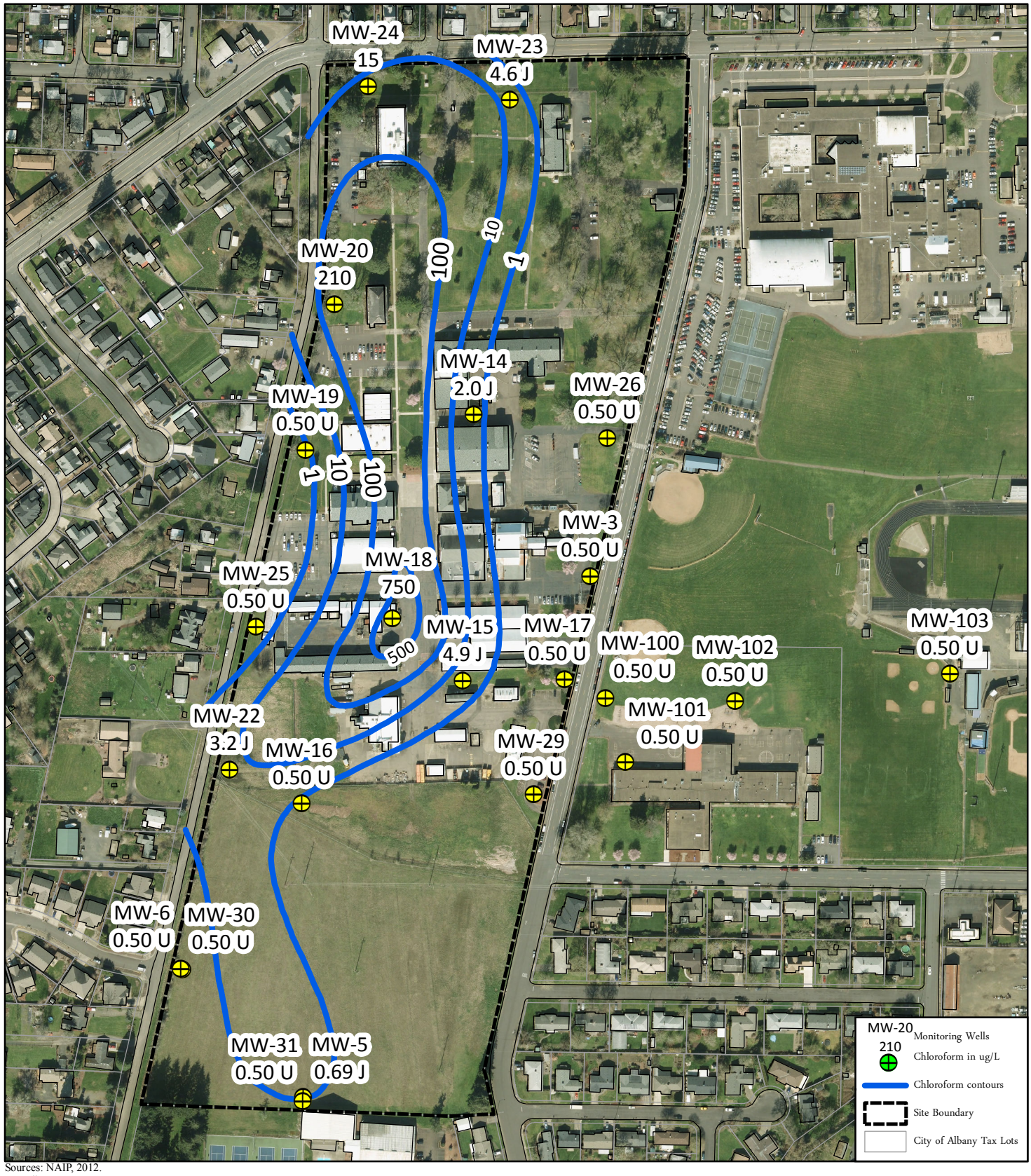
NETL ALBANY

GROUNDWATER SAMPLING

March 2019

ALBANY, OREGON

FIGURE 7



Sources: NAIP, 2012.
Albany GIS, 2007.

150 75 0 150 300
Feet

CONCENTRATION OF CHLOROFORM

IN THE GRAVEL AQUIFER, MARCH 2019

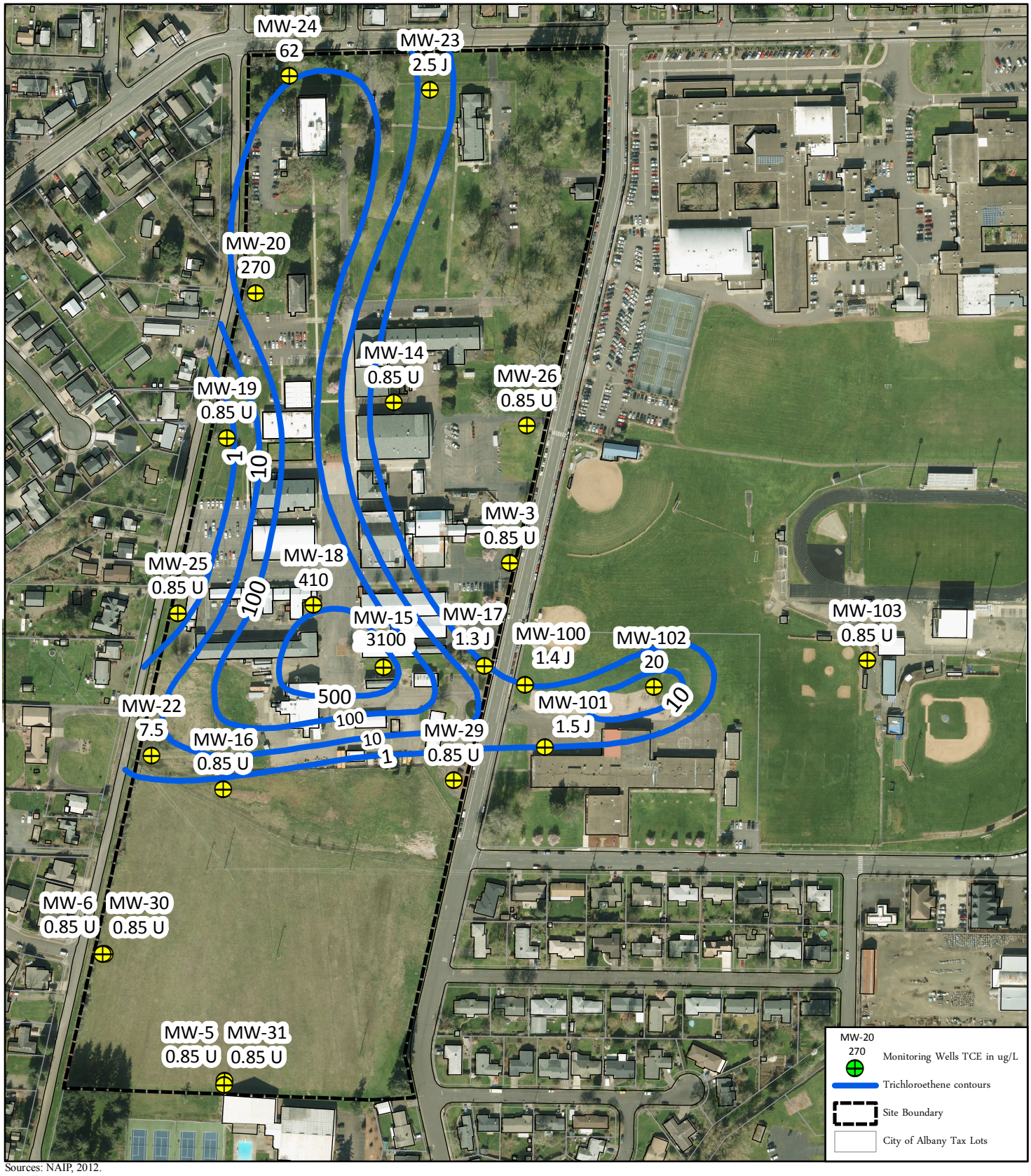
NETL ALBANY

GROUNDWATER SAMPLING

March 2019

ALBANY, OREGON

FIGURE 8



Sources: NAIP, 2012.
Albany GIS, 2007.

150 75 0 150 300
Feet

CONCENTRATION OF TRICHLOROETHENE IN THE GRAVEL AQUIFER, MARCH 2019

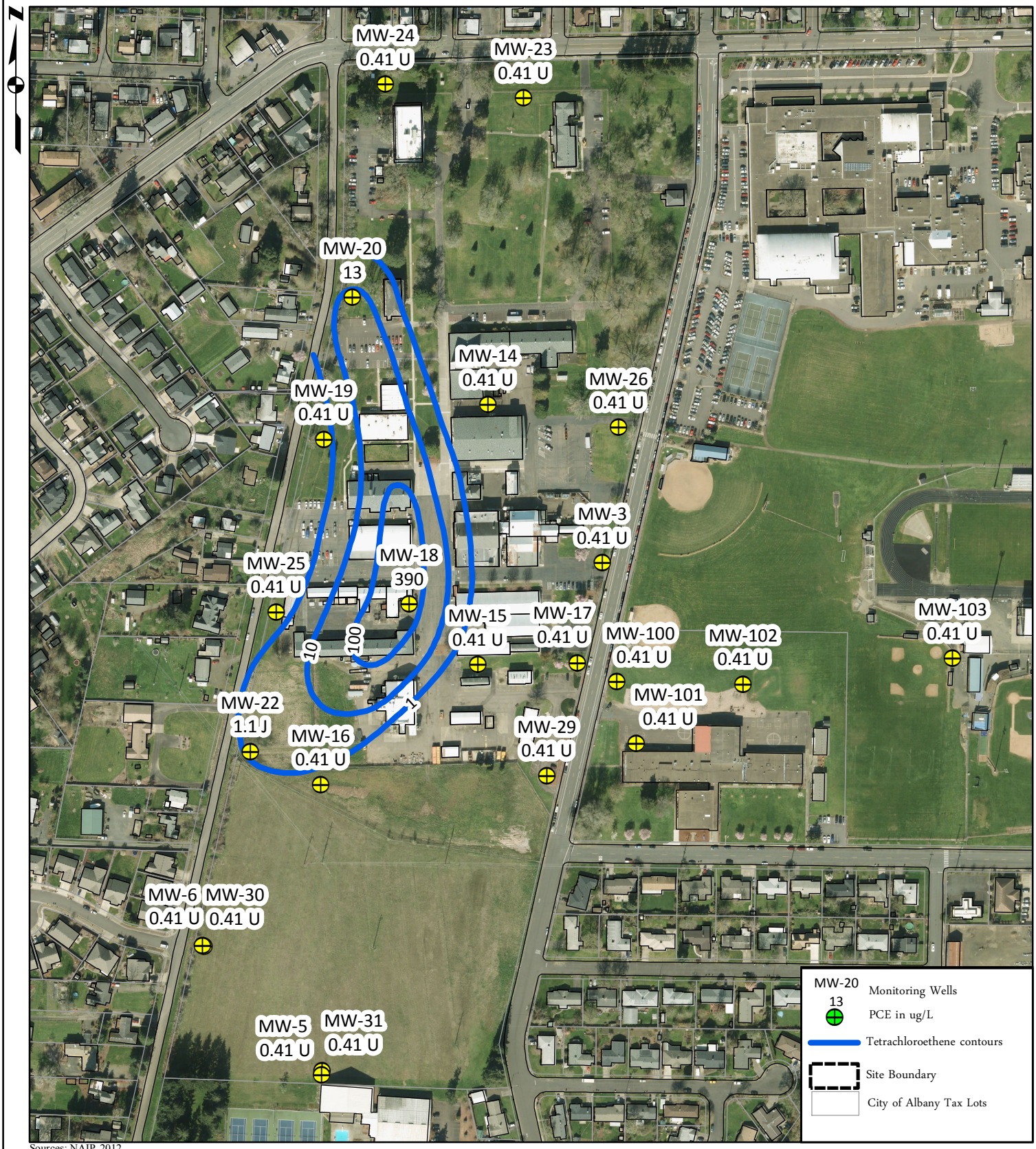
NETL ALBANY

GROUNDWATER SAMPLING

March 2019

ALBANY, OREGON

FIGURE 9



Sources: NAIP, 2012.
Albany GIS, 2007.

150 75 0 150 300
Feet

CONCENTRATION OF TETRACHLOROETHENE IN THE GRAVEL AQUIFER, MARCH 2019

NETL ALBANY
GROUNDWATER SAMPLING
ALBANY, OREGON

March 2019

FIGURE 10



Sources: NAIP, 2012.
Albany GIS, 2007.

150 75 0 150 300
Feet

CONCENTRATION OF CARBON TETRACHLORIDE

IN THE PERCHED AQUIFER MARCH 2019

NETL ALBANY
GROUNDWATER SAMPLING
ALBANY, OREGON

March 2019

FIGURE 11