



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND
HEADQUARTERS, UNITED STATES ARMY GARRISON, FORT DRUM
10000 10TH MOUNTAIN DIVISION DRIVE
FORT DRUM, NEW YORK 13602-5000

October 8, 2013

Public Works
Environmental Division

New York State Department of
Environmental Conservation
ATTN: Ms. Heather Bishop
Division of Environmental Remediation
Remedial Bureau A
625 Broadway, 11th Floor
Albany, New York 12233-7015



Dear Ms. Bishop:

Enclosed for your review and approval is a copy of the plan "Draft Field Sampling Plan Addendum for the AAFES Station Site, Building P-2140 at Fort Drum, New York". This plan was discussed at the July 9, 2013 Installation Restoration Program progress meeting.

If you have any questions concerning this report and request, please contact Paul Zang at (315) 772-6312 or paul.g.zang.civ@mail.mil.

Sincerely,

A handwritten signature in black ink that reads "James M. Miller".

James M. Miller
Chief, Environmental Division
Public Works

Enclosure

**DRAFT
FIELD SAMPLING PLAN ADDENDUM
FOR THE AAFES STATION SITE, BUILDING P-2140**

AT

FORT DRUM, NEW YORK

Prepared For:



**UNITED STATES ARMY ENVIRONMENTAL COMMAND
2450 CONNELL ROAD, BLDG 2264
FORT SAM HOUSTON, TX 78234**

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Contract Number: W91ZLK-05-D-0011
Delivery Order: 004

September 2013

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Acronyms and Abbreviations

AAFES	Army and Air Force Exchange Service
AAS	Aquifer Air Sparging
bgs	below ground surface
BTEX	Benzene, toluene, ethylbenzene, and total xylenes
DPE	Dual-Phase Extraction
EA	EA Engineering, Science, and Technology, Inc.
FSP	Field Sampling Plan
ft	foot OR feet
ft ²	square feet
MTBE	Methyl Tert-Butyl Ether
NYSDEC	New York State Department of Environmental Conservation
OP-TECH	OP-TECH Environmental Services, Inc.
Plexus	Plexus Scientific Corporation
ppmv	Parts per million by volume
TVHs	Total Volatile Hydrocarbons
µg/L	Micrograms per Liter
USAEC	United States Army Environmental Command
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOCs	Volatile Organic Compounds

1 INTRODUCTION

Plexus Scientific Corporation (Plexus), under contract to the United States Army Environmental Command (USAEC), was tasked with developing and implementing a Field Sampling Plan (FSP) to support the Installation Restoration Program and Basewide Monitoring Program at the Fort Drum Military Installation. The 2009 Annual Basewide FSP was published in March 2009 and outlined sampling and gauging activities for, among other sites, the Army and Air Force Exchange Service (AAFES) Station Site, Building P-2140. Specifically, for the AAFES Station Site, Building P-2140, the FSP outlined a Post-Termination Monitoring Program to be implemented for a period of three years. This FSP Addendum presents the monitoring results from the Post-Termination Monitoring Program over the past three years and requests discontinuation of the Post-Termination Monitoring Program at the AAFES Station Site, Building P-2140, as verbally approved by NYSDEC during a July 9, 2013 meeting. The preparation of this document is authorized under USAEC Contract No. W91ZLK-05-D-0011, Delivery Order No. 0004.

2 BACKGROUND

2.1 Site Location

Fort Drum is located in upstate New York, approximately 10 miles northeast of Watertown and 80 miles north of Syracuse (**Figure 2-1**). The Military Installation encompasses approximately 168 square miles.

AAFES Station Site, Building P-2140 is located in the old Cantonment area of Fort Drum (**Figure 2-2**). It is bounded on the north by Nash Boulevard, on the west by First Street, and on the south by a wetland associated with the Black River. AAFES Station Site, Building P-2140 is an active gasoline retail service station. The site consists of a one-story convenience store (formerly a two-bay service station), three gasoline underground storage tanks (USTs), a fuel oil UST, a waste oil UST, associated fuel dispensers, and a paved lot.

2.2 Topography

AAFES Station Site, Building P-2140 is located in the Lake Erie-Ontario Lowlands Province. The Lake Erie-Ontario Lowlands consist predominantly of flat land characterized by small sand plains, swamps, drumlin fields, and disrupted drainage patterns (EA Engineering, Science, and Technology, Inc. [EA], 1999). In general, the surface topography of the AAFES Station Site, Building P-2140, including the paved parking area, pump dispensers, and UST field is relatively level. The remainder of the property slopes to the southwest at a grade of approximately 15 percent (EA, 2003).

2.3 Geology

The geology of the source area at the AAFES Station Site, Building P-2140 is mainly sandy lacustrine deposits at thicknesses greater than 45 feet (ft). The unconsolidated deposits consist of medium to fine sand with varying amounts of silt (trace to little) (EA, 2003). The silt content increases with depth. Soil boring data collected down-gradient of the source area indicate that the thickness of the overlying sandy deposits decreases in this area (20 to 25 ft thick). Soil borings completed adjacent to and down-gradient of the nearby wetland indicate that the deltaic sand deposit in this area is 4 to 9 ft thick and overlies a glacial till unit (EA, 2003).

2.4 Hydrogeology

The water table is generally highest in the spring, due to precipitation and snow melt. Recharge is generally low in the summer, but increases again in the late fall. The lowest water-table levels generally occur in October and November (EA, 2003). Groundwater levels measured in December 2008 indicated that depth to groundwater ranged from approximately 5 to 28 ft below ground surface (bgs), with groundwater flowing generally to the southeast towards the nearby wetland area (**Figure 2-3**). Based on historical groundwater measurements, the hydraulic

gradient at AAFES Station Site, Building P-2140 is approximately 0.035 and decreases to 0.004 beyond the perimeter fence, towards the wetland area.

2.5 Site History

In October 1993, OP-TECH Environmental Services, Inc. (OP-TECH) removed five USTs and associated piping at AAFES Station Site, Building P-2140. During the removal of these tanks, it was found that the soil in the tank area and near the associated dispenser piping had been contaminated by gasoline. OP-TECH removed 311 tons of gasoline-contaminated soil from the tanks and dispenser areas. There was no underlying soil analyses performed because the site was not excavated to clean soil due to the extensive amount of contaminated.

A soil vapor survey was conducted during the initial site investigation to assess the presence of volatile organic compounds (VOCs) in unsaturated zone soil in the areas potentially impacted from historical usage and to provide guidance in the selection of soil boring/monitoring well locations. Based on the results of a vertical profile in the vicinity of the former UST excavation, a target depth of 10 ft bgs was selected for obtaining soil vapor samples. A total of 31 soil vapor samples from 25 sample locations were obtained and analyzed in the field for the presence of benzene, toluene, ethylbenzene, and total xylenes (BTEX); the samples were also quantified for total volatile hydrocarbons (TVH). The distribution of reported TVH concentrations indicated the presence of three areas of elevated soil vapor concentrations. The first area, located in the vicinity of the former UST excavation, exhibited the highest reported BTEX and TVH concentrations, at 3,210 parts per million by volume (ppmv) and 8,600 ppmv, respectively. The second area of elevated soil vapor readings was located immediately southwest of the fuel dispenser island and north-northwest of the former UST excavation, with reported concentrations of BTEX and TVH at 172 ppmv and 2,400 ppmv, respectively. The third area of elevated BTEX and TVH concentrations was located southeast of the AAFES Station Site, Building P-2140, with reported BTEX and TVH concentrations of 15 ppmv and 22 ppmv, respectively. The analytical data from soil samples collected indicated that residual petroleum-related hydrocarbons were present in vadose zone soil in the area immediately southwest of the fuel dispenser island (MW-2140-02; 15 to 17 ft bgs), and the area of the former UST excavation (MW-2140-03; 8 to 10 ft bgs).

As presented by EA in March 2000, based on the initial site investigation, an area of petroleum-impacted soil and separate-phase product extends from the fuel dispenser pad, approximately 150 ft to the southeast to monitoring well MW-2140-05, which is located beyond the line of extraction wells (EX-2140-02 through EX-2140-05). This corresponds to an overall area of approximately 8,450 square feet (ft²). Petroleum-impacted soil in the vicinity of the former product lines and the former UST field extends from the release point down to the groundwater table (i.e., approximately 6 to 23 ft bgs) and is estimated to encompass an area of approximately 2,530 ft². Petroleum-impacted soil located hydraulically down-gradient of the former UST field is present in a 4-foot interval situated above the groundwater table (i.e., approximately 19 to 23 ft

bgs) and is estimated to encompass an area of approximately 5,920 ft². The estimated volume of subsurface soil targeted for corrective action was estimated to be 2,790 cubic yards (EA, 2000).

A dual-phase extraction (DPE) treatment system began operation on January 30, 2002. The objective of the DPE system was to address light non-aqueous phase liquids and residual soil contamination in the source area of the AAFES Station Site, Building P-2140. In order to improve the performance of the DPE system, an Aquifer Air Sparging (AAS) system was installed in the source area in 2006 to enhance remediation of the dissolved plume by addressing residual soil contamination below the water table and increasing contaminant recovery rates during periods of elevated water table. Field activities associated with the DPE system enhancements were completed between November 2005 and February 2006, which included the installation of 16 AAS wells and associated underground piping and retrofitting the existing trailer with AAS equipment.

Downgradient of the source area, prior to the wetlands area and Fort Drum property line, an AAS with ozone treatment system was installed in Fall 2000. The AAS ozone treatment system began operation on December 14, 2000. The purpose of the AAS ozone treatment system was to treat the dissolved-phase total BTEX and methyl tert-butyl ether (MTBE) plume downgradient of the source area. In March 2009, the AAS ozone treatment system was evaluated, found successful, and a request for the system to be shutdown was submitted to New York State Department of Environmental Conservation (NYSDEC). See **Figure 2-4** for the current BTEX plume location, concentrated well upgradient of the AAS ozone treatment system.

In a March 2009 letter, NYSDEC concurred with the Army's request for shutdown of the ozone system at AAFES Station Site, Building P-2140. As part of that concurrence, NYSDEC requested that a Post-Termination Monitoring Program be implemented for a period of three years following the shutdown. In compliance with requirements from NYSDEC, the 2009 Annual Basewide FSP included necessary samples to fulfill the requirements of a Post-Termination Monitoring Program. The following monitoring wells were included in the monitoring program: 2140-MW14, MW16 through MW19, MW27, and MW29. Each of these wells was to be sampled for VOCs and MTBE in the spring and fall sampling events of 2009, 2010, 2011, and 2012. In conjunction with the fall events, two surface water samples were also to be collected, from locations 2140-SW01 and SW02.

In August 2009, Plexus implemented ozone AAS as an alternative technology in the source area of the BTEX Plume. Plexus installed seven ozone injection points ranging between 25 to 30-ft bgs in the area of monitoring well MW02 and MW37. The DPE/AAS system was deactivated on 22 December 2009 in preparation for ozone injection activities. The ozone treatment unit began operation on 22 December 2009, and is currently operating at the Site. In December 2011, Plexus implemented a five month nutrient application at the Site. Following the nutrient application trial, Plexus continued ozone system operations.

3 FIELD ACTIVITIES

As outlined in the 2009 Annual Basewide FSP, the following monitoring wells were sampled for VOCs and MTBE through 2012: 2140-MW14, MW16 through MW19, MW27, and MW29. In addition, surface water samples were from 2140-SW01 and SW02 during the fall sampling events.

Field activities were performed in accordance with procedures described in the *Environmental Investigation for Fort Drum, Quality Assurance Program Plan* (Plexus, 2008). The semi-annual sampling events were coordinated and performed by Plexus personnel. All field activities and site access were coordinated with Fort Drum Public Works Environmental Division personnel.

All treatment systems were shut down two to the three days prior to the sampling events to allow sufficient time for water table recovery. The systems were brought back online following completion of the sampling events. Wells were gauged using a standard interface probe. Low-flow purging (minimal drawdown) and sampling were used to obtain representative samples from the formation adjacent to the well screen and was conducted in accordance with U.S. Environmental Protection Agency (USEPA) approved Region II guidelines (USEPA, 1998). Water quality parameters were monitored throughout purging, and included temperature, potential of Hydrogen, specific conductance (conductivity), turbidity, dissolved oxygen, and oxidation-reduction potential.

Groundwater and surface water samples, along with all associated quality assurance/quality control samples, were submitted to Accutest Laboratories of Dayton, New Jersey, for VOC and MTBE analyses, as outlined in the 2009 FSP (Plexus, 2009).

4 Results

See **Table 4-1** for a summary of analytical results from groundwater and surface water sampling at the AAFES Station Site, Building P-2140 in the previous three years of Post-Termination Monitoring. See **Figure 4-1** for a map of historical BTEX concentrations at all locations included in the Post-Termination Monitoring Plan at the AAFES Station Site, Building P-2140.

4.1 Groundwater Results

Monitoring well 2140-MW14 has not had any analytes detected during the Post-Termination Monitoring Program. See **Figure 4-2** for a time series of BTEX concentrations at monitoring well 2140-MW14.

Monitoring well 2140-MW16 has not had any analytes exceed applicable screening criteria during the Post-Termination Monitoring Program. Benzene was the only analyte detected, at 0.44 micrograms per liter ($\mu\text{g/L}$) during the Fall 2012 sampling event. See **Figure 4-3** for a time series of BTEX concentrations at monitoring well 2140-MW16.

Monitoring well 2140-MW17 has had one analyte exceed applicable screening criteria during the Post-Termination Monitoring Program—benzene during the Fall 2010 sampling event at 1.8 $\mu\text{g/L}$. Since that event, benzene has not been detected at monitoring well 2140-MW17. See **Figure 4-4** for a time series of BTEX concentrations at monitoring well 2140-MW17.

Monitoring well 2140-MW18 has not had any analytes exceed applicable screening criteria during the Post-Termination Monitoring Program. Benzene was the only analyte detected, at 0.54 $\mu\text{g/L}$ during the Fall 2012 sampling event. See **Figure 4-5** for a time series of BTEX concentrations at monitoring well 2140-MW18.

Monitoring well 2140-MW19 has had one analyte exceed applicable screening criteria during the Post-Termination Monitoring Program—benzene during the Fall 2010 sampling event at 4.5 $\mu\text{g/L}$. Benzene has been detected at monitoring well 2140-MW19 twice since the Fall 2010 sampling event: at 0.54 $\mu\text{g/L}$ during the Fall 2012 sampling event, and at 0.3 $\mu\text{g/L}$ during the Spring 2013 sampling event. See **Figure 4-6** for a time series of BTEX concentrations at monitoring well 2140-MW19.

Monitoring well 2140-MW27 has had one analyte exceed applicable screening criteria during the Post-Termination Monitoring Program—benzene during the Fall 2010 sampling event at 12 $\mu\text{g/L}$. Since that event, benzene has not been detected at monitoring well 2140-MW27. See **Figure 4-7** for a time series of BTEX concentrations at monitoring well 2140-MW27.

Monitoring well 2140-MW29 has not had any analytes detected during the Post-Termination Monitoring Program. See **Figure 4-8** for a time series of BTEX concentrations at monitoring well 2140-MW29.

4.2 Surface Water Results

Surface water sampling location 2140-SW01 has not had any analytes exceed applicable screening criteria during the Post-Termination Monitoring Program. Acetone was the only analyte detected, at 8.2 μ /L during the Fall 2012 sampling event. See **Figure 4-9** for a time series of BTEX concentrations at surface water sampling location 2140-SW01.

Surface water sampling location 2140-SW02 has not had any analytes detected during the Post-Termination Monitoring Program. See **Figure 4-10** for a time series of BTEX concentrations at surface water sampling location 2140-SW02.

5 CONCLUSIONS AND RECOMENDATIONS

Plexus proposes discontinuation of the Post-Termination Monitoring Program at the AAFES Station Site, Building P-2140, as verbally approved by NYSDEC during a July 9, 2013 meeting, based on review of analytical results during the Post-Termination Monitoring Program.

6 REFERENCES

Plexus Scientific Corporation (Plexus), 2008. *Environmental Investigation for Fort Drum, Quality Assurance Program Plan, Gasoline Alley*, Fort Drum, New York.

Plexus, 2009. *2009 Annual Basewide Field Sampling Plan*, Fort Drum, New York.

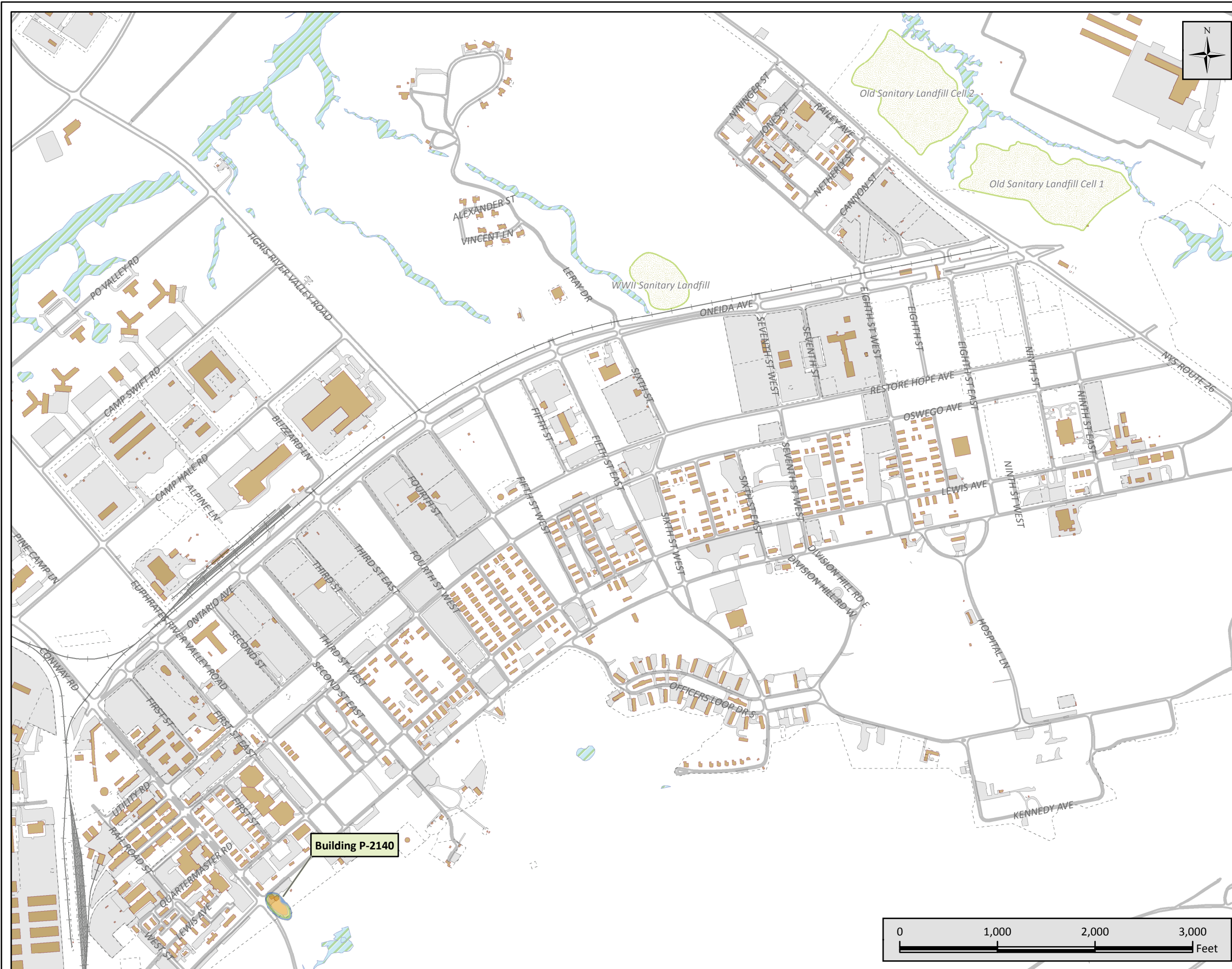
U.S. Environmental Protection Agency Region II, 1998. *Groundwater Sampling Procedure: Low Stress (Low Flow) Purging and Sampling*.

EA. 1999. *Draft Remedial Investigation Data Gap Study, AAFES Station*, Fort Drum, New York. January.

EA. 2003. *Final Corrective Measures Study, AAFES Station*, Fort Drum, New York. June.

TABLES

FIGURES



Legend

- Fence Line
 - + Rail Road
 - Paved Roadline
 - Landfill Site
 - Wetlands
 - Building
 - Paved Area
- Spring 2013 BTEX Plume**
- 1 µg/L
 - 10 µg/L
 - 100 µg/L
 - 1,000 µg/L

Abbreviation Key:
µg/L = micrograms per liter



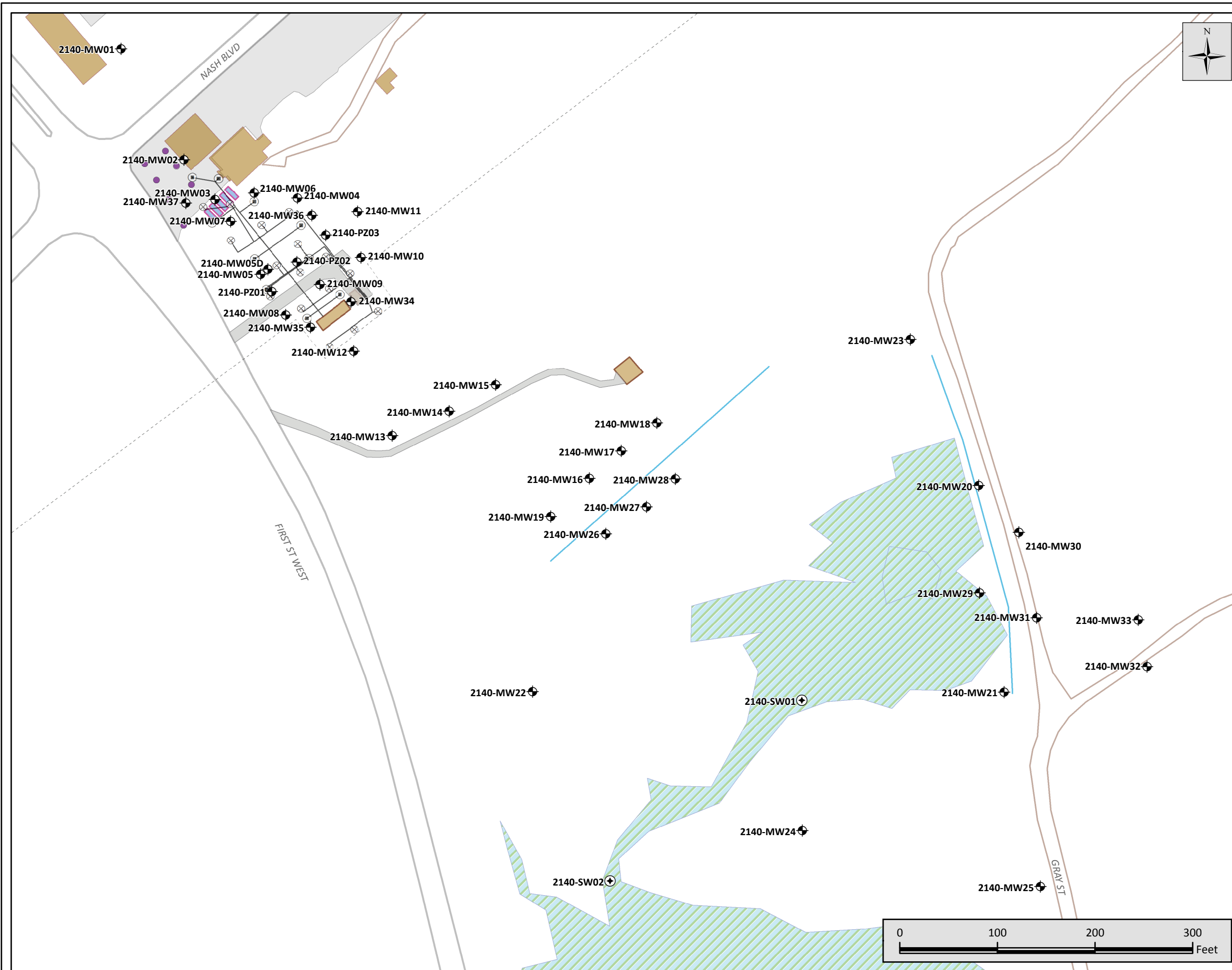
5510 Cherokee Ave.
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Created By: Betsy Bouton
Date: September 2013

FIGURE 2-1

Location Overview Map

**Field Sampling Plan Addendum for
The AAFES Station Site, Building P-2140
at Fort Drum, New York**



Legend

- ⊕ Groundwater Monitoring Wells
- ⊕ Surface Water Sample Locations
- Ozone Injection Points
- ⊗ Airsparge Wells
- ⊕ Multi-Phase Extraction Wells
- System Pipes
- Ozone Sparging Lines
- Former UST
- Fence Line
- Paved Road
- Unpaved Road
- ▨ Wetlands
- Building
- Paved Area



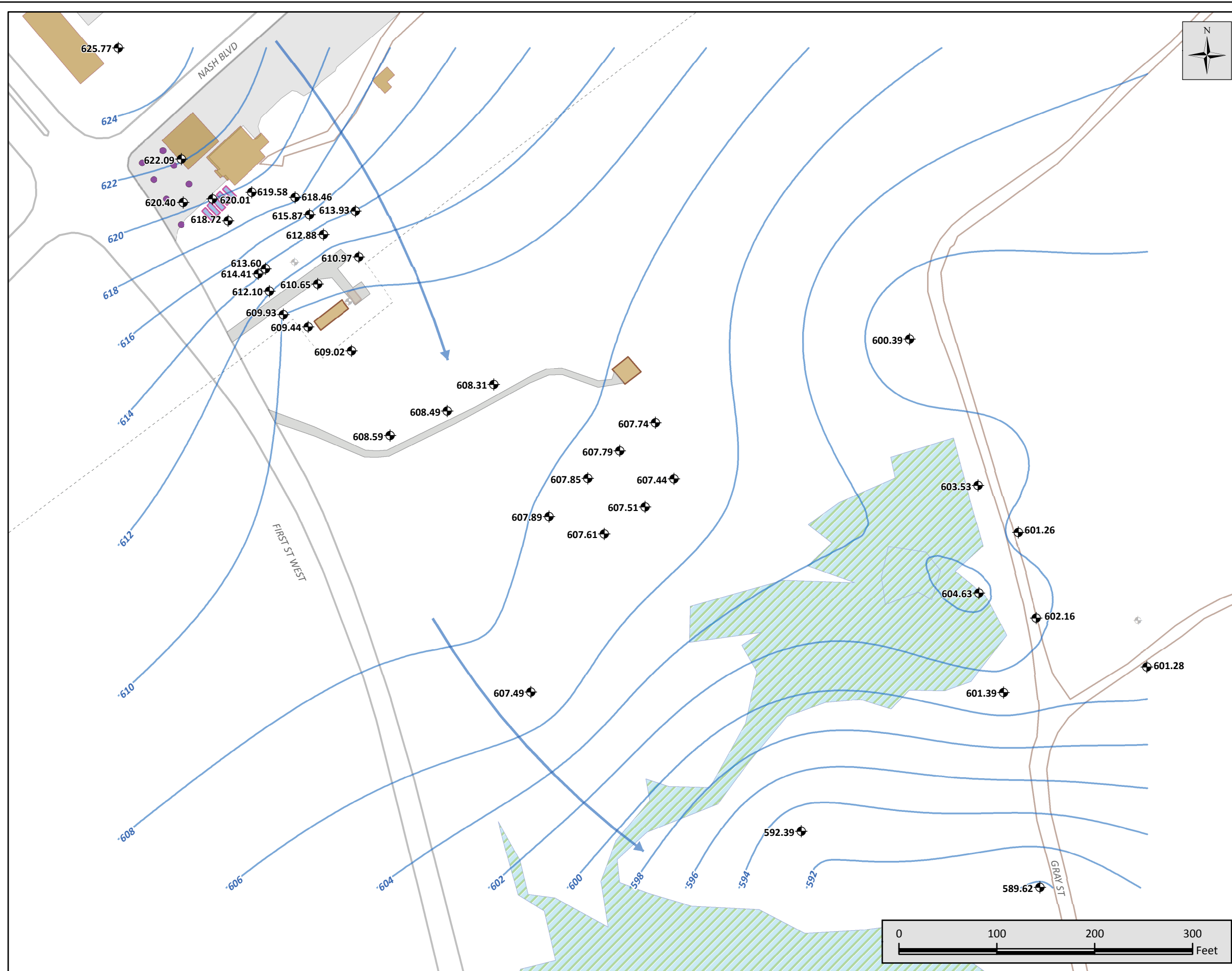
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Date: September 2013

FIGURE 2-2

**AAFES Station Site Building P-2140
Site Map**

Field Sampling Plan Addendum for
The AAFES Station Site, Building P-2140
at Fort Drum, New York



Legend

- ◆ Gauged Wells (ft MSL)
- Other Monitoring Wells
- Ozone Injection Points
- ➔ Groundwater Flow Direction
- Groundwater Contour (ft MSL)
- Former UST
- - - Fence Line
- Paved Road
- Unpaved Road
- ▨ Wetlands
- Building
- Paved Area

Abbreviation Key:
 ft - Feet
 MSL - Mean Sea Level
 UST - Underground Storage Tank



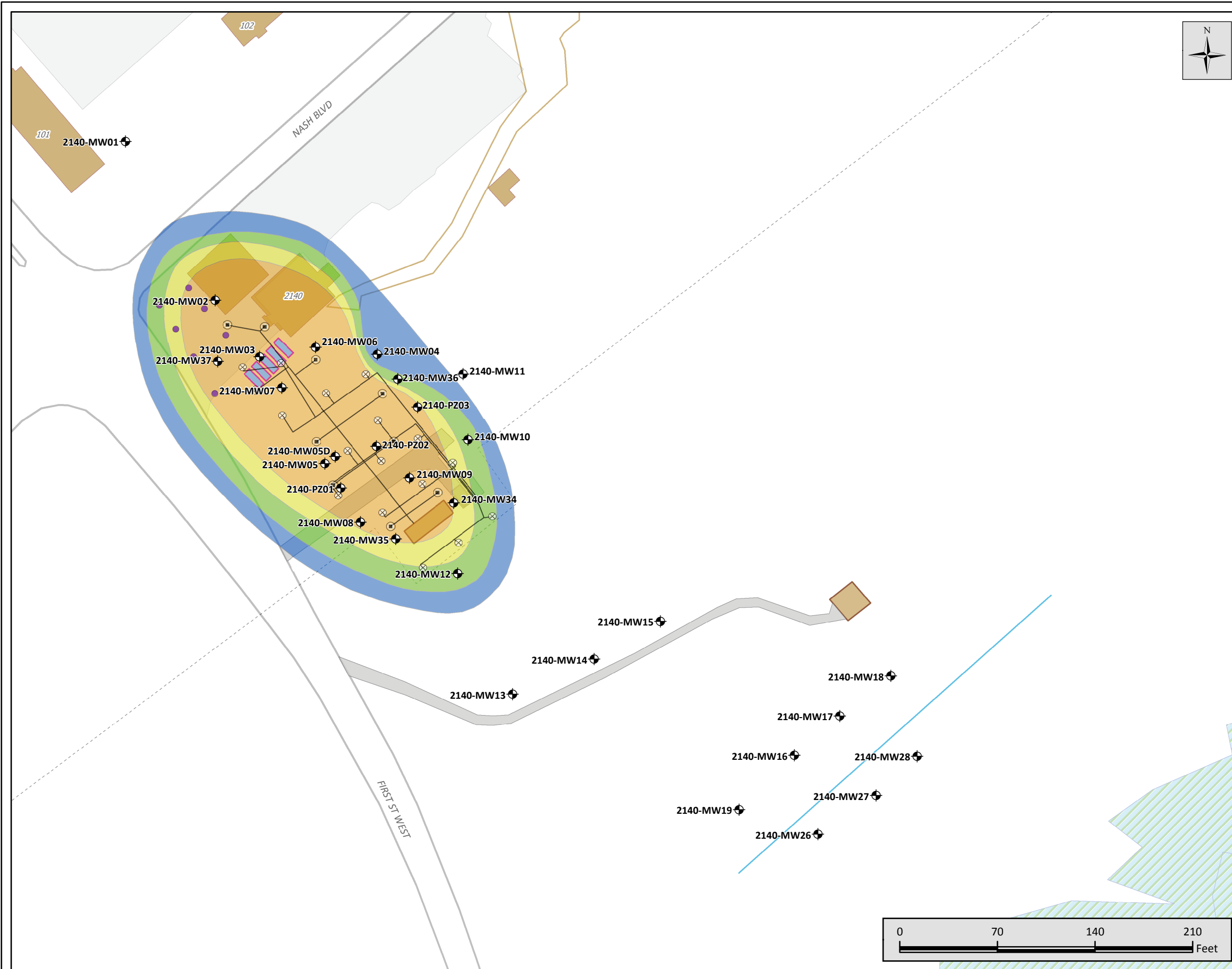
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 Date: September 2013

FIGURE 2-3

**AAFES Station Site Building P-2140
 Groundwater Contour Map
 Spring 2013**

**Field Sampling Plan Addendum for
 The AAFES Station Site, Building P-2140
 at Fort Drum, New York**



Legend

- ⊕ Monitoring Wells
- Ozone Injection Points
- ⊗ Airsparge Wells
- ⊖ Multi-Phase Extraction Wells
- System Pipes
- Ozone Sparging Lines
- Former UST
- - - Fence Line
- + Rail Road
- Paved Road
- Unpaved Road
- ▨ Wetlands
- Building
- Paved Area

Spring 2013 BTEX Plume

- 1 µg/L
- 10 µg/L
- 100 µg/L
- 1,000 µg/L

Abbreviation Key:
µg/L = micrograms per liter

PLEXUS
scientific

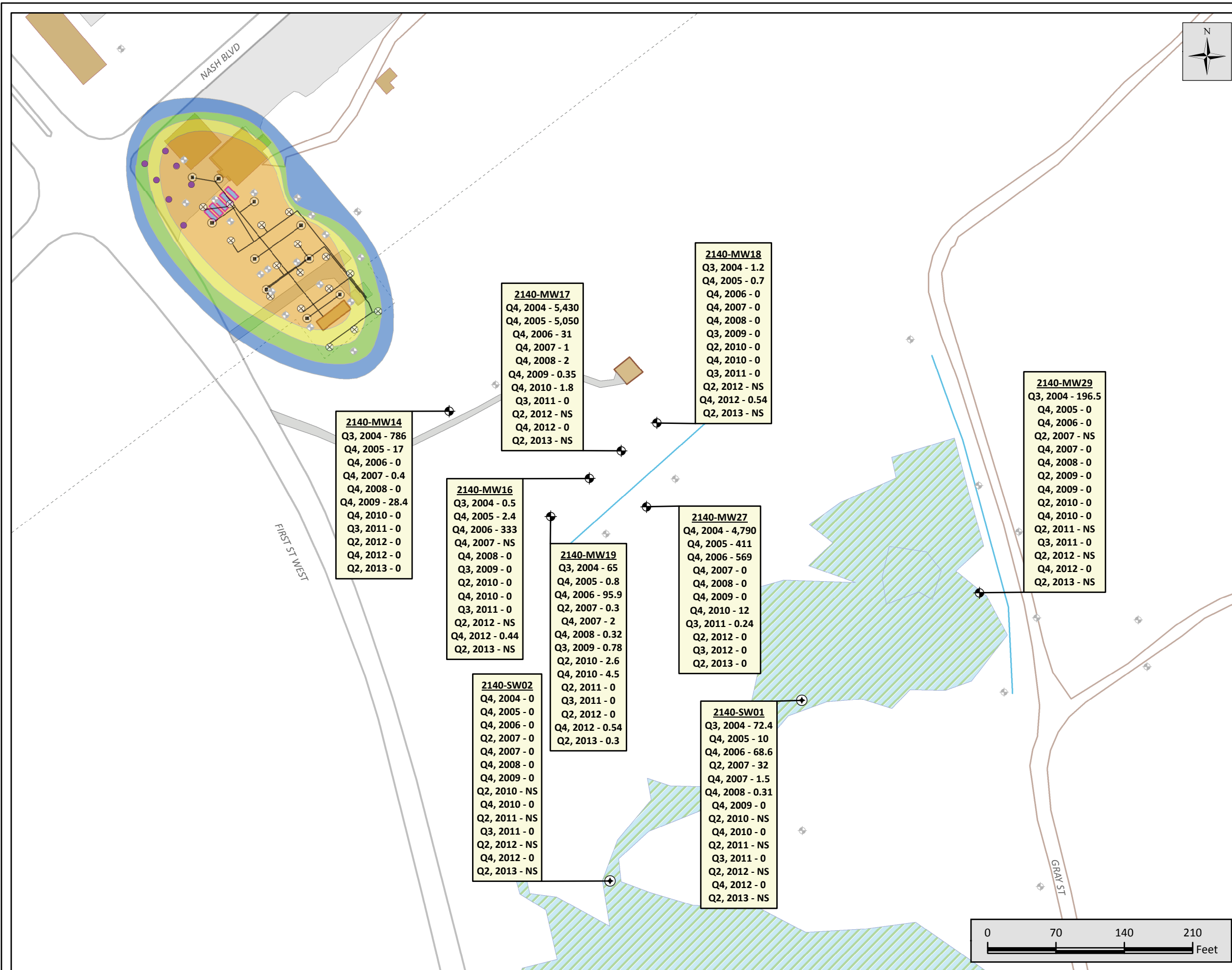
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Date: September 2013

FIGURE 2-4

**AAFES Station Site Building P-2140
Total BTEX Concentration Plume
Spring 2013**

Field Sampling Plan Addendum for
The AAFES Station Site, Building P-2140
at Fort Drum, New York



Legend

- ⊕ Groundwater Monitoring Wells
- ⊕ Surface Water Sample Locations
- ⊕ Other Monitoring Wells
- Ozone Injection Points
- ⊗ Airsparge Wells
- ⊕ Multi-Phase Extraction Wells
- System Pipes
- Ozone Sparging Lines
- Former UST
- - - Fence Line
- Paved Road
- Unpaved Road
- ▨ Wetlands
- Building
- Paved Area

Spring 2013 BTEX Plume

- 1 µg/L
- 10 µg/L
- 100 µg/L
- 1,000 µg/L

Historical Total BTEX Label Key:
Result values are expressed in units of micrograms per liter (µg/L)

Location Well ID
Quarter, Year - Total BTEX (µg/L)
Q4, 2008 - 2,000

NS = Not Sampled

25 years of excellence

PLEXUS scientific

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Date: September 2013

FIGURE 4-1
AAFES Station Site Building P-2140
Historical BTEX Concentration Map,
Fall 2004 – Spring 2013

Field Sampling Plan Addendum for
The AAFES Station Site, Building P-2140
at Fort Drum, New York

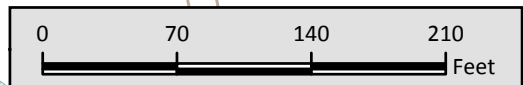


Figure 4-2: 2140-MW14 BTEX Time Series

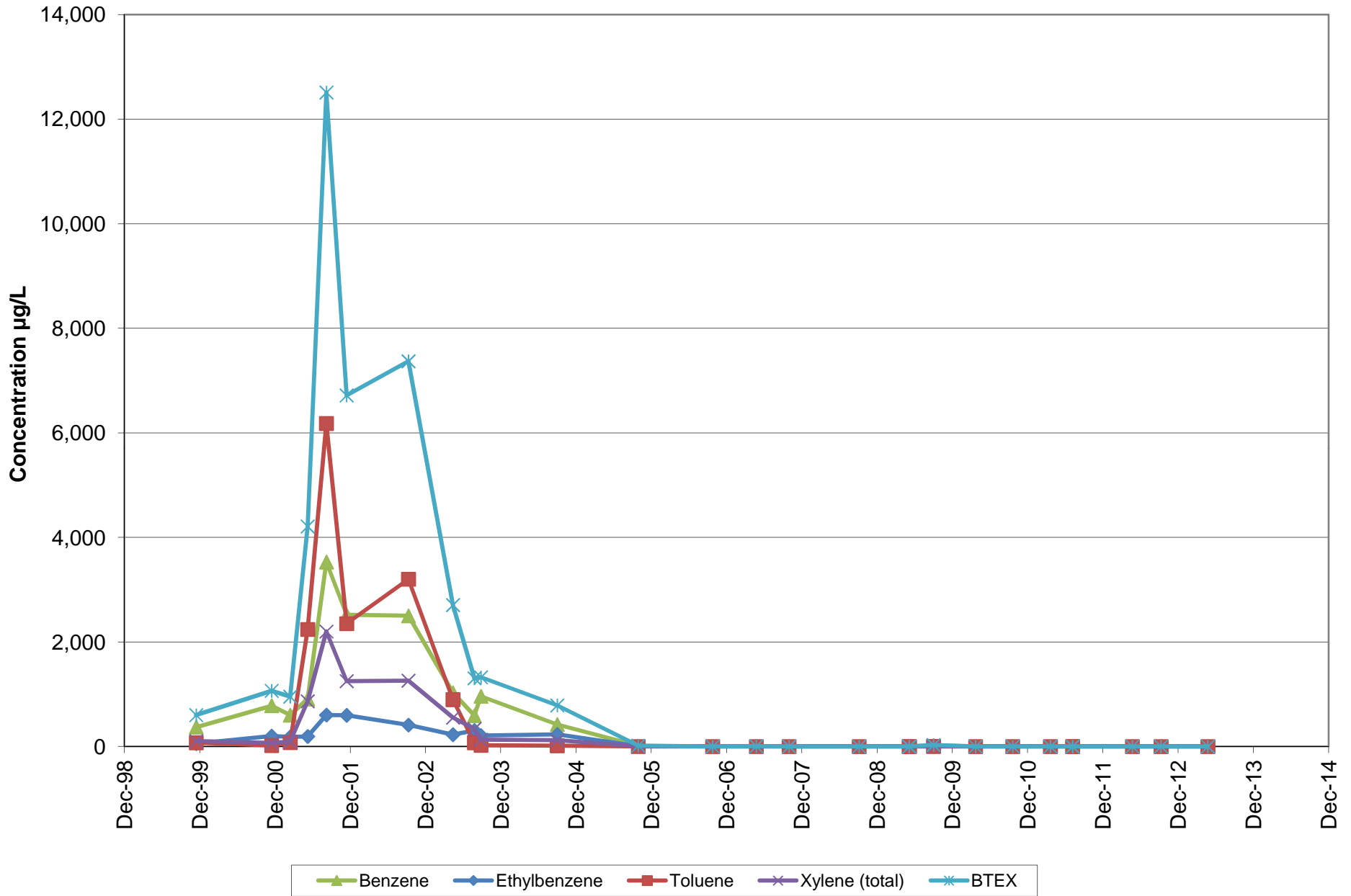


Figure 4-3: 2140-MW16 BTEX Time Series

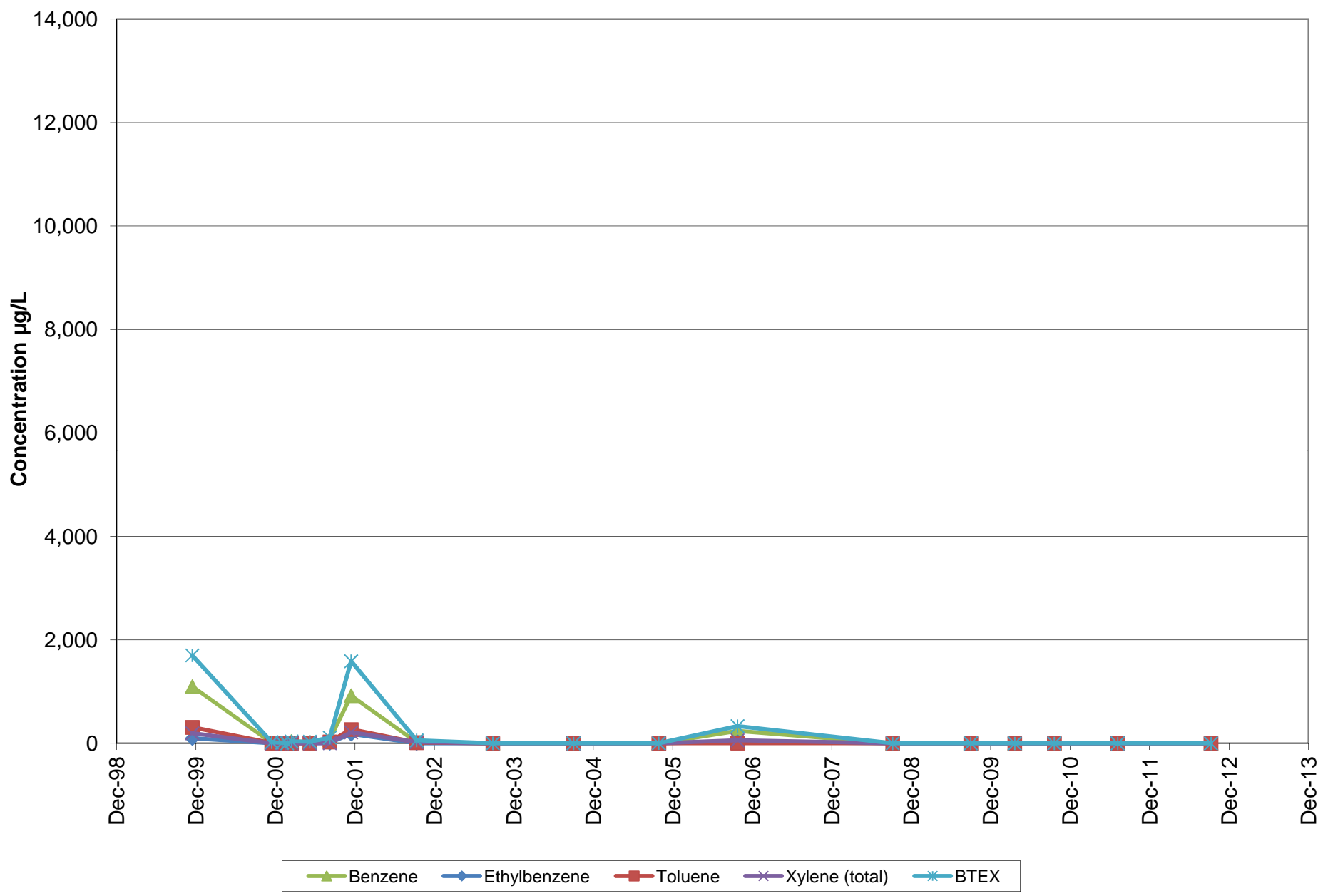


Figure 4-4: 2140-MW17 BTEX Time Series

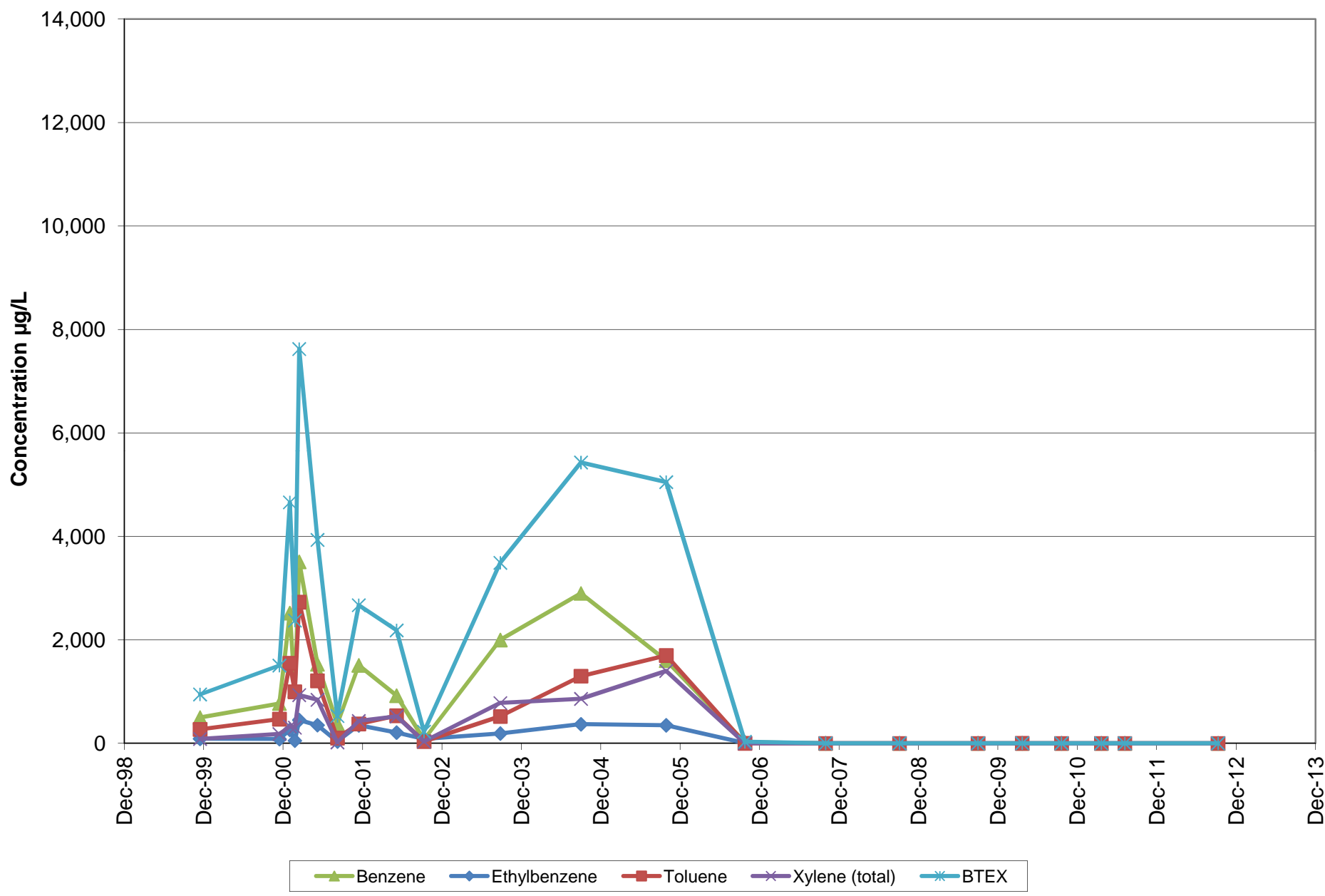


Figure 4-5: 2140-MW18 BTEX Time Series

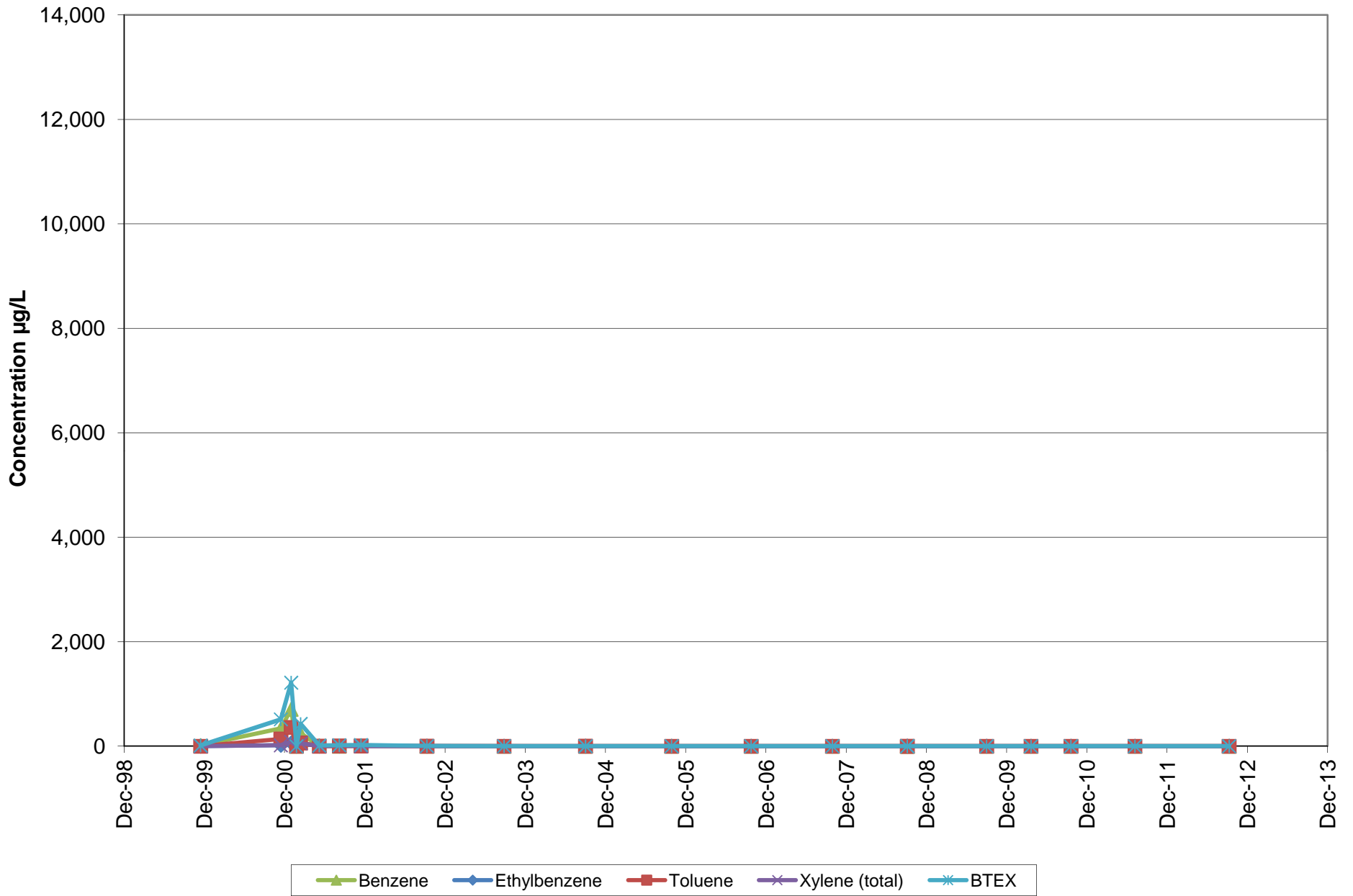


Figure 4-6: 2140-MW19 BTEX Time Series

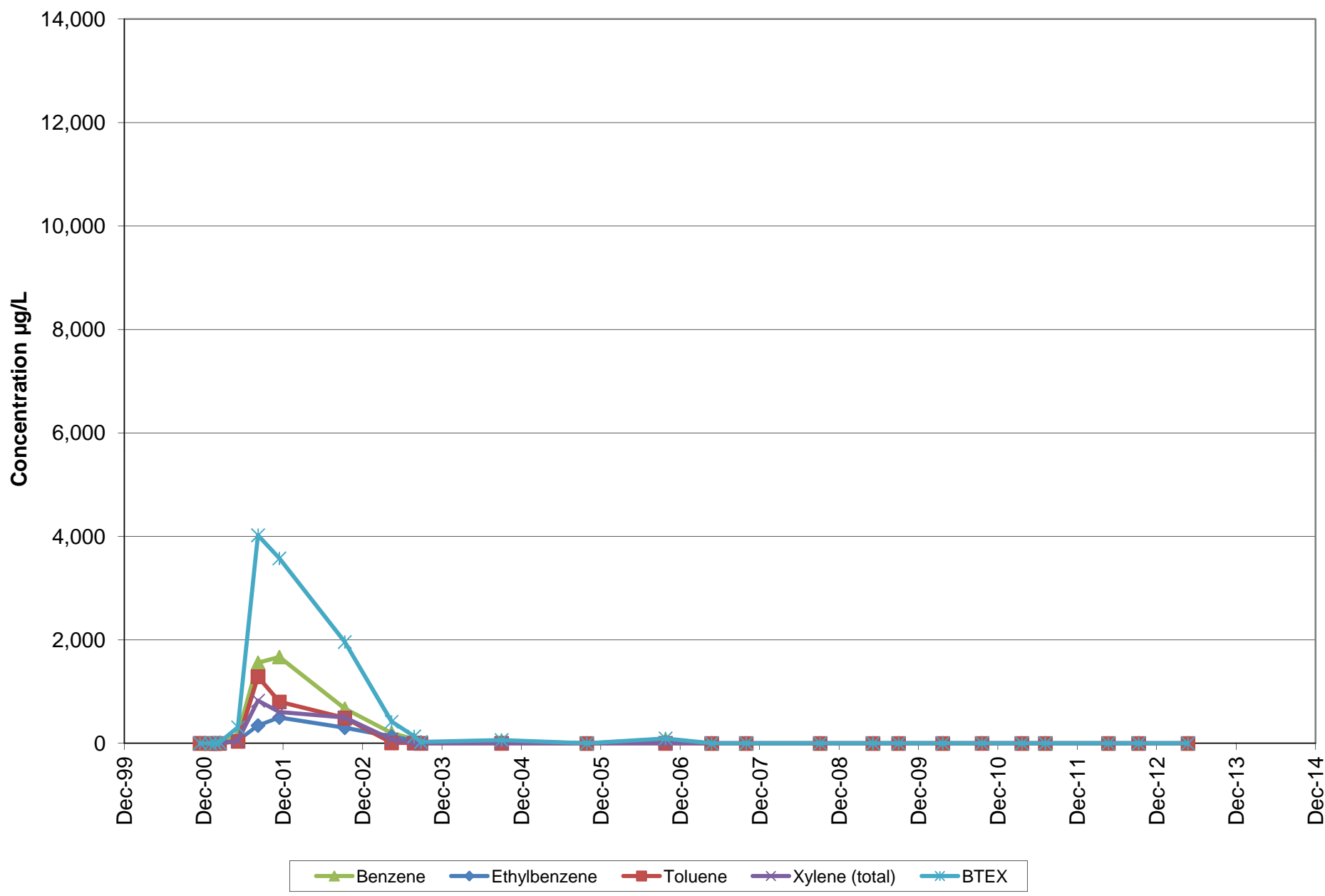


Figure 4-7: 2140-MW27 BTEX Time Series

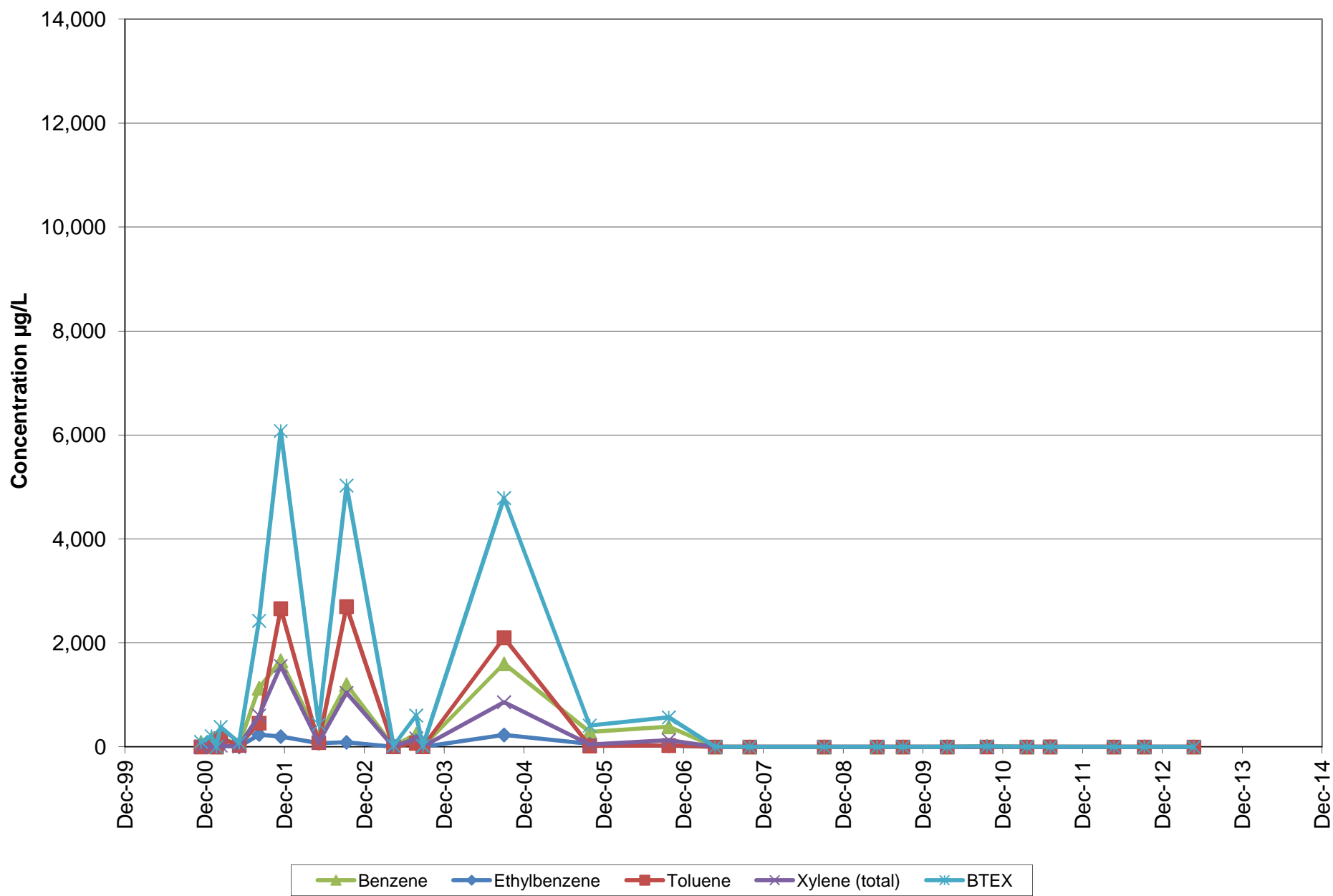


Figure 4-8: 2140-MW29 BTEX Time Series

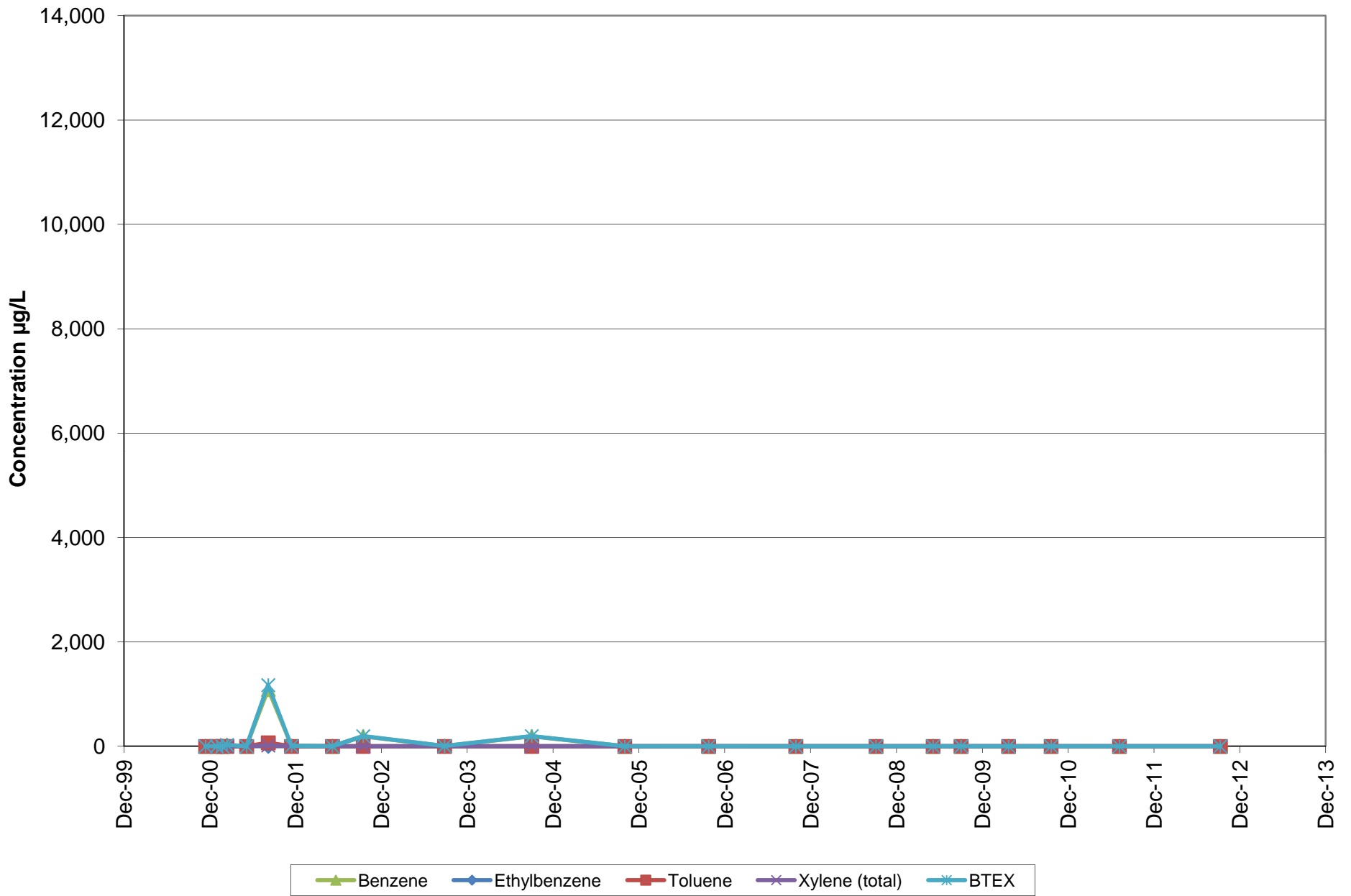


Figure 4-9: 2140-SW01 BTEX Time Series

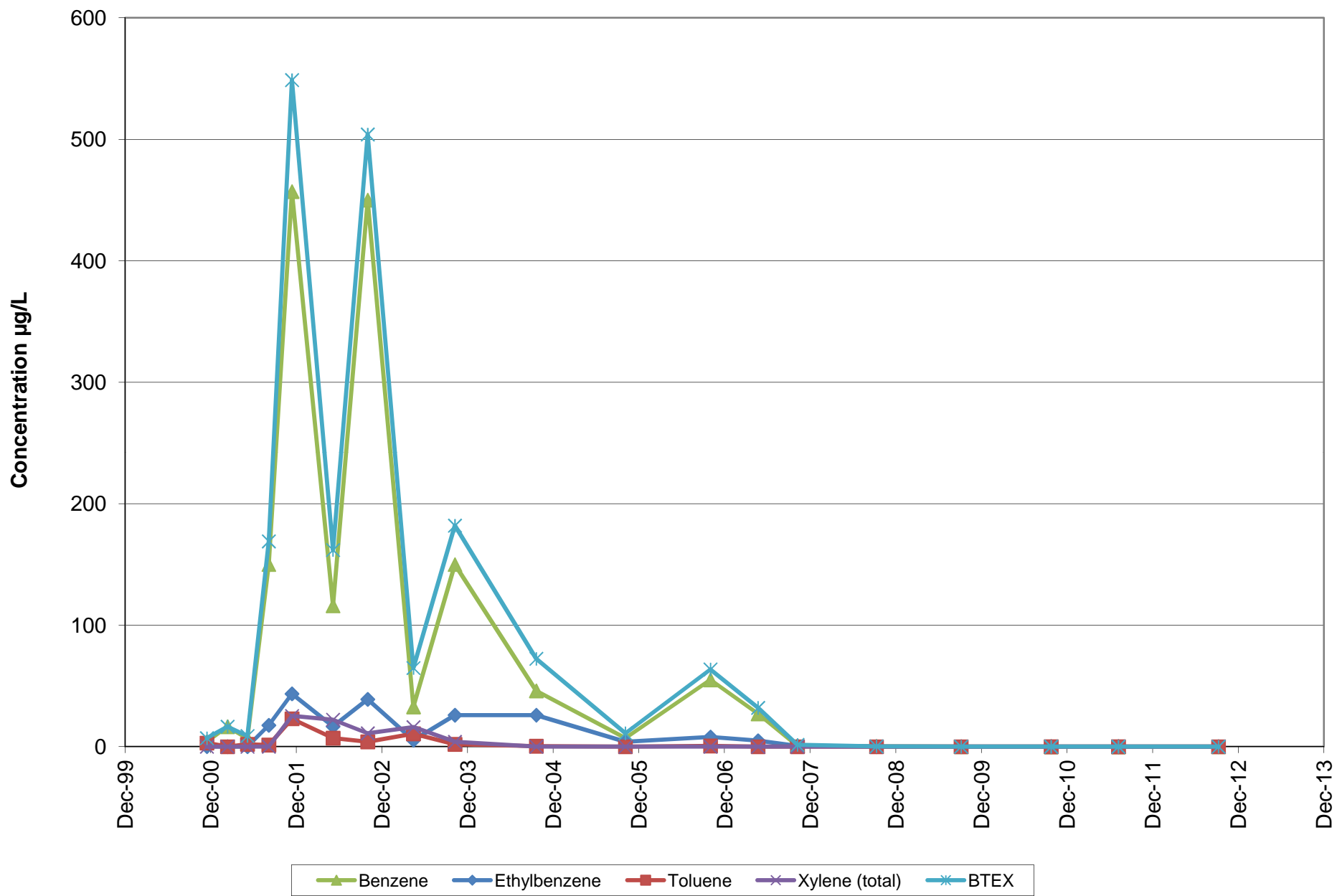


Figure 4-10: 2140-SW02 BTEX Time Series

