2016 ANNUAL PERFLUOROCHEMICALS (PFCs) GROUNDWATER MONITORING REPORT FOR THE OAKDALE SITE OAKDALE, MINNESOTA

May 2017

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1. INTRODUCTION

Since 1980, the 3M Company (3M) has cooperated with the Minnesota Pollution Control Agency (MPCA) in the investigation and remediation of the Oakdale Site (Site) in Oakdale, Minnesota. As shown in Figure 1-1, the Site straddles Highway 14 (former State Highway 5) and is bounded on the north by upper 35th Street, on the east by Hadley Avenue and commercial businesses, on the south by a railroad right-of-way and wetlands, and on the west by Granada Avenue. The Site area south of Highway 14 is currently undeveloped with the exception of the 3M groundwater treatment building. Also, a landscaping business borders the southeast Site property boundary. Highway 14 and the associated right-of-way intersect the northern part of the Site.

The ground surface in the Site area north of Highway 14 is slightly elevated relative to the neighboring properties. One small pond and a marsh area are present in the northwest and northeast corners of this portion of the property, respectively, and a small drainage ditch is present that originates at the pond in the northwest corner of the Site and extends in a southerly direction under Highway 14. Access to the Site property north of Highway 14 is unrestricted. Access to the Site area south of Highway 14 is generally restricted due to natural features such as wetlands and low-lying drainage areas. Fencing with locked gates restricts access to the remaining portions of the Site property south of Highway 14.

3M has entered into a Settlement Agreement and Consent Order (the Agreement) with the MPCA for the purpose of undertaking remedial investigations and response actions to address perfluorochemicals (PFCs) present in various media at three Minnesota sites including the Oakdale Site. The Agreement became effective on May 22, 2007. In the Agreement, MPCA recognized that 3M had already completed a significant amount of work at the Site in partial fulfillment of the Remedial Investigation/Feasibility Study (RI/FS) requirements. Submission of the RI Report in June 2007 (WESTON, 2007) fulfilled 3M's RI obligation.

In accordance with the Agreement, 3M prepared the Feasibility Study (FS) (WESTON, 2008a, 2008b) which provided an evaluation of various response action alternatives that

could address PFCs in soil and groundwater at the Site, and a recommendation for implementation. The FS-recommended response action alternative for groundwater included enhancing the existing groundwater pumpout system and adding granular activated carbon (GAC) treatment prior to discharge (Groundwater Alternative GW-1) to the Metropolitan Council Environmental Services (MCES) sewer system.

Concurrent with the agency's review of the FS Report, 3M requested approval (in a February 28, 2008 letter) from the MPCA to initiate certain Interim Response Actions at the Site. These Interim Response Actions included the installation of Geoprobe borings to obtain the lithologic information necessary to design and locate new pumpout wells, installation of the new pumpout wells in the south-central/southeastern portion of the Site, and the performance of short-term pump tests on the newly installed pumpout wells to assess the quality and quantity of the groundwater that would require treatment.

In a letter to 3M dated March 13, 2008, the MPCA approved the Oakdale FS Report (after modifications) and 3M's request to initiate Interim Response Actions. In March and April 2008, 3M implemented the MPCA–approved Interim Response Actions including the installation of twelve new pumpout wells and the performance of several short-term pump tests at the new pumpout wells. In September and October 2008, pumps were installed in the new wells and conveyance piping was run from the wells to the existing treatment building. Pumping of the expanded pumpout system began on November 4, 2008, and the extracted water was discharged to the MCES sewer system, as approved by the MCES.

Data collected from the Interim Response Actions were used as design input for the groundwater treatment facility. In November 2008, the MPCA formally selected the preferred groundwater alternative and MPCA's decision was included in the Minnesota Decision Document (MDD) for the site. In the MDD, MPCA required 3M to submit a Remedial Design/Response Action (RD/RA) Plan. The RD/RA Plan was submitted to MPCA in February 2009 (WESTON, 2009). In accordance with the RD/RA Plan, a new groundwater treatment facility (GWTF) was designed during the summer of 2009. Following design, construction of the new GWTF occurred in late 2009, and operations

were started on April 1, 2010. The Construction Completion Report (RA Implementation Report) was submitted to MPCA in August 2010 (WESTON, 2010a).

The Oakdale RD/RA Plan contained a description of the post-RA long-term monitoring that would be required to evaluate groundwater and surface water quality, as it related to PFCs. On November 12, 2010, 3M submitted a comprehensive site-wide Groundwater and Surface Water Sampling Plan (Sampling Plan) to the MPCA (WESTON, 2010b). MPCA's review of the Sampling Plan resulted in minor modifications to the program which were documented in a January 25, 2011 letter to the MPCA. This report, covering the 2016 monitoring activities, is the fifth annual PFC monitoring report that has been submitted to the MPCA under the finalized monitoring program.

WESTON SOLUTIONS

Legend

- Fenceline
- Drainageway
- Railroad
- Inferred Limits of the Abresch Area
- Surface Water Features

Map Source:
ESRI Imagery Mapping Service, 2016

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Figure 1-1

Site Location Map
Oakdale Site
Oakdale, MN

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2. SAMPLING PROGRAM

2.1 GROUNDWATER AND SURFACE WATER SAMPLING LOCATIONS

The monitoring results discussed in this report are for the groundwater and surface water monitoring program for PFCs at the Site. Monthly discharge reports for the groundwater pumpout system were prepared and sent to the MCES and City of Oakdale. A copy of the 2016 monthly discharge reports is provided in Appendix A.

The groundwater monitoring network at the Site and the surrounding areas currently consists of 38 monitoring wells, 20 pumpout wells and eight piezometers (Figures 2-1 and 2-2). As shown in Table 2-1, water level readings are taken on an approximate quarterly basis from all monitoring wells and piezometers. In accordance with the MPCA-approved Sampling Plan, samples are collected from 28 of these wells on an annual basis and are analyzed for the following 12 PFCs:

- Perfluorooctanoic acid (PFOA)
- Perfluorooctane sulfonate (PFOS)
- Perfluorobutane sulfonate (PFBS)
- Perfluorohexane sulfonate (PFHS)
- Perfluorobutanoic acid (PFBA)
- Perfluoropentanoic acid (PFPeA)
- Perfluorohexanoic acid (PFHxA)
- Perfluoroheptanoic acid (PFHpA)
- Perfluorononoic acid (PFNA)
- Perfluorodecanoic acid (PFDA)
- Perfluoroundecanoic acid (PFUnA)
- Perfluorododecanoic acid (PFDoA)

During the annual sampling event, groundwater samples are also collected from monitoring wells W2007 and W26R and analyzed for four PFCs (PFBA, PFOA, PFBS and PFOS).

An intermittent stream flows through the property, ultimately discharging east of the site into Raleigh Creek (also intermittent). At the request of the MPCA, 3M agreed to

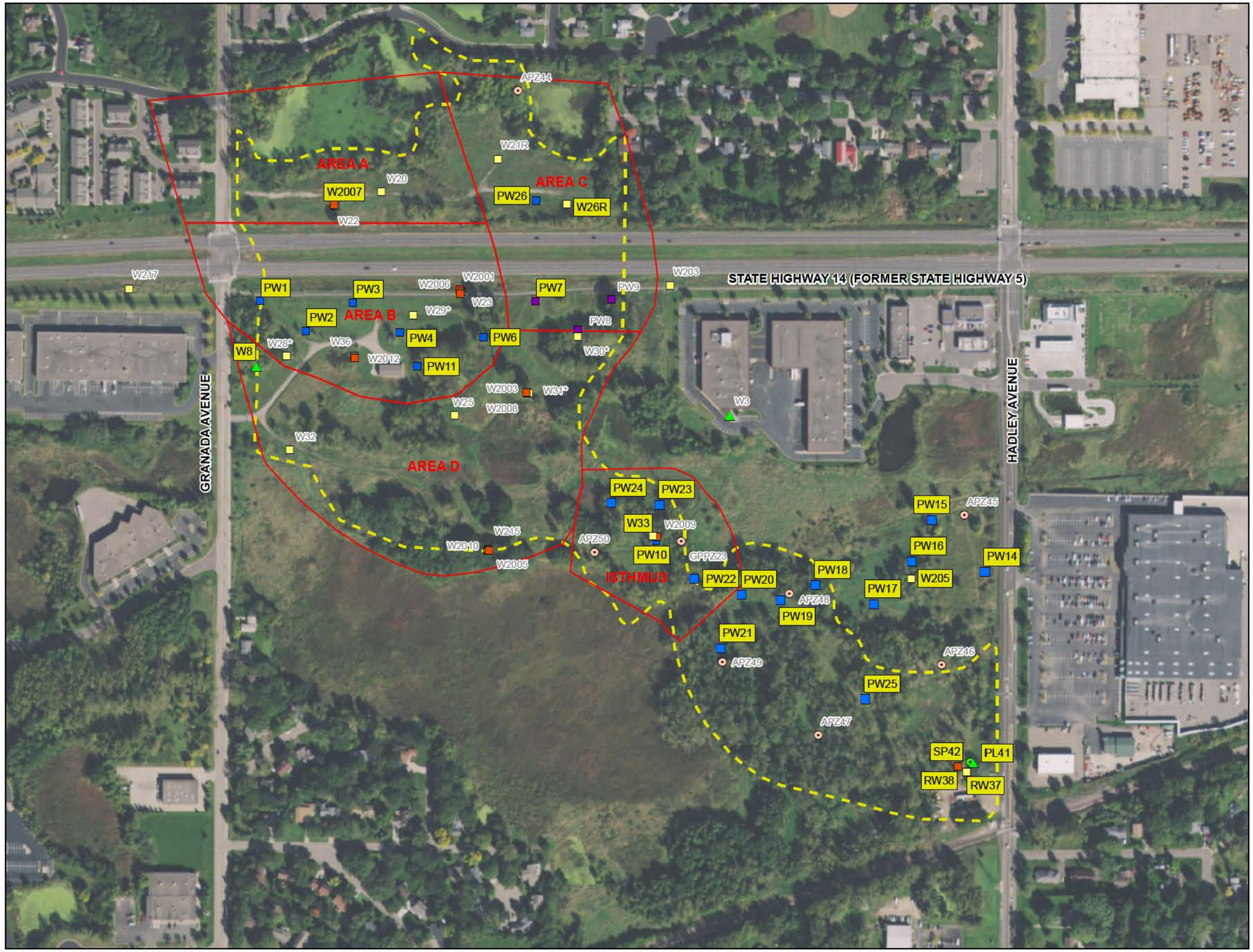
continue collecting annual surface water samples from the six surface water locations (conditions permitting) shown on Figure 2-3. During 2016, sufficient flow was present to collect surface water samples from locations SW01, SW12, SW13 and SW16 during the annual sampling event performed in late October/early November 2016. No flow was present at locations SW14 and SW15.

2.2 SAMPLE COLLECTION AND ANALYSIS

This report contains the results of the groundwater and surface water sampling events that occurred during calendar year 2016. The annual sampling event was initiated the week of October 31, 2016. All samples were collected by WESTON and submitted to the 3M Environmental Laboratory in St. Paul, MN, for the appropriate PFC analyses.

2.3 TREATMENT SYSTEM MONITORING

In accordance with the MCES permit, monitoring of groundwater discharged through the groundwater treatment system is conducted at the Site. The treatment facility operational status is documented to include equipment status, clarifier operation, chemical inventories, control settings, response to any alarm conditions, and pressure to determine the need to backwash the activated carbon units. At least twice per month, cumulative discharge volumes and instantaneous pumping rates for each pumpout well were recorded.



Legend

- Inferred Limits of the Site Area
- Groundwater Monitoring Areas
- Upper Alluvium Monitoring Well
- Lower Alluvium Monitoring Well
- Platteville Monitoring Well
- Alluvium Monitoring Well (Former Pumpout Well)
- Pumpout Well
- St. Peter Monitoring Well
- Piezometer
- RW38 PFC Groundwater Sampling Location

Notes:

1) W21 and W26 were abandoned in November 2010 Replacement wells were installed and included in the monitoring network after soil excavation activities have been completed in this area
2) Wells denoted with an asterisk (*) are typically dry during periods of low precipitation and may not yield groundwater samples

Map Source:
ESRI Imagery Mapping Service, 2016

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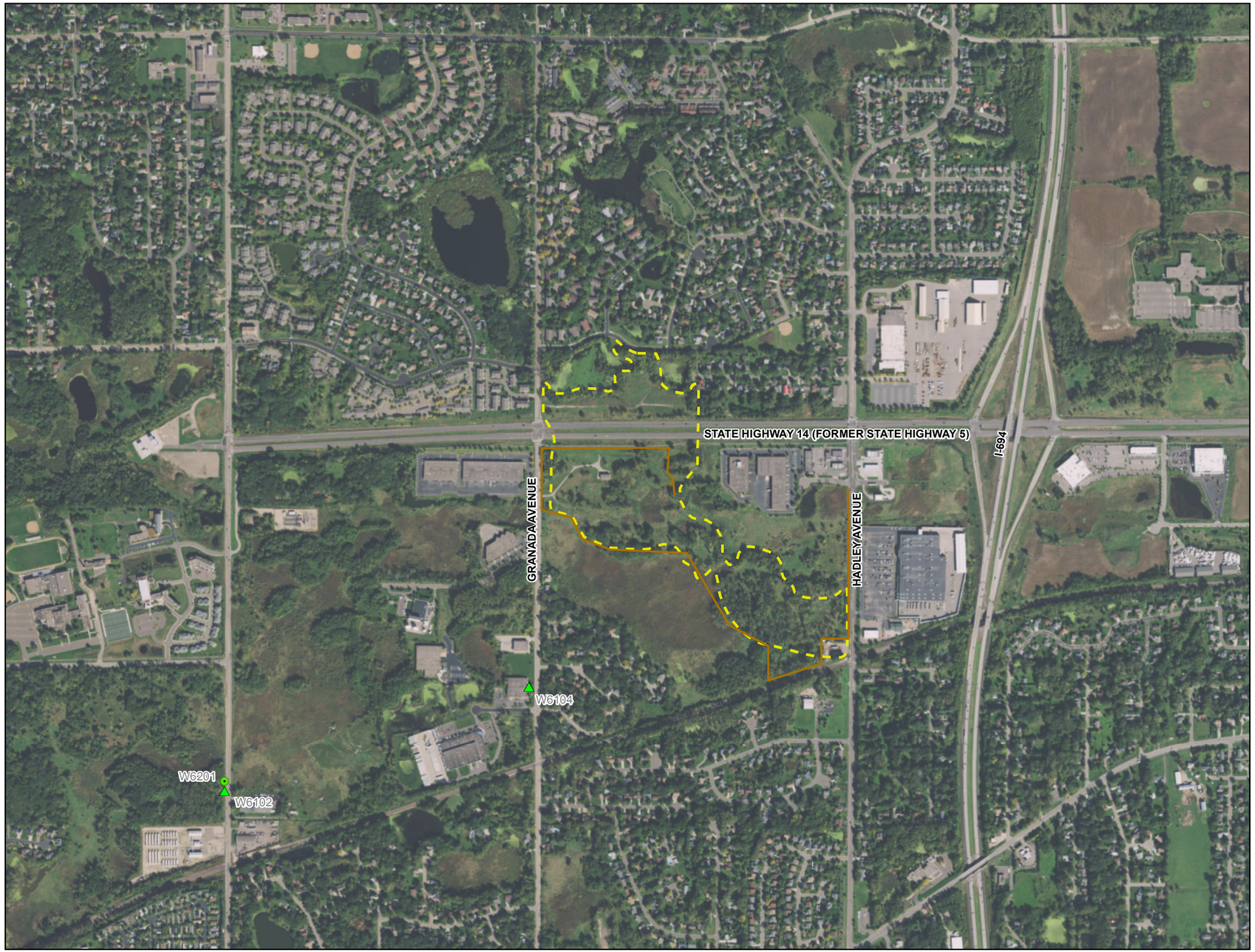
Figure 2-1

Site PFC Groundwater Monitoring Network

Oakdale Site
Oakdale, Minnesota



Legend

- Inferred Limits of the Site Area
- Fenceline
- St. Peter Monitoring Well
- Platteville Monitoring Well
- W6104 Groundwater Level Measurement Location

Map Source:
ESRI Imagery Mapping Service, 2016

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Figure 2-2

Regional Groundwater Measurement Locations

Oakdale Site
Oakdale, Minnesota

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Legend

- Surface Water Sampling Location
- Fenceline

Map Source:
ESRI Imagery Mapping Service, 2016

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Figure 2-3

Surface Water
Sampling Locations

Oakdale Site
Oakdale, Minnesota

Table 2-1

PFCs Monitoring Plan Schedule - 2016
Oakdale Site, Oakdale, MN

Well	Aquifer	Well Type	Jan - March 2016	April - June 2016	July - Sept 2016	Oct - Dec 2016
Area A (upgradient of pumpout wells)						
W20	Upper Alluvium	Monitoring	WL	WL	WL	WL
W22	Upper Alluvium	Monitoring	WL	WL	WL	WL
W2007	Lower Alluvium	Monitoring	WL	WL	WL	WL, 4 PFCs
Area B (area of pumpout wells)						
PW1	Upper and Lower Alluvium	Pumpout	WL	WL	WL	WL,12 PFCs
PW2	Upper and Lower Alluvium	Pumpout	WL	WL	WL	WL,12 PFCs
PW3	Upper and Lower Alluvium	Pumpout	WL	WL	WL	WL,12 PFCs
PW4	Upper and Lower Alluvium	Pumpout	WL	WL	WL	WL,12 PFCs
PW6	Upper and Lower Alluvium	Pumpout	WL	WL	WL	WL,12 PFCs
PW11	Upper and Lower Alluvium	Pumpout	WL	WL	WL	WL,12 PFCs
W23	Upper Alluvium	Monitoring	WL	WL	WL	WL
W28	Upper Alluvium	Monitoring	WL	WL	WL	WL
W29	Upper Alluvium	Monitoring	WL	WL	WL	WL
W36	Upper Alluvium	Monitoring	WL	WL	WL	WL
W2001	Lower Alluvium	Monitoring	WL	WL	WL	WL
W2006	Lower Alluvium	Monitoring	WL	WL	WL	WL
W2012	Lower Alluvium	Monitoring	WL	WL	WL	WL
Area C (upgradient of pumpout wells that were shut off in 2003)						
W21R[a]	Upper Alluvium	Monitoring	WL	WL	WL	WL
W26R[a]	Upper Alluvium	Monitoring	WL	WL	WL	WL, 4 PFCs
PW7	Upper and Lower Alluvium	Pumpout	WL	WL	WL	WL, 12 PFCs
PW8	Upper and Lower Alluvium	Pumpout	WL	WL	WL	WL
PW9	Upper and Lower Alluvium	Pumpout	WL	WL	WL	WL
APZ44	Upper Alluvium	Piezometer	WL	WL	WL	WL

12 PFCs: PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFNA, PFDA, PFUnDA, PFDoA, PFBS, PFHS, and PFOS.

WL: Water Level Measurement

[a]: Monitoring wells W21 and W26 were abandoned in November 2010 due to soil excavation activities in this area. Replacement wells W21R and W26R were installed after soil excavation activities were completed.

Table 2-1 (cont'd)

PFCs Monitoring Plan Schedule - 2016
Oakdale Site, Oakdale, MN

Well	Aquifer	Well Type	Jan - March 2016	April - June 2016	July - Sept 2016	Oct - Dec 2016
Area D (area where natural attenuation will be evaluated following shutdown)						
W25	Upper Alluvium	Monitoring	WL	WL	WL	WL
W30	Upper Alluvium	Monitoring	WL	WL	WL	WL
W31	Upper Alluvium	Monitoring	WL	WL	WL	WL
W32	Upper Alluvium	Monitoring	WL	WL	WL	WL
W215	Upper Alluvium	Monitoring	WL	WL	WL	WL
W2003	Lower Alluvium	Monitoring	WL	WL	WL	WL
W2005	Lower Alluvium	Monitoring	WL	WL	WL	WL
W2008	Lower Alluvium	Monitoring	WL	WL	WL	WL
W2010	Lower Alluvium	Monitoring	WL	WL	WL	WL
East Pond	Surface Water Elevation Point	N/A	WL	WL	WL	WL
Platteville						
W3	Platteville	Monitoring	WL	WL	WL	WL
W8	Platteville	Monitoring	WL	WL	WL	WL,12 PFCs
W6102	Platteville	Monitoring	WL	WL	WL	WL
W6104	Platteville	Monitoring	WL	WL	WL	WL
PL41	Platteville	Monitoring	WL	WL	WL	WL, 12 PFCs
St Peter						
W6201	St Peter	Monitoring	WL	WL	WL	WL
SP42	St Peter	Monitoring	WL	WL	WL	WL, 12 PFCs
SP44	St Peter	Monitoring	WL	WL	WL	WL

12 PFCs: PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFNA, PFDA, PFUnDA, PFDoA, PFBS, PFHS, and PFOS.
WL: Water Level Measurement

Table 2-1 (cont'd)

PFCs Monitoring Plan Schedule - 2016
Oakdale Site, Oakdale, MN

Well	Aquifer	Well Type	Jan - March 2016	April - June 2016	July - Sept 2016	Oct - Dec 2016
Other Wells						
PW10	Surficial Alluvium Units	Pumpout	WL	WL	WL	WL,12 PFCs
W33	Upper Alluvium	Monitoring	WL	WL	WL	WL, 12 PFCs
W203	Upper Alluvium	Monitoring	WL	WL	WL	WL
W205	Upper Alluvium	Monitoring	WL	WL	WL	WL, 12 PFCs
W217	Upper Alluvium	Monitoring	WL	WL	WL	WL
W2009	Lower Alluvium	Monitoring	WL	WL	WL	WL
APZ45	Upper Alluvium	Piezometer	WL	WL	WL	WL
APZ46	Upper Alluvium	Piezometer	WL	WL	WL	WL
APZ47	Upper Alluvium	Piezometer	WL	WL	WL	WL
APZ48	Upper Alluvium	Piezometer	WL	WL	WL	WL
APZ49	Upper Alluvium	Piezometer	WL	WL	WL	WL
APZ50	Upper Alluvium	Piezometer	WL	WL	WL	WL
GPPZ23	Lower Alluvium	Piezometer	WL	WL	WL	WL
PC45	Prairie du Chien	Monitoring	WL	WL	WL	WL
PW14	Lower Alluvium	Pumpout	WL	WL	WL	WL, 12 PFCs
PW15	Lower Alluvium	Pumpout	WL	WL	WL	WL, 12 PFCs
PW16	Lower Alluvium	Pumpout	WL	WL	WL	WL, 12 PFCs
PW17	Lower Alluvium	Pumpout	WL	WL	WL	WL, 12 PFCs
PW18	Lower Alluvium	Pumpout	WL	WL	WL	WL, 12 PFCs
PW19	Lower Alluvium	Pumpout	WL	WL	WL	WL, 12 PFCs
PW20	Lower Alluvium	Pumpout	WL	WL	WL	WL, 12 PFCs
PW21	Lower Alluvium	Pumpout	WL	WL	WL	WL, 12 PFCs
PW22	Lower Alluvium	Pumpout	WL	WL	WL	WL, 12 PFCs
PW23	Lower Alluvium	Pumpout	WL	WL	WL	WL, 12 PFCs
PW24	Lower Alluvium	Pumpout	WL	WL	WL	WL, 12 PFCs
PW25	Lower Alluvium	Pumpout	WL	WL	WL	WL, 12 PFCs
PW26[b]	Lower Alluvium	Pumpout	WL	WL	WL	WL, 12 PFCs
RW37	Lower Alluvium	Monitoring	WL	WL	WL	WL, 12 PFCs
RW38	Lower Alluvium	Monitoring	WL	WL	WL	WL, 12 PFCs

12 PFCs: PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFNA, PFDA, PFUnDA, PFDoA, PFBS, PFHS, and PFOS.

WL: Water Level Measurement

PW26[b] : Pumpout well PW26 was installed in 2011 after soil excavation activities were completed.

3. WATER MONITORING AND RESULTS

In 2016, the groundwater pumpout well network and treatment system continued to operate to satisfy the requirements of the Agreement for plume containment and contaminant removal as presented in this document. As required by the Feasibility Study completed under the Agreement, the extracted groundwater is treated using GAC prior to discharging to the MCES collection system. Plume containment involves both horizontal and vertical hydraulic control by maintaining an inward hydraulic gradient in the upper and lower alluvium groundwater impacted with PFCs. This restricts the potential for the downward migration of PFCs from the alluvium to underlying bedrock units.

Vertical containment at the Site is also provided by the lower confining units (glacial till unit and the Decorah Shale) that restrict the potential downward migration of groundwater from the alluvium aquifer to the Platteville Formation. These lower confining units are present across most of the Site as shown on Figure 3-1. A geologic cross-section, constructed along the transect shown on Figure 3-1, is presented in Figure 3-2. This cross-section depicts the lithologic units present beneath the Site.

The following sections contain a discussion of the groundwater and surface water monitoring results for 2016.

3.1 GROUNDWATER ELEVATIONS

Depth-to-groundwater measurements were collected quarterly at 46 monitoring well/piezometer locations shown on Figures 2-1 and 2-2. A table summarizing available well construction and other information for the Site wells is included in Appendix B. The depth-to-groundwater and groundwater elevations recorded in 2016 from the monitoring wells/piezometers are presented in Table 3-1. As observed in previous years, the 2016 water levels exhibit some seasonal fluctuations, but remain consistent with historical measurements. Groundwater elevations were generally lowest in early August 2016 due to lower recharge to the groundwater table during the early to mid-summer months. In August through November 2016, above normal precipitation of approximately 20.1 inches (in.) was recorded for the area compared to normal precipitation of 12.9 in.

(www.climate.umn.edu). The above normal precipitation in August-November 2016 resulted in highs in groundwater levels measured in most wells in November 2016.

In the vicinity of the groundwater pumpout system in the north-central Site area, groundwater elevations in the lower alluvium in 2016 were maintained at a level lower than those in the underlying Platteville Formation. Specifically, this differential is measured as the difference in water levels between Platteville monitoring well W8 and lower alluvium monitoring well W2012, and between Platteville monitoring well W3 and lower alluvium monitoring well W2008 (see well locations in Figure 2-1). Figure 3-3 shows the difference in water levels for 2016. The typical lower groundwater elevation in the basal alluvium monitoring wells (W2008 and W2012) compared to the corresponding water levels in the nearby Platteville Formation monitoring wells (W3 and W8) verifies that the pumpout well network induces an upward vertical gradient near the pumpout system in the central Site area.

The groundwater elevation data collected from the network of wells listed in Table 3-1 have been used to construct quarterly groundwater elevation contour maps to assess the area of groundwater capture (assuming two-dimensional groundwater flow) induced by the groundwater pumpout system. Using these data, two groundwater elevation contour maps, one for the upper alluvium aquifer and one for the lower alluvium aquifer, were constructed for dates that site-wide depth-to-groundwater measurements were recorded. Upper alluvium aquifer monitoring wells are screened primarily across the water table (uppermost water-bearing unit) across the Site. The lower alluvium monitoring wells are screened in the more permeable strata above the subcropping bedrock or (where present) glacial till.

The groundwater elevation contour maps for the Site are constructed using KT3D (Tonkin and Larson, 2002; Karanovic, Tonkin and Wilson, 2009), a computer software program designed to contour groundwater elevation data while taking into account one or more pumping centers. KT3D uses a log-linear kriging algorithm to create two-dimensional groundwater contour maps with more tightly spaced groundwater elevation contours that are inferred around pumping centers. KT3D calculates groundwater

elevations in the vicinity of pumping centers using a standard analytical method (Thiem analytical method) that incorporates the hydraulic gradients in each alluvium unit. This approach (i.e. using KT3D) results in a more representative groundwater elevation contour map and capture zones as compared to including measurement of groundwater elevations in pumping wells that could overestimate capture zones. For upper alluvium monitoring wells that were measured as dry, the groundwater elevation was conservatively assumed to be at the bottom of well. Due to the above normal precipitation that was received in the Site area in 2016, upper alluvium monitoring wells that are typically dry contained measurable groundwater.

Figures 3-4 and 3-5 are the corresponding groundwater elevation contours for the upper and lower alluvium aquifers, respectively, based on water level data collected on March 2, 2016 (1st Quarter 2016(1Q2016)). Figures 3-6 through 3-11 contain the corresponding groundwater elevation contour maps for June 15, 2016 (2Q2016), August 2, 2016 (3Q2016) and November 30, 2016 (4Q2016).

An examination of the groundwater elevation contours in Figures 3-4 through 3-11 reveals that the groundwater pumpout system is creating a large cone of depression that has dewatered a portion of both the upper and lower alluvium immediately south of Highway 14 (north-central Site area). The large cone of depression is created primarily by higher yielding pumpout wells PW4, PW6 and PW11 that penetrate a coarse sand unit in the lower alluvium that increases their yield compared to other pumpout wells immediately south of Highway 14. The coarse sand unit was not encountered during the drilling of wells west of pumpout well PW4; therefore, the cone of depression created by higher yielding wells PW4, PW6 and PW11 is shallower in the alluvium unit west of pumpout well PW4 as shown in Figures 3-4 through 3-11. The proximity of pumpout wells PW4, PW6 and PW11 to one another suggests that a potential redundancy exists in the pumping network.

The pumping of pumpout wells PW14 through PW25 in the southeast Site area does not produce a cone of depression in the groundwater surface as extensive as that in the north-central Site area, but the groundwater contours indicate that groundwater flow is inward

toward the pumpout wells. The likely explanation for the less extensive cone of depression in the southeast Site area compared to the north-central Site area is due to the higher transmissivity of the lower alluvium unit in the southeast Site area. A higher transmissivity reduces the amount of drawdown in the aquifer and results in a shallower cone of depression.

In the southeast area of the Site, pumpout well PW25 is approximately 400 feet northwest of monitoring wells RW37 and RW38. As part of the Feasibility Study (WESTON, January 2008a) for the Site, groundwater modeling was performed to support the conceptual layout for expansion of the existing pumpout system in the central ("isthmus" area (shown in Figure 2-1)) and southeastern Site area. The groundwater modeling results indicated that groundwater originating in the area of monitoring wells RW37 and RW38 could potentially migrate downward into the underlying Platteville Formation prior to reaching the line of pumpout wells (PW14 through PW19) located farther north. Therefore, pumpout well PW25 was included in the expanded well network to capture groundwater originating in the far southeastern corner of the property (i.e. in the area including, and to the west of, monitoring wells RW37 and RW38).

As shown in the groundwater elevation contours maps in Figures 3-4 through 3-11, the groundwater elevations for monitoring wells RW37 and RW38 are consistently higher than water level measuring points to the north. Nearby piezometers APZ-47 and APZ-46 confirm that the hydraulic gradient and direction of groundwater flow shown in these maps is consistently to the north/northwest toward pumpout wells PW14, PW16, PW17 and PW25. This direction of groundwater flow is consistent with historical maps, as shown on Figure 3-12, which was constructed using groundwater elevation data collected under non-pumping conditions. The groundwater elevation contours in Figure 3-12 confirms the northerly direction of shallow groundwater flow in the southeast corner of the Site.

It is also noted that the groundwater elevation for monitoring well RW38 is consistently lower than adjacent shallower monitoring well RW37 (see Table 3-1). This lower groundwater elevation is due to both the higher permeability of the lower alluvium

sediments that monitoring well RW38 is completed within, and the operation of the pumpout wells. As mentioned in previous reports for the Oakdale Site, more drawdown due to the operation of the pumpout wells is measured in monitoring wells completed in the lower alluvium compared to adjacent monitoring wells completed in the upper alluvium. This induces groundwater to flow vertically from the upper alluvium to the more permeable lower alluvium sediments in this area. Therefore, as shown in Figures 3-4 through 3-11, the low levels of PFCs present in the upper and lower alluvium groundwater near monitoring wells RW37/RW38 migrate in a north to northwesterly direction toward pumpout wells PW14, PW15, PW16, PW17 and PW25.

A cross section extending from the southeast property boundary north to Raleigh Creek is provided in Figure 3-13 to aid in visualizing groundwater flow in this area of the Site (see transect location in Figure 3-10). As shown in Figure 3-13, groundwater flow within the lower alluvium aquifer is primarily horizontal while groundwater flow in the upper alluvium is primarily vertically downward toward the lower alluvium aquifer. Due to its higher permeability in this area of the Site, the lower alluvium acts as a drain for the overlying upper alluvium aquifer. Further discussion and documentation of groundwater flow conditions at the Site are provided in previous reports for the Site and not repeated here (WESTON, 2007; WESTON, 2010b).

3.2 GROUNDWATER QUALITY

In accordance with the Sampling Plan, the annual groundwater sampling event was performed from October 31 through November 4, 2016. Table 3-2 contains a summary of groundwater PFC analytical data for the groundwater sampling performed at the Site from March 2012 through November 2016. The complete laboratory analytical report for 2016 is included in Appendix C. PFBA, PFOA, PFBS and PFOS concentrations for select wells are plotted on trend graphs and provided in Appendix D.

The complete PFC analytical data from 2005 through 2016 were evaluated by applying the Mann-Kendall trend test (at an $\alpha = 0.05$ significance level) to PFOS, PFOA, PFBS and PFBA concentrations for those Site monitoring wells where sufficient groundwater analytical data are available (i.e. ≥ 5 sampling events). The Mann-Kendall trend test is a

non-parametric statistical procedure that is used for analyzing trends in data over time (Gilbert, 1987). Nonparametric methods require no assumptions regarding the underlying statistical distribution of the data. The outcome of the procedure depends on the ranking of individual data points and not the overall magnitude of the data points. The Mann-Kendall procedure can be used for data sets that include irregular sampling intervals, data below the detection limit, and trace or missing data. The method may be applied to track data trends for the purpose of groundwater compliance monitoring, site assessment, and monitoring of the performance of groundwater corrective actions (USEPA, 2009).

Mann-Kendall trend test outcomes consist of the identification of statistically significant increasing trends, no statistically significant trend or a statistically significant decreasing trend at the specified significance level. In addition, a "not detected" (ND) qualifier was assigned when ≥ 75 percent of the PFC analytical results are less than the laboratory quantitation limit (LQL) and at least the last 4 results are less than the LQL. These data were not analyzed using the Mann-Kendall trend test since it would not provide a meaningful analysis. Tables 3-3 and 3-4 provide a summary of the results of the Mann-Kendall trend test analysis, and the complete PFC analytical data used to apply the Mann-Kendall analysis is provided in Appendix E.

A discussion of the groundwater PFC analytical results is provided in the following subsections. The discussion of groundwater analytical results is organized by hydrogeologic unit monitored by the wells and focuses primarily on the PFOS, PFBS, PFOA and PFBA results for consistency with previous reporting. However, the analytical results for the other PFCs are discussed where pertinent.

3.2.1 Upper and Lower Alluvium Monitoring and Pumpout Wells

Groundwater PFC analytical results from the 2016 monitoring and pumpout wells in the upper and lower alluvium units are presented in Table 3-2. As shown on Figure 2-1, the upper and lower alluvium wells included in the PFC groundwater sampling program are distributed across the Site property.

Lower alluvium monitoring well W2007 and upper alluvium monitoring well W26R are located to the north of Highway 14. As shown in Table 3-2, the 2016 PFOA and PFOS concentrations present in the groundwater sample collected during the 2016 annual groundwater sampling event from monitoring well W2007 are comparable to previous results. PFBA and PFBS concentrations are slightly higher compared to previous results. The Mann-Kendall results for well W2007 indicate no statistically significant trends. A trend graph for monitoring well W26/W26R is included in Appendix D presenting PFC concentrations over time. As shown in the trend graph, and the analytical data included in Table 3-2, a significant decline in PFOS, PFBS, PFOA and PFBA concentrations is apparent over time. The Mann-Kendall results for monitoring well W26/26R presented in Table 3-3 confirms a statistically significant decrease in PFOS, PFBS, PFOA and PFBA concentrations. The Mann-Kendall trend test was applied to the analytical data collected from original monitoring well W26 and replacement well W26R, presented in Appendix E, to determine trends.

As stated in previous reports, monitoring well W26 was abandoned in 2010 due to soil excavation activities that were performed in an area encompassing this well in accordance with the MPCA-approved RD/RA Plan for PFCs. After completion of the soil excavation and removal, monitoring well W26R was installed immediately adjacent to, and screened across the same interval as, original monitoring well W26. The continuing decline of PFC concentrations in monitoring well W26R indicates that the soil remediation activities, in combination with the pumping of nearby pumpout well PW26, have effectively reduced PFCs in groundwater in this area. The Mann-Kendall results for pumpout well PW26 presented in Table 3-4 indicate a statistically significant increasing trend in PFBA concentrations, and no statistically significant trend for other PFCs. A cursory review of the PFC analytical data for pumpout well PW26 in Table 3-2 indicates a decrease in PFC concentrations over the past 2 years further supporting the effectiveness of the soil remediation activities in the area.

Former pumpout well PW7 is located south of monitoring well W26R and Highway 14, and is included in the annual PFC groundwater sampling program for the Site. Former pumpout well PW7 was installed as part of the original network of pumpout wells to

remediate VOCs in groundwater, and approval was received from MPCA to shut down this well (and PW8 and PW9) in 2003 since groundwater elevation data indicate that groundwater capture is maintained at the Site without pumpout wells PW7, PW8 and PW9 operating. Comparing the 2016 PFC analytical results to previous PFC results for PW7 presented in Table 3-2, indicates a general decrease in concentration in some PFCs (e.g. PFBA), while other PFCs (e.g. PFHS and PFBS) fluctuate with no discernible trend. The Mann-Kendall trend test indicates a statistically significant increase in PFOS and PFOA, decrease in PFBA and no statistically significant trend in PFBS and PFHS.

Upper alluvium monitoring well W33 is located in the "isthmus" area of the Site. As shown in the PFC analytical results presented in Table 3-2, the PFC concentrations in groundwater within the "isthmus" are higher compared to PFC results for other areas on Site. An inspection of the 2016 PFC analytical results for well W33 indicates lower PFC concentrations compared to historical data. The Mann-Kendall analysis indicates a statistically significant decrease in PFBS and PFBA concentrations in well W33, and no statistically significant trend indicated for PFOS, PFOA or PFHS.

Pumpout wells PW10, PW22, PW23 and PW24 are also installed within the "isthmus" area to capture and recover groundwater containing PFCs. The 2016 PFC analytical results for pumpout wells PW23 and PW24 indicate a decrease in concentration compared to historical data, while the 2016 PFC analytical results for pumpout well PW22 are comparable to historical results. PFC concentrations in pumpout well PW10 in 2016 showed an increase compared to historical results since 2012. The Mann-Kendall trend test results for pumpout wells PW10, PW22, PW23 and PW24 indicate no statistically significant (long term) trend for all parameters with the exception of the following:

- Pumpout well PW10: A statistically significant decreasing trend in PFBA concentrations;
- Pumpout well PW23: A statistically significant decreasing trend in PFBA concentrations;

- Pumpout well PW24: A statistically significant decreasing trend in PFBS and PFOA concentrations.

The low permeability of the upper and lower alluvium units in the "isthmus" area limits the migration of PFCs. Furthermore, these conditions restrict the sustainable flow rates of pumpout wells PW10, PW22, PW23 and PW24 in the "isthmus" area.

Pumpout wells PW18, PW19, PW20, and PW21 are located immediately east/southeast of the "isthmus" area. A visual inspection of the PFC analytical data presented in Table 3-2 for these pumpout wells indicates that PFC concentrations in pumpout well PW21 are lower compared to other three pumpout wells. Pumpout well PW21 was installed at the base of lower alluvium unit and included in the expanded pumpout well network since groundwater modeling indicated that shallow groundwater in this area may migrate from the lower alluvium downward into the underlying bedrock before reaching pumpout wells PW19 and PW20 to the north. The lower PFC concentrations in pumpout well PW21 indicate a limited impact of PFCs in the lower alluvium in this area of the Site. A review of the historical data presented in Table 3-2 for pumpout wells PW18, PW19, PW20 and PW21 indicates a general decrease in PFC concentrations over time. The Mann-Kendall trend test results for pumpout wells PW18, PW19, PW20 and PW21 are presented in Table 3-4. The Mann-Kendall trend test results for pumpout wells PW18, PW19, PW20 and PW21 indicate no statistically significant trend for all parameters with the exception of the following:

- Pumpout well PW18: A statistically significant decreasing trend in PFOA concentrations;

- Pumpout well PW19: A statistically significant decreasing trend in PFOS, PFBS, PFOA and PFHS concentrations;

- Pumpout well PW21: A statistically significant decreasing trend in PFOS, PFBS, PFOA, PFBA and PFHS concentrations. The decreasing trends in PFCs in pumpout well PW21 indicate that the other pumpout wells in the area are limiting the migration of PFCs in the lower alluvium.

Monitoring well W205, located east of the "isthmus" area, is screened across the upper alluvium (water table) unit and is included in the annual PFC groundwater sampling program. A trend graph for monitoring well W205 is included in Appendix D. A review of this graph indicates that although concentrations fluctuate, there is a declining trend in PFCs over time. The Mann-Kendall trend test supports this visual observation as a statistically significant decreasing trend was identified for PFOS, PFBS and PFOA. No statistically significant trend was identified for PFBA or PFHS. The trend graph and Mann-Kendall results for monitoring well W205 indicate that the operation of nearby pumpout wells PW14, PW15, PW16 and PW17 continue to effectively reduce PFC concentrations in groundwater in this area of the Site. The Mann-Kendall trend test results for pumpout wells PW14, PW15, PW16, PW17 and PW18 are presented in Table 3-4. The Mann-Kendall trend test results for pumpout wells PW14, PW15, PW16, PW17 and PW18 indicate no statistically significant trend for all parameters with the exception of the following:

- Pumpout well PW14: A statistically significant decreasing trend in PFOA concentrations;
- Pumpout well PW15: A statistically significant decreasing trend in PFOS, PFBS, PFOA and PFBA concentrations;
- Pumpout well PW17: A statistically significant increasing trend in PFOS concentrations;
- Pumpout well PW18: A statistically significant decreasing trend in PFOA concentrations.

As shown in Figure 3-11, pumpout well PW15 is located north, and under non-pumping conditions is hydraulically downgradient (see Figure 3-12), of the other pumpout wells in the area (e.g. PW16, PW17 and PW25). The decreasing PFOS, PFBS, PFOA and PFBA trend in pumpout well PW15 suggests that the higher PFCs are being captured and restricted from migrating further north (downgradient) by pumpout wells PW14, PW16, PW17 and PW25.

Monitoring wells RW37 and RW38 are located in the southeastern corner of the Site property. Monitoring well RW37 is screened in the upper alluvium from approximately 5.5 to 15.5 feet below ground surface (ft bgs), and adjacent deeper monitoring well RW38 is screened in the lower alluvium from 48.5 to 58.5 ft bgs. As shown in the PFC analytical data presented Table 3-2, with the exception of PFOS in monitoring well RW37, all other PFCs remain below 1.0 µg/L in the groundwater samples collected in 2016 from monitoring wells RW37 and RW38. PFOS concentrations continue to fluctuate with no significant trend in monitoring well RW37 identified by the Mann-Kendall trend test. A statistically significant increasing PFBA trend was identified in monitoring well RW38, although PFBA concentrations remain below 0.3 µg/L. Either no statistically significant trend or a "ND" was identified by the Mann-Kendall test for the other PFCs in monitoring wells RW37 and RW38.

Six additional pumpout wells (PW1, PW2, PW3, PW4, PW6 and PW11) were sampled during the November 2016 annual sampling event and analyzed for 12 PFCs. All six wells are located in the north-central area of the Site and screened across the upper and lower alluvium unit. As shown in Table 3-2, the total PFC concentration in pumpout wells PW4, PW6 and PW11 are generally higher compared to the total PFC concentration in pumpout wells PW1, PW2 and PW3. As shown in groundwater elevation contour maps presented in Figures 3-4 through 3-11, and discussed in Section 3.1, a large cone of depression is present in the groundwater surface in the north-central Site area. The PFC analytical data, coupled with the area of capture shown in the groundwater elevation contour maps, indicate that pumpout wells PW1, PW2, PW3, PW4, PW6 and PW11 are effectively containing PFCs in this area of the Site. The Mann-Kendall trend test results for pumpout wells PW1, PW2, PW3, PW4, PW6 and PW11 are provided in Table 3-4 and indicate no statistically significant trend for all parameters with the exception of the following:

- Pumpout well PW2: A statistically significant increasing trend in PFOA and PFBA concentrations;
- Pumpout well PW3: A statistically significant decreasing trend in PFOA concentrations;

- Pumpout well PW6: A statistically significant increasing trend in PFOS concentrations;
- Pumpout well PW10: A statistically significant decreasing trend in PFBA concentrations;
- Pumpout well PW11: A statistically significant increasing trend in PFOS and PFOA concentrations.

3.2.2 Platteville Formation

Two monitoring wells (W8 and PL41) completed within the Platteville Formation are included in the annual sampling program, and the PFC analytical data is provided in Table 3-2. Trend graphs presenting PFC concentrations over time were constructed for these wells and are provided in Appendix D. As shown in these trend graphs, and the PFC analytical data presented in Table 3-2, it can be seen that there are fluctuations in PFBA, PFOA, and PFOS concentrations over time in wells W8 and PL41. As shown in Table 3-2, the 2016 PFBA, PFOA and PFOS analytical results for wells W8 and PL41 are lower compared to the November 2015 results.

The Mann-Kendall trend test results presented in Table 3-3 show either no statistically significant trend or a "ND" for PFCs in monitoring well PL41. In addition, a "ND" and no statistically significant trend was identified for PFHS and PFBS, respectively, for monitoring well W8. A statistically significant increasing trend in PFBA, PFOA and PFOS was identified for monitoring well W8. As shown in Table 3-2, the 2016 PFBA concentration was less than 1.0 µg/L, and PFOS and PFOA concentrations were less than 0.1 µg/L in well W8.

Groundwater elevation contour maps presented in Figures 3-4 through 3-11 continue to indicate that groundwater capture in the upper and lower alluvium is being maintained at the Site. In addition, as established in the long-term VOC monitoring program for the Site, the criteria for defining vertical groundwater capture in the area near monitoring well W8, was to ensure that an upward vertical gradient exists between Platteville Formation monitoring well W8 and nearby lower alluvium monitoring well W2012. As

discussed in Section 3.1 and shown in Figure 3-3, the quarterly groundwater elevation data collected in 2016 show that an upward vertical hydraulic gradient continues to be maintained near monitoring well W8. Previous hydraulic data collected at the Site and presented in prior reports (WESTON, 2008a; 2008b; 2015), show the pronounced effect of the pumpout system on groundwater elevations in maintaining hydraulic control in the vicinity of wells W8 and PL41. Due to the fluctuations in PFOS concentrations in monitoring wells W8 and PL41, the short-term pumping tests that were proposed in previous reports (WESTON, 2015) will be postponed until additional PFC analytical data are collected from these wells and a further trend analysis is performed.

3.2.3 St. Peter Sandstone

Monitoring well SP42 is completed within the St. Peter Sandstone and was included in the 2016 annual sampling event. A trend graph presenting PFC concentrations over time for monitoring well SP42 is provided in Appendix D, and a summary of PFC results since March 2012 is provided in Table 3-2. As shown in Table 3-2, PFBA, PFOA and PFOS concentrations in 2016 were higher compared to November 2015 PFC concentrations. PFBA (0.178 µg/L) and PFOA (0.145 µg/L) concentrations were within the historical range detected in well SP42 while PFOS (1.27 µg/L) was higher compared to the previous maximum PFOS concentration of 0.693 µg/L detected in June 2012. Historical PFBA, PFOA and PFOS analytical data for well SP42 shown in Table 3-2 indicate short-term fluctuations. The Mann-Kendall trend test was applied to evaluate long-term PFCs trends in well SP42, and indicated no statistically significant trend for PFOS, PFOA or PFBA concentrations. A "ND" was identified for PFBS and PFHS concentrations.

3.2.4 Surface Water

As described in the Sampling Plan, quarterly surface water samples were collected for four years from six locations (when conditions permitted) within Raleigh Creek to the east of the Site. Since the first quarterly surface water sampling event was conducted in 2012, the sampling events performed in 2015 represented the fourth year of surface water monitoring. Per a June 30, 2016 letter from 3M to MPCA, 3M agreed to continue

collecting surface water samples for PFC analyses from Raleigh Creek during the annual PFC sampling event.

During the annual sampling event performed in late October/early November 2016, sufficient flow was observed in Raleigh Creek to collect surface water samples from locations SW01, SW12, SW13 and SW16 (see locations on Figure 3-14). No flow was observed at locations SW14 and SW15 during the period that the annual sampling event was performed. The complete surface water PFC analytical data from October 2010 through November 2016 are presented in Table 3-5. An inspection of Table 3-4 indicates that the surface water sampling locations were either dry or frozen during the majority of the quarterly sampling events. This demonstrates the intermittent flow conditions for Raleigh Creek east of the Site.

The surface water PFC analytical results for 2016 are presented on Figure 3-14. The PFC surface water analytical data presented on Figure 3-14 and Table 3-5 show fluctuations in PFC concentrations over time. These observations are to be expected due to varying weather related run-off and surface water flow conditions. PFC analytical results for 2016 are within the historical range observed at each sampling location. PFC analytical results at surface water sampling locations SW12 and SW13 decreased in 2016 compared to 2015 results. The PFC analytical data (2010-2016) indicate a general decrease in surface water PFC concentrations with increasing distance from the Site. The Mann-Kendall trend test results for the surface water sampling locations are provided in Table 3-6 and indicate either a “ND” or no statistically significant trend for all parameters where sufficient data is available to perform an analysis.

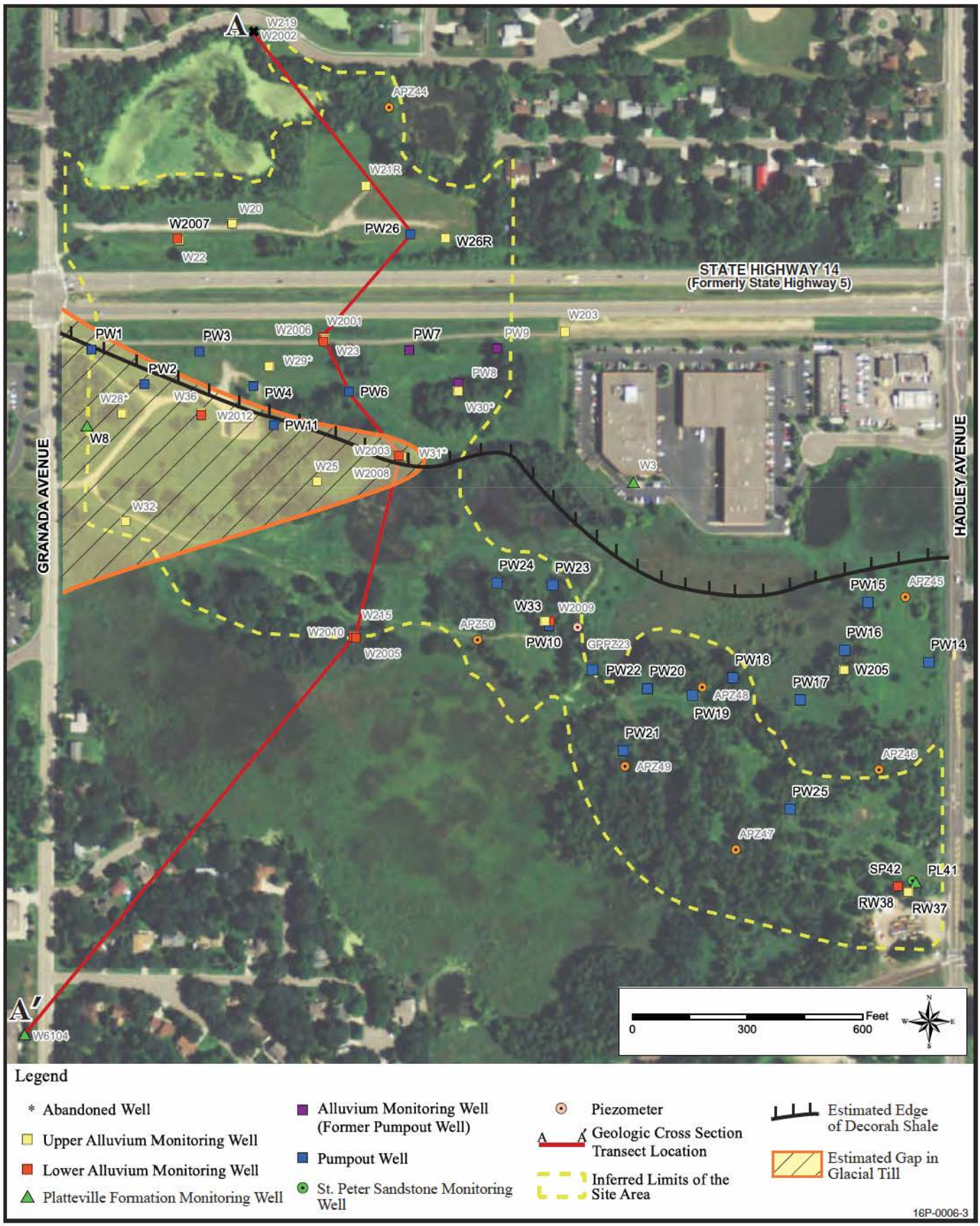
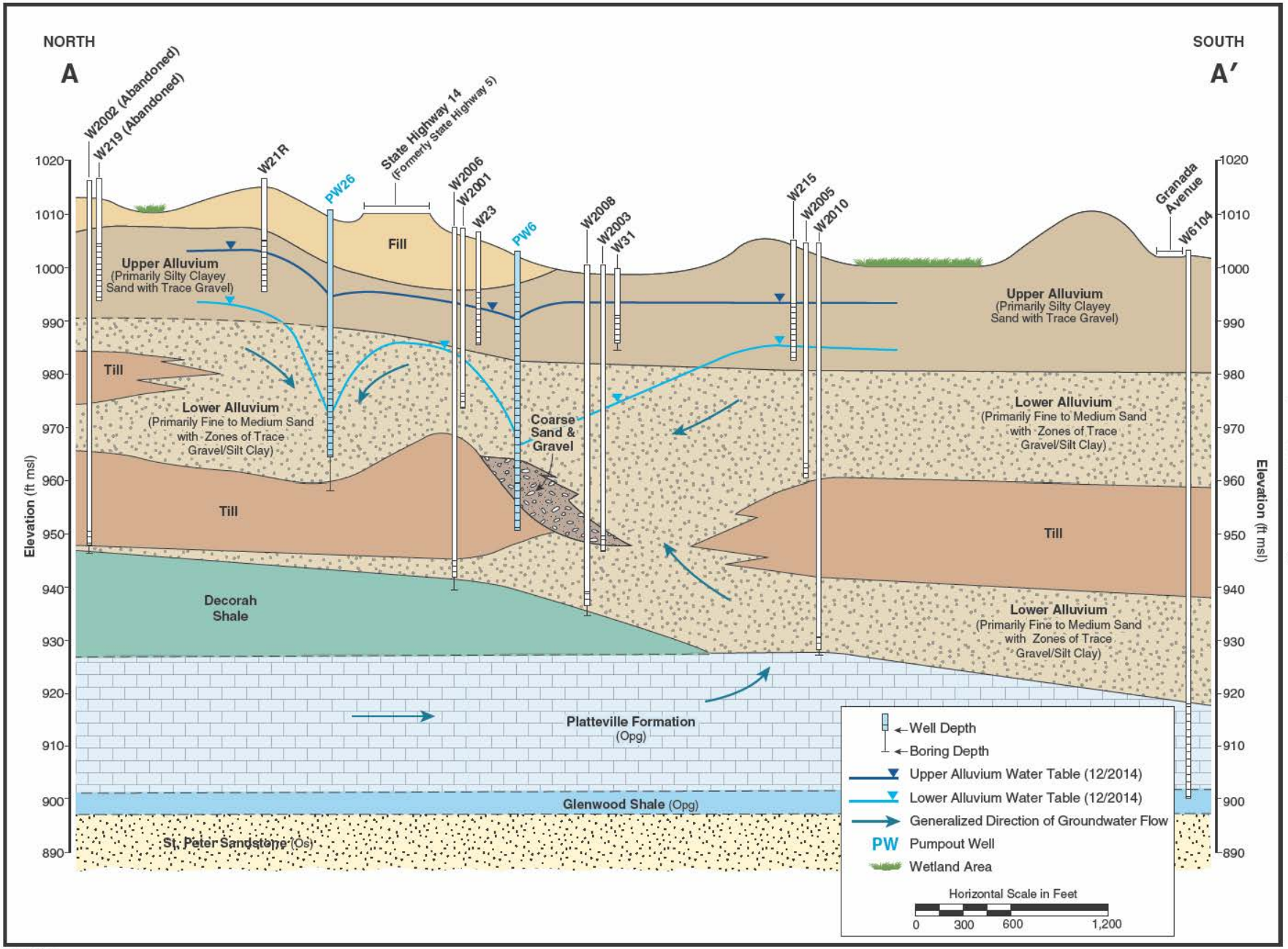


Figure 3-1 Geologic Cross Section A-A′ Location and Well Location Map
Oakdale Site
Oakdale, Minnesota

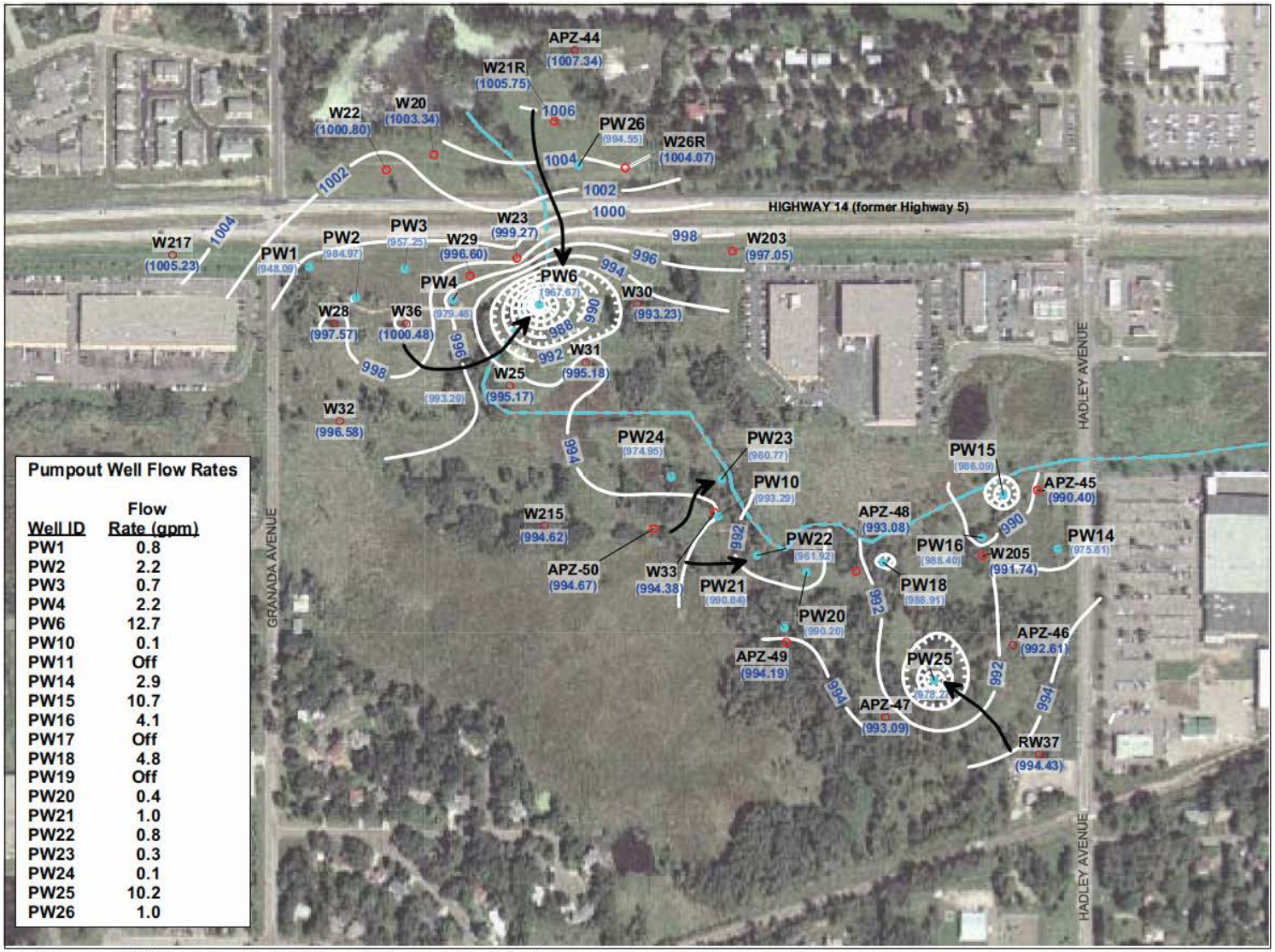


16P-0006-1

Figure 3-2 Geologic Cross Section A-A′
Oakdale Site

Figure 3-3
Hydrograph of Platteville (W3 and W8) and Lower Alluvium Wells (W2008 and W2012)
January 2015 - December 2016
Oakdale Site, Oakdale, MN

HydroGRAPH-QRY_10-W3-W8-W2008-W2012-OKMN-2016
Fig3-3-2016(FC RPT)



Note: 1. Pumpout well PW11 was temporarily off on date water levels measured due to electrical issues.
2. During this event, pumpout wells PW17 and PW19 were off temporarily and allowed to reach a steady-state condition to provide additional groundwater monitoring points for the lower alluvium contour map.
3. Groundwater elevations for pumpout wells are posted but not used in preparing contours. Groundwater elevation contours are inferred around pumping centers.
4. The locations of pumpout wells PW17 and PW19 are shown on Figure 3-5.

2016 0302 OKMN UA.srf

Figure 3-4

Groundwater Elevation Contour Map Upper Alluvium Aquifer 1st Quarter 2016 2 March 2016

Oakdale Site Oakdale, Minnesota

Pumpout Well Flow Rates

Well ID	Flow Rate (gpm)
PW1	0.8
PW2	2.2
PW3	0.7
PW4	2.2
PW6	12.7
PW10	0.1
PW11	Off
PW14	2.9
PW15	10.7
PW16	4.1
PW17	Off
PW18	4.8
PW19	Off
PW20	0.4
PW21	1.0
PW22	0.8
PW23	0.3
PW24	0.1
PW25	10.2
PW26	1.0

Legend

- Pumpout Well Location (PW)
- Monitoring Well/Piezometer Location (W/APZ)
- Groundwater Elevation Contour (contour interval 2 feet)
- (989.58) Monitoring Well/Piezometer Groundwater Elevation (ft MSL)
- (986.09) Pumpout Well Groundwater Elevation (ft MSL)
- Intermittent Stream (Approximate location)
- Groundwater Flow Path

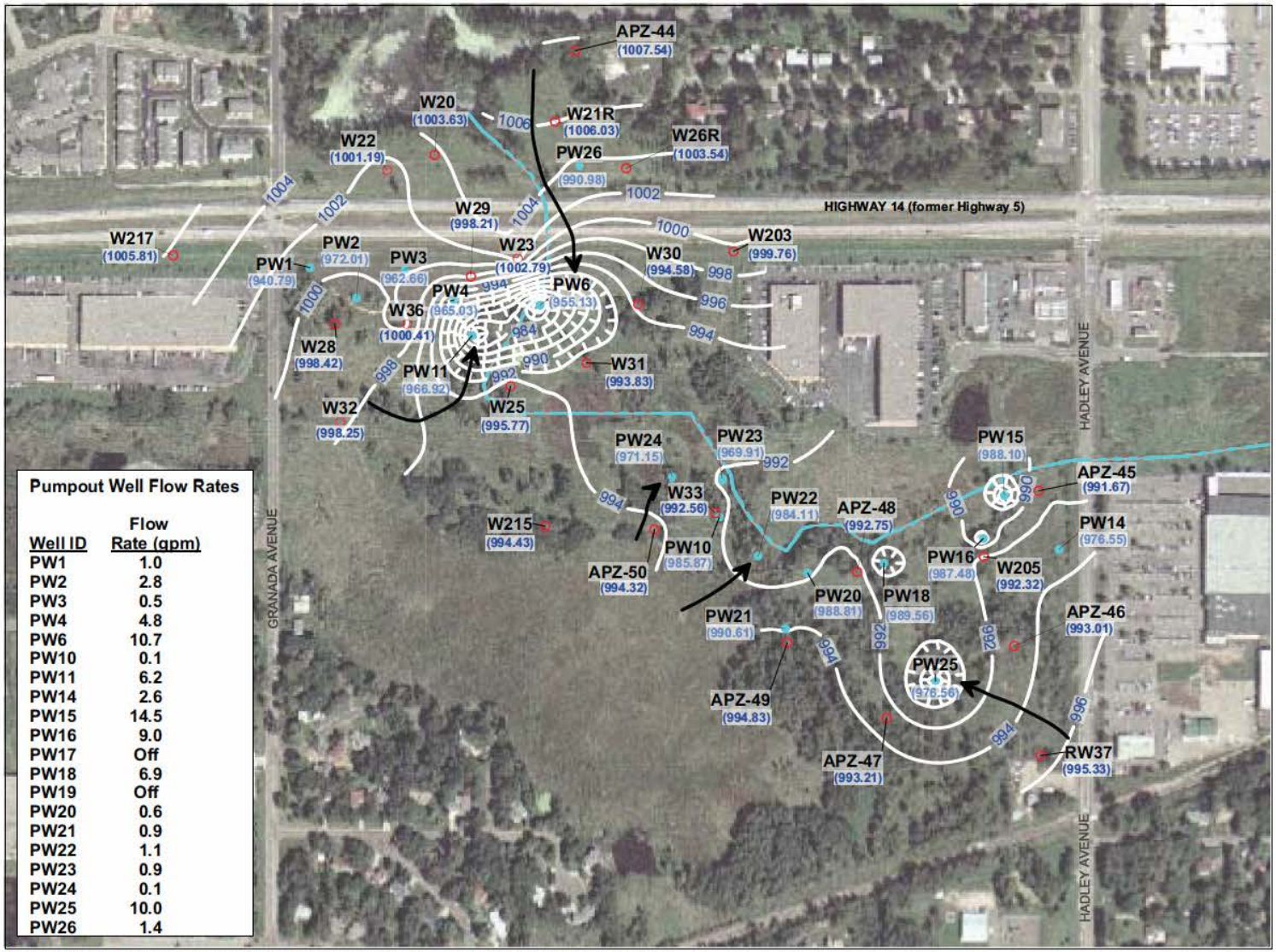
Note: 1. Pumpout well PW11 was temporarily off on date water levels measured due to electrical issues.
2. During this event, pumpout wells PW17 and PW19 were off temporarily and allowed to reach a steady-state condition to provide additional groundwater monitoring points for the lower alluvium contour map.
3. Groundwater elevations for pumpout wells are posted but not used in preparing contours. Groundwater elevation contours are inferred around pumping centers.

2016 0302 OKMN LA.srf

Figure 3-5

Groundwater Elevation Contour Map Lower Alluvium Aquifer 1st Quarter 2016 2 March 2016

Oakdale Site Oakdale, Minnesota



Pumpout Well Flow Rates

Well ID	Flow Rate (gpm)
PW1	1.0
PW2	2.8
PW3	0.5
PW4	4.8
PW6	10.7
PW10	0.1
PW11	6.2
PW14	2.6
PW15	14.5
PW16	9.0
PW17	Off
PW18	6.9
PW19	Off
PW20	0.6
PW21	0.9
PW22	1.1
PW23	0.9
PW24	0.1
PW25	10.0
PW26	1.4

Legend

- Pumpout Well Location (PW)
- Monitoring Well/Piezometer Location (W/APZ)
- Groundwater Elevation Contour (contour interval 2 feet)
- (991.67) Monitoring Well/Piezometer Groundwater Elevation (ft MSL)
- (988.10) Pumpout Well Groundwater Elevation (ft MSL)
- Intermittent Stream (Approximate location)
- Groundwater Flow Path

N W E S

0 250 500
Feet

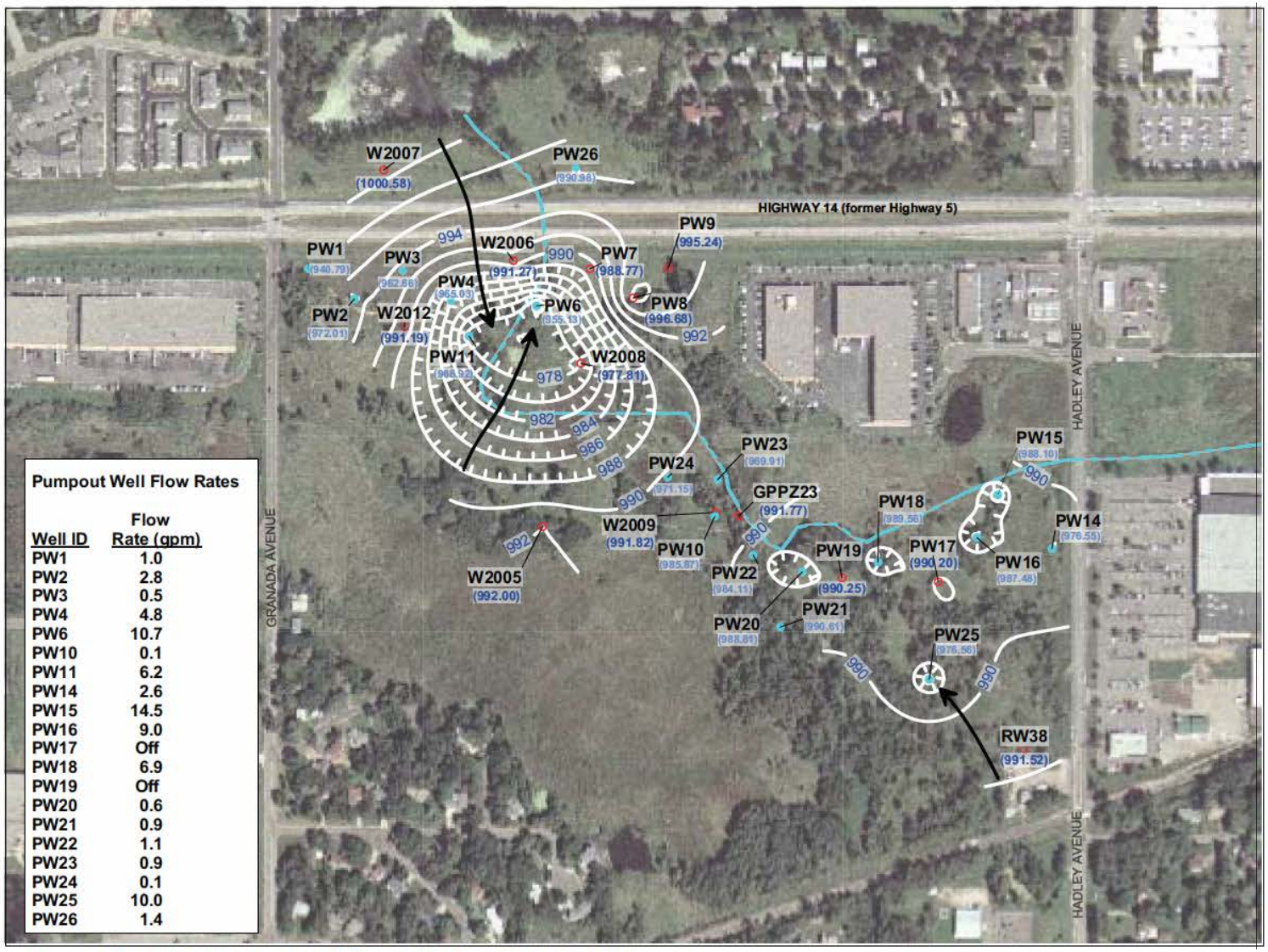
Note: 1. During this event, pumpout wells PW17 and PW19 were off temporarily and allowed to reach a steady-state condition to provide additional groundwater monitoring points for the lower alluvium contour map.
2. Groundwater elevations for pumpout wells are posted but not used in preparing contours. Groundwater elevation contours are inferred around pumping centers.
3. The locations of pumpout wells PW17 and PW19 are shown on Figure 3-7.

2015 0615 OKMN SH srf

Figure 3-6

Groundwater Elevation Contour Map Upper Alluvium Aquifer 2nd Quarter 2016 15 June 2016

Oakdale Site Oakdale, Minnesota



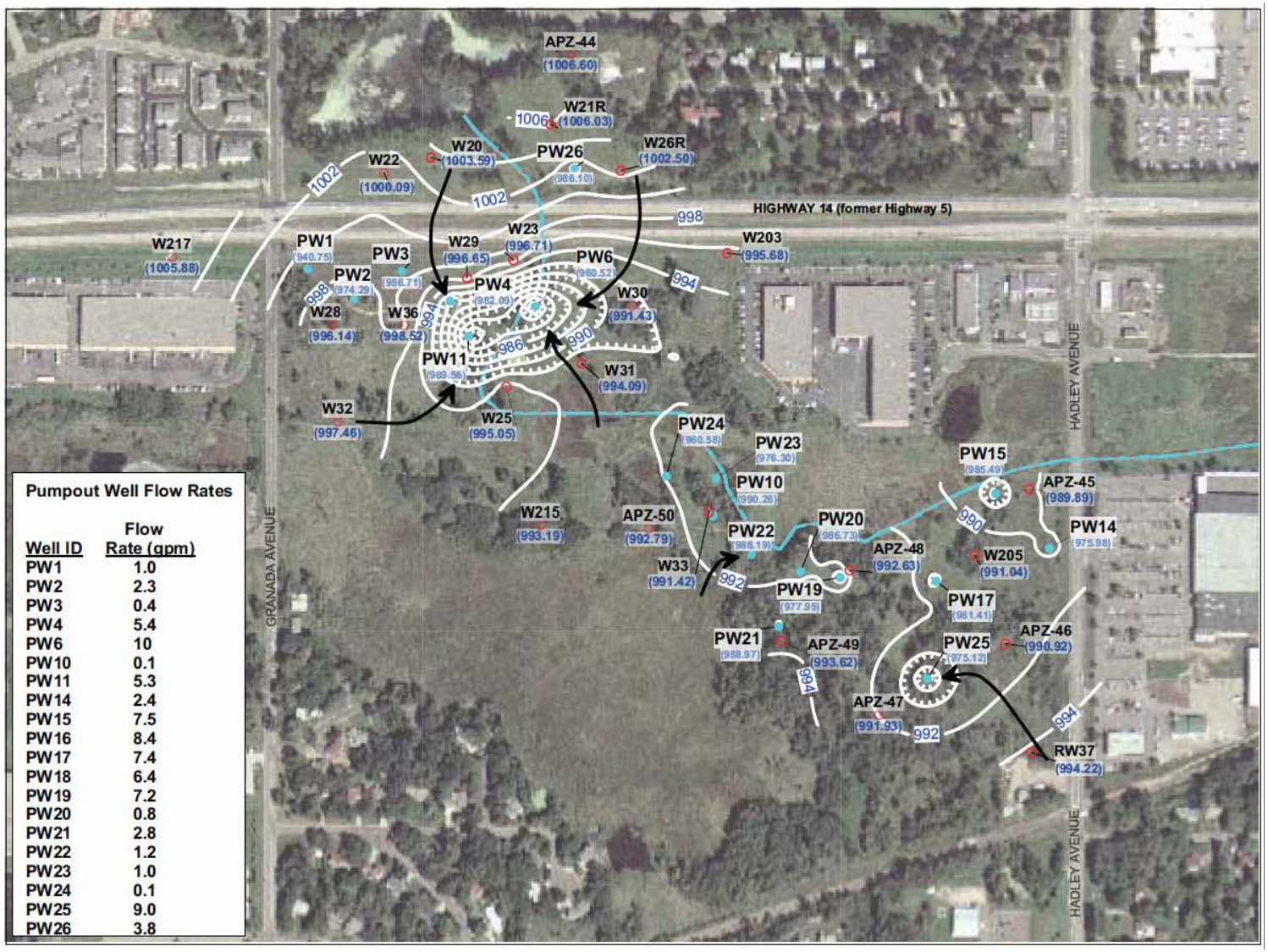
Note: 1. During this event, pumpout wells PW17 and PW19 were temporarily off and allowed to reach a steady-state condition to provide additional groundwater monitoring points for the lower alluvium contour map.
2. Groundwater elevations for pumpout wells are posted but not used in preparing contours. Groundwater elevation contours are inferred around pumping centers.

2016 0615 OKMN LA sf

Figure 3-7

Groundwater Elevation Contour Map Lower Alluvium Aquifer 2nd Quarter 2016 15 June 2016

Oakdale Site Oakdale, Minnesota



Pumpout Well Flow Rates

Well ID	Flow Rate (gpm)
PW1	1.0
PW2	2.3
PW3	0.4
PW4	5.4
PW6	10
PW10	0.1
PW11	5.3
PW14	2.4
PW15	7.5
PW16	8.4
PW17	7.4
PW18	6.4
PW19	7.2
PW20	0.8
PW21	2.8
PW22	1.2
PW23	1.0
PW24	0.1
PW25	9.0
PW26	3.8

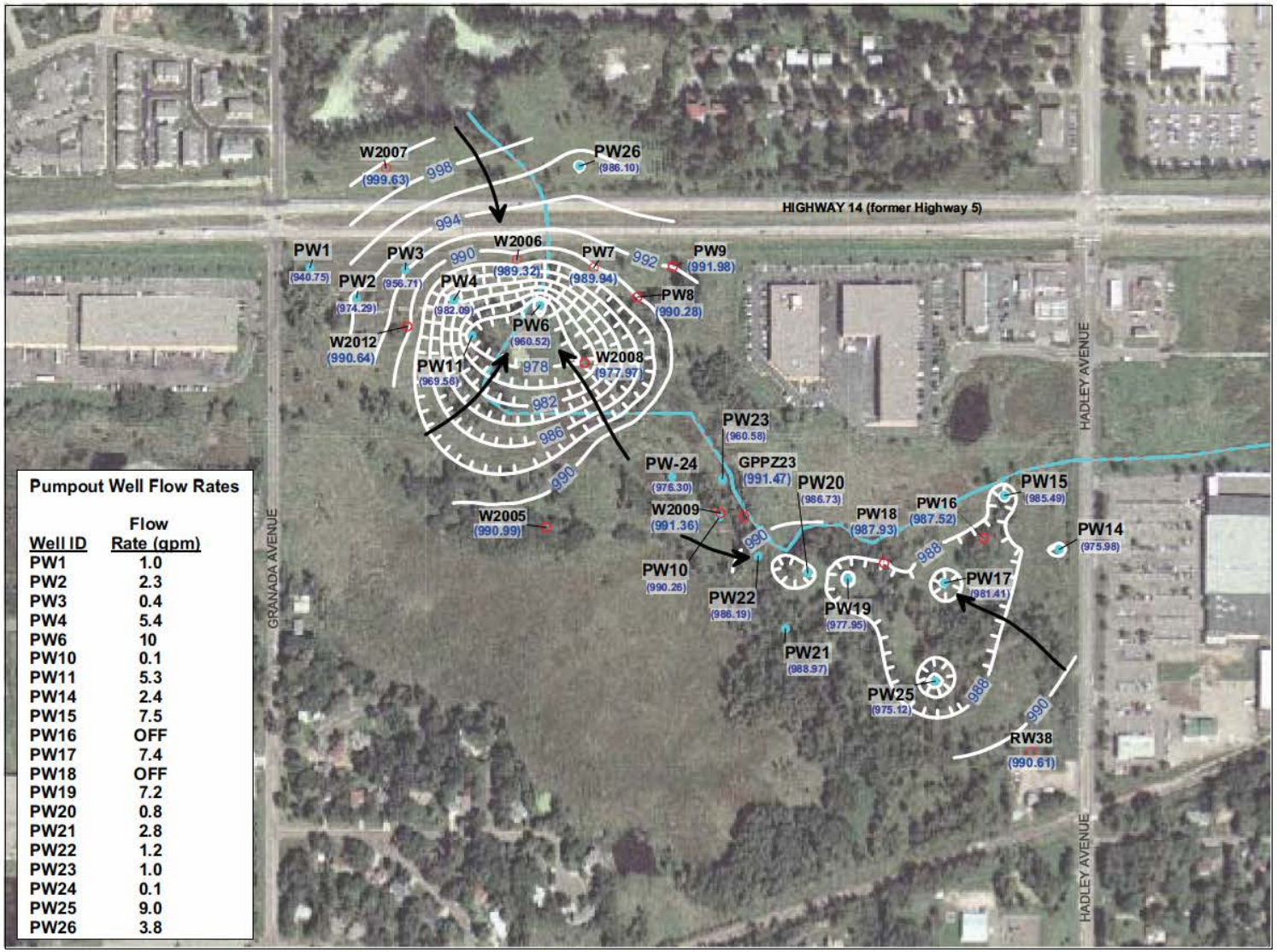
Note: 1. For each well measured as dry, the groundwater elevation was conservatively assumed to be at bottom of well.
2. Groundwater elevations for pumpout wells are posted but not used in preparing contours. Groundwater elevation contours are inferred around pumping centers.
3. The locations of pumpout wells PW16 and PW18 are shown on Figure 3-9.

2015 0402 OKMN UA.srf

Figure 3-8

Groundwater Elevation Contour Map Upper Alluvium Aquifer 3rd Quarter 2016 2 August 2016

Oakdale Site Oakdale, Minnesota



Pumpout Well Flow Rates

Well ID	Flow Rate (gpm)
PW1	1.0
PW2	2.3
PW3	0.4
PW4	5.4
PW6	10
PW10	0.1
PW11	5.3
PW14	2.4
PW15	7.5
PW16	OFF
PW17	7.4
PW18	OFF
PW19	7.2
PW20	0.8
PW21	2.8
PW22	1.2
PW23	1.0
PW24	0.1
PW25	9.0
PW26	3.8

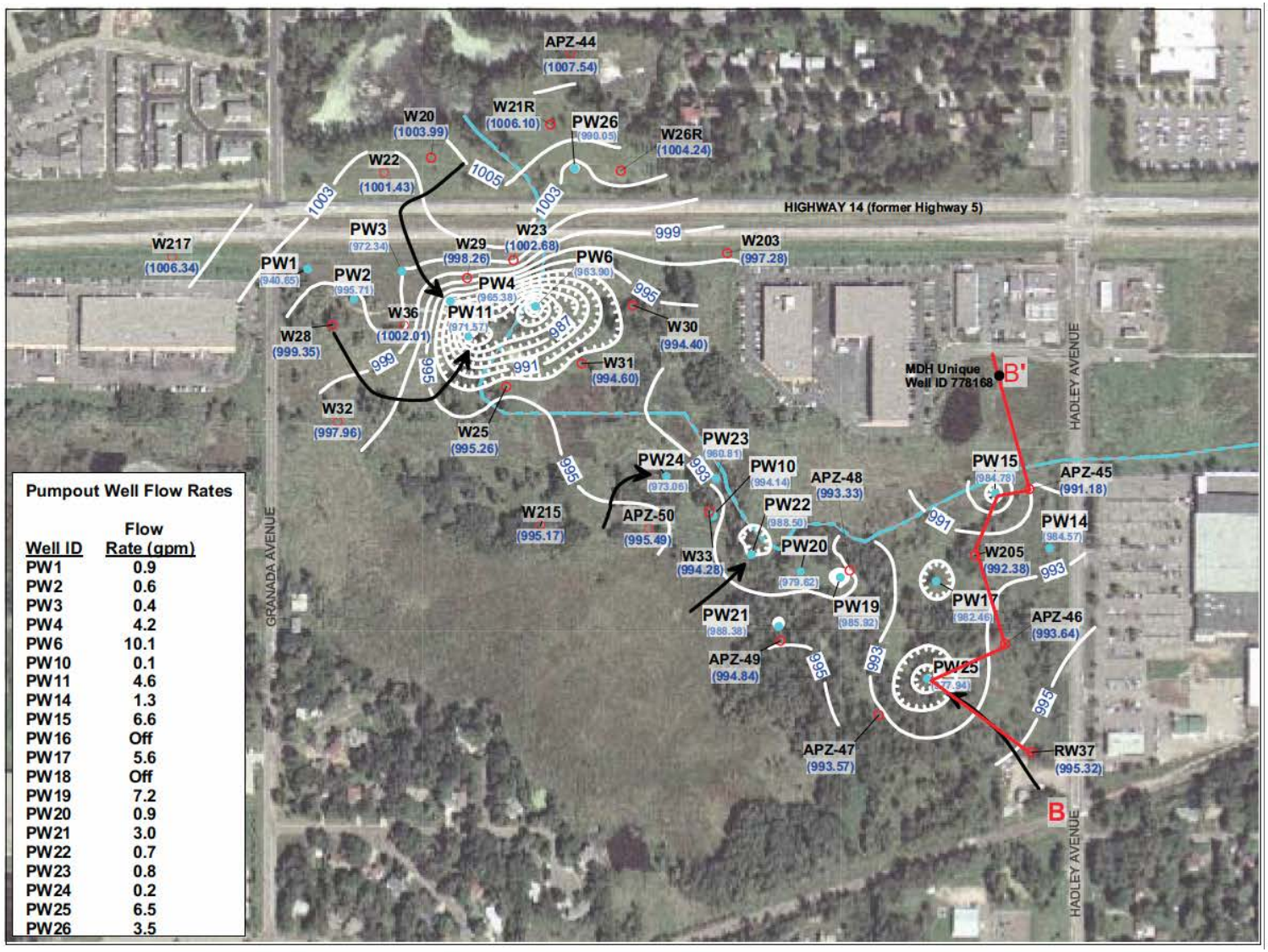
Note: 1. During this event, pumpout wells PW17 and PW19 were off temporarily and allowed to reach a steady-state condition to provide additional groundwater monitoring points for the lower alluvium contour map.
2. Groundwater elevations for pumpout wells are posted but not used in preparing contours. Groundwater elevation contours are inferred around pumping centers.

Figure 3-9

Groundwater Elevation Contour Map Lower Alluvium Aquifer 3rd Quarter 2016 2 August 2016

Oakdale Site Oakdale, Minnesota

2015 0402 OKMN LA.srf



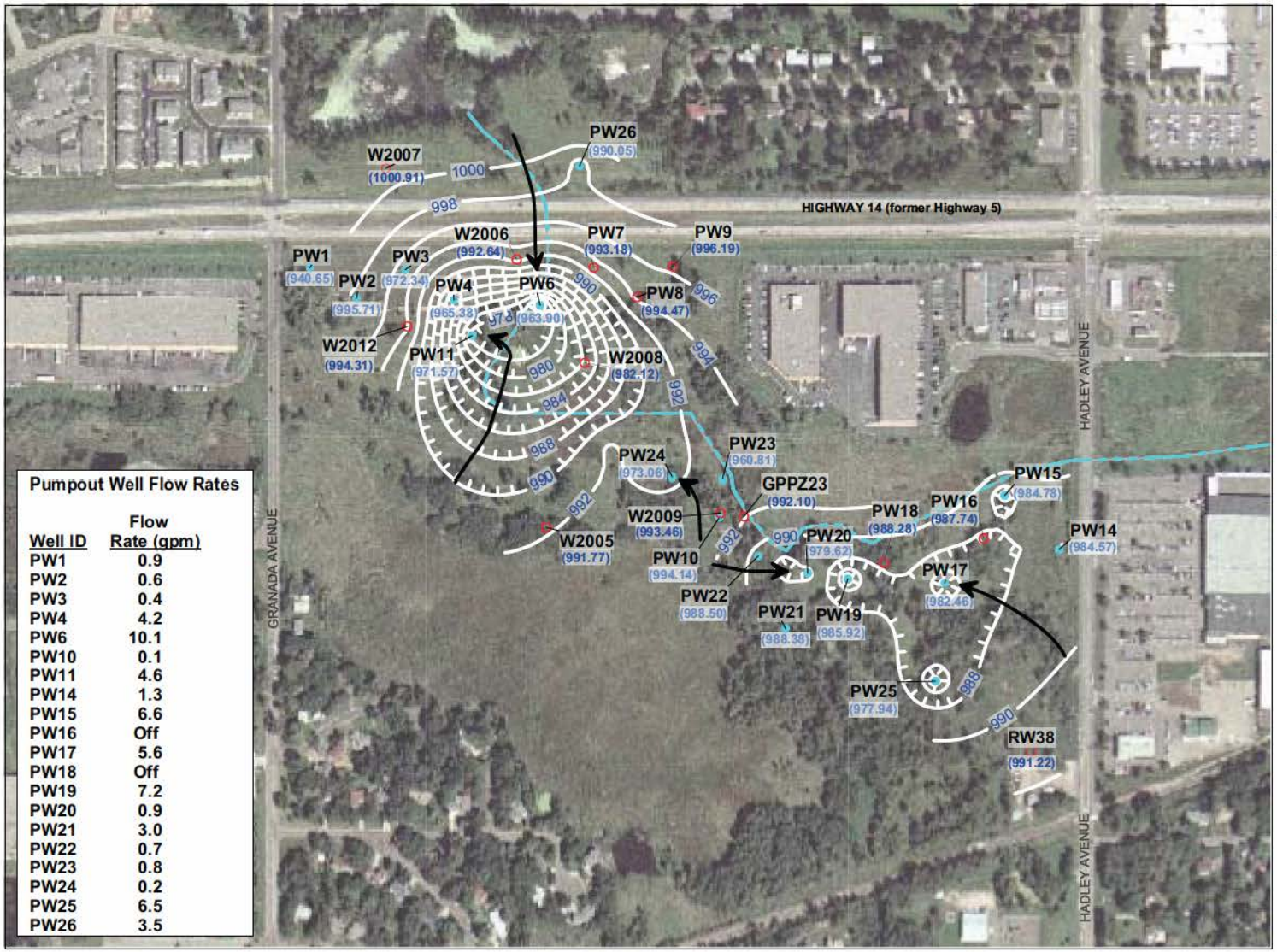
Note: 1. For each well measured as dry, the groundwater elevation was conservatively assumed to be at bottom of well.
2. Groundwater elevations for pumpout wells are posted but not used in preparing contours. Groundwater elevation contours are inferred around pumping centers.
3. The locations of pumpout wells PW16 and PW18 are shown on Figure 3-11.

2015 0402 OKMN UA.srf

Figure 3-10

Groundwater Elevation Contour Map Upper Alluvium Aquifer 4th Quarter 2016 30 November 2016

Oakdale Site Oakdale, Minnesota



Pumpout Well Flow Rates

Well ID	Flow Rate (gpm)
PW1	0.9
PW2	0.6
PW3	0.4
PW4	4.2
PW6	10.1
PW10	0.1
PW11	4.6
PW14	1.3
PW15	6.6
PW16	Off
PW17	5.6
PW18	Off
PW19	7.2
PW20	0.9
PW21	3.0
PW22	0.7
PW23	0.8
PW24	0.2
PW25	6.5
PW26	3.5

Legend

- Pumpout Well Location (PW)
- Monitoring Well/Piezometer Location (W/APZ)
- Groundwater Elevation Contour (contour interval 2 feet)
- (987.02) Monitoring Well/Piezometer Groundwater Elevation (ft MSL)
- (985.60) Pumpout Well Groundwater Elevation (ft MSL)
- Intermittent Stream (Approximate location)
- Groundwater Flow Path

Note: 1. During this event, pumpout wells PW17 and PW19 were off temporarily and allowed to reach a steady-state condition to provide additional groundwater monitoring points for the lower alluvium contour map.
2. Groundwater elevations for pumpout wells are posted but not used in preparing contours. Groundwater elevation contours are inferred around pumping centers.

Figure 3-11

Groundwater Elevation Contour Map Lower Alluvium Aquifer 4th Quarter 2016 30 November 2016

Oakdale Site Oakdale, Minnesota

2015 0402 OKMN LA sf

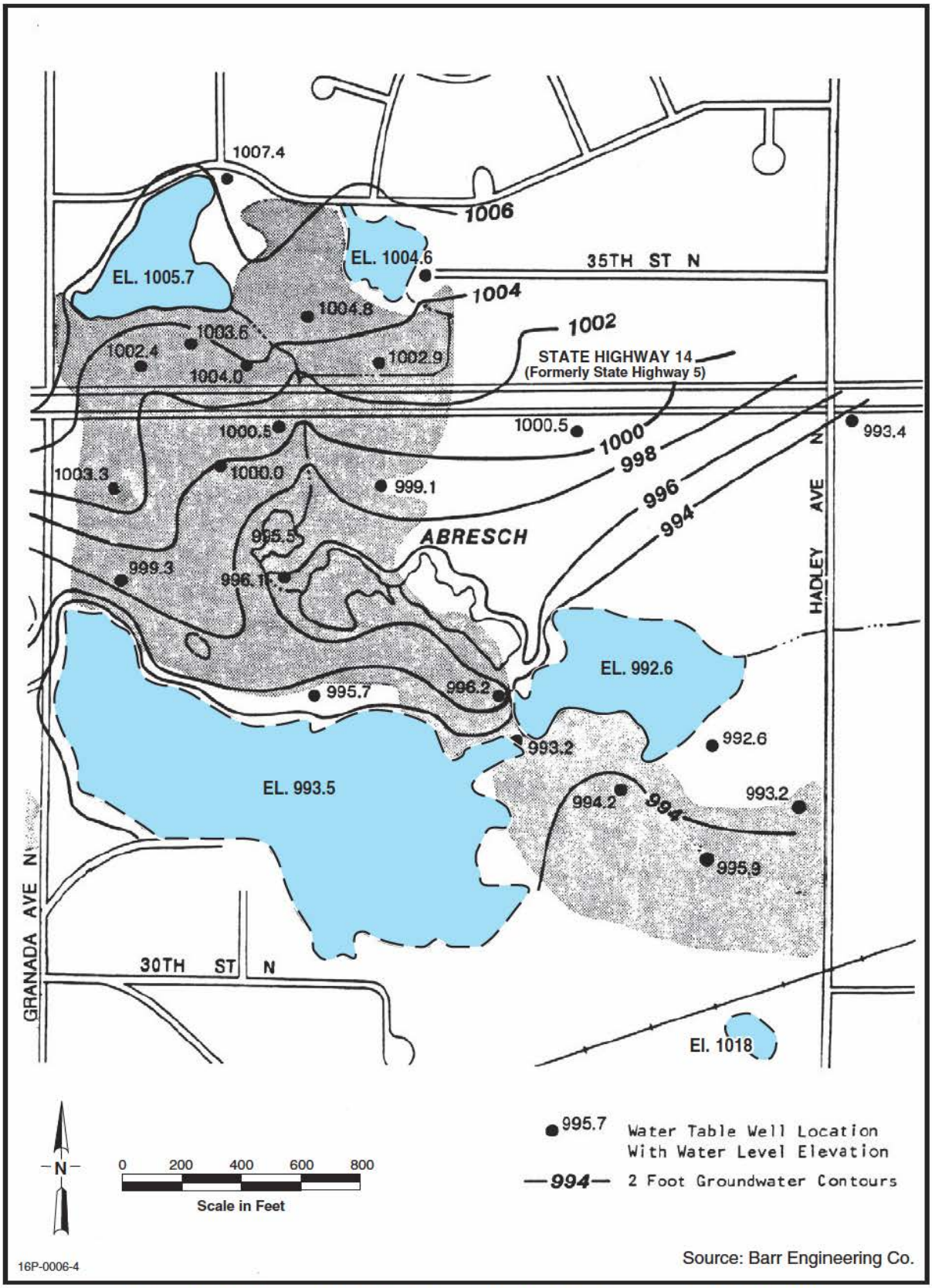
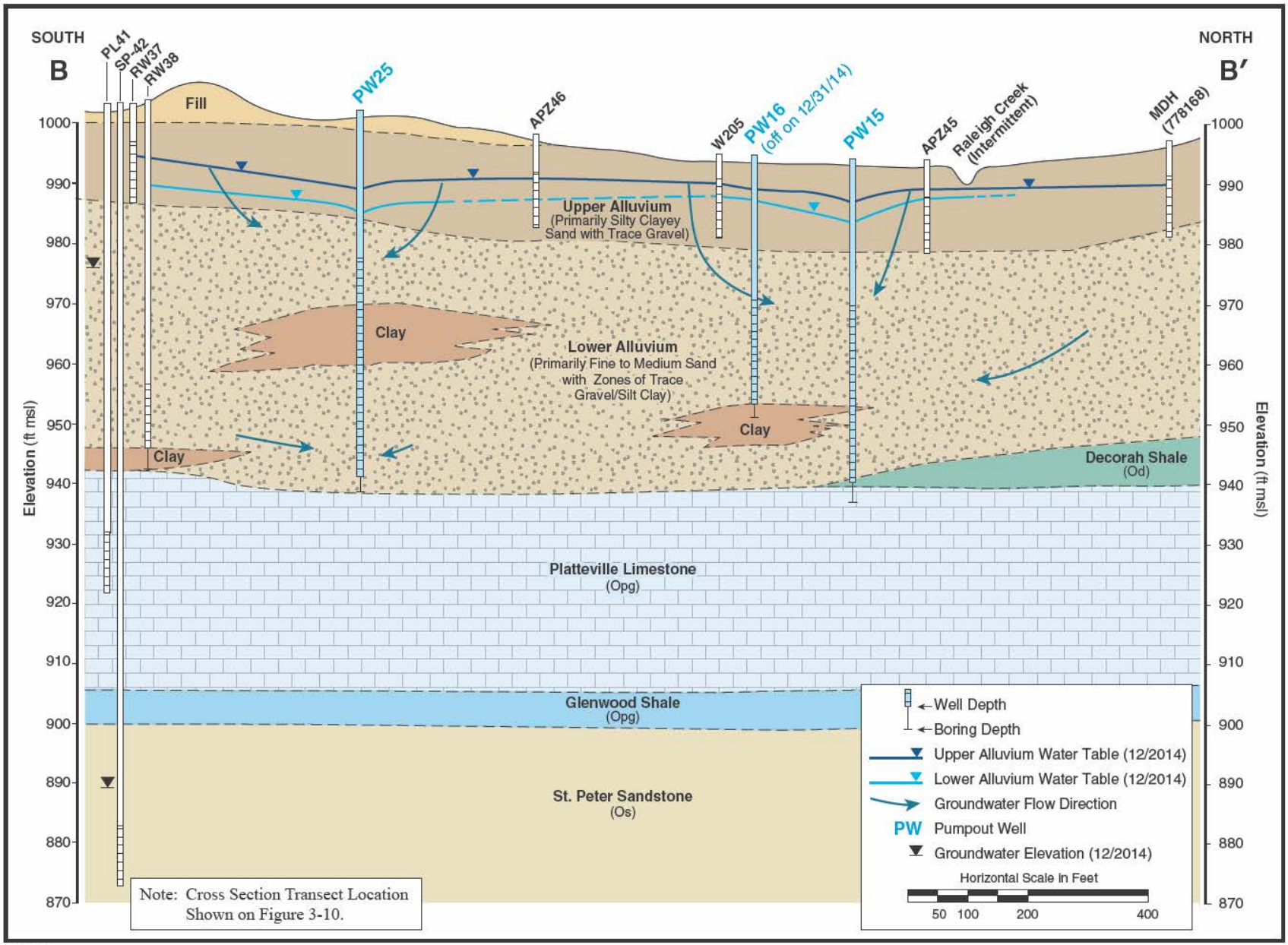
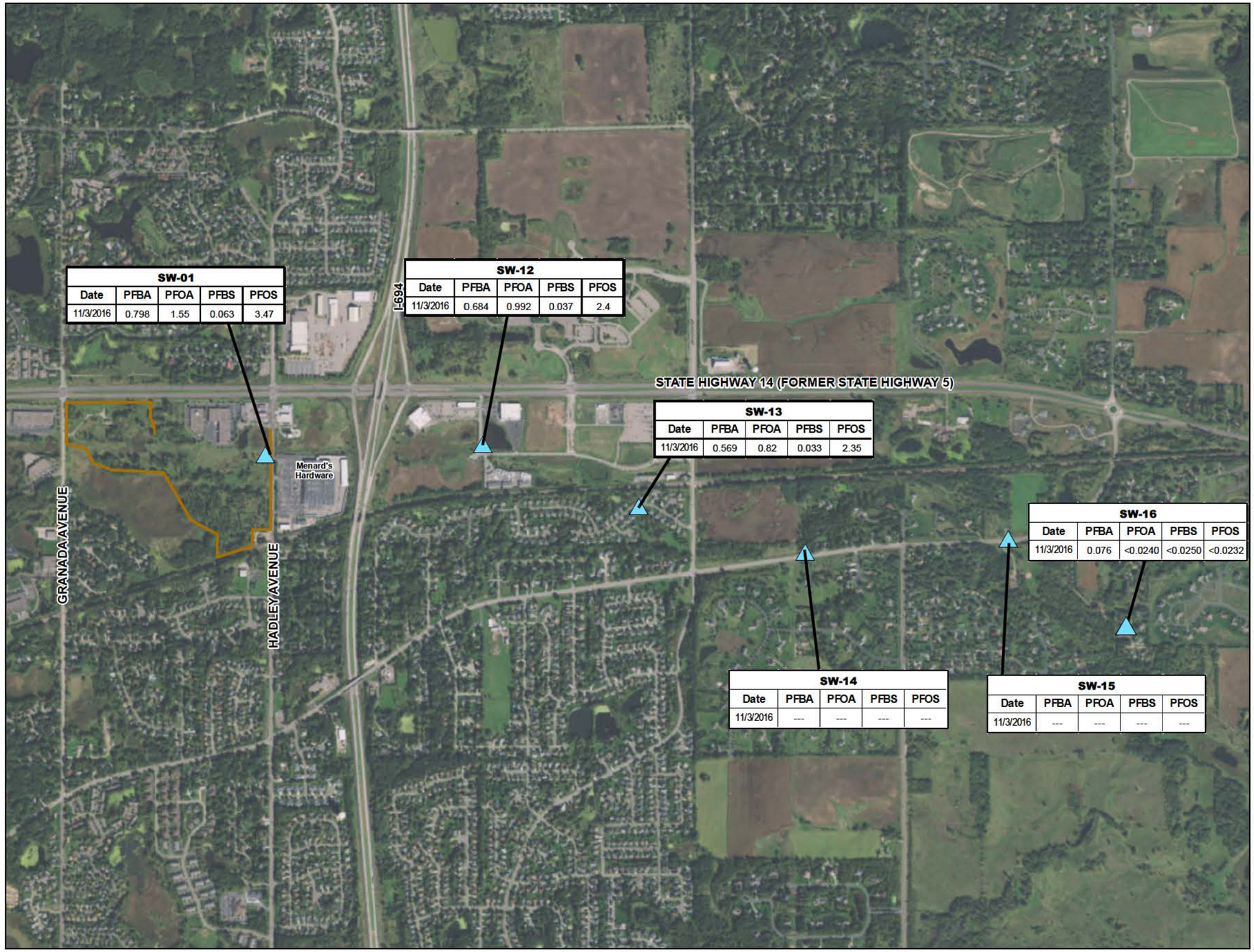


Figure 3-12 Upper Alluvium Groundwater Contours - April 2-4, 1984
Non-Pumping Condition
Oakdale Site, MN



16P-0006

Figure 3-13 Geologic Cross Section B-B′
Southeast Site Area
Oakdale Site



File: Y:\Oakdale\mxd\SurfaceWater_SampResults_March2016.mxd, 4/20/2017 4:14:11 PM, johna

Legend

- Surface Water Sampling Location
- Fenceline

Notes:

- Samples were collected when flow was observed during sampling events. If the location was dry or frozen, samples were not collected.
- All sample results reported in parts per billion. (ppb, ug/L)

Imagery Source: ESRI Imagery Mapping Service, 2013

N
W E
S

0 625 1,250 2,500
Feet

Figure 3-14
Surface Water Sampling Results
November 2016
Oakdale Site
Oakdale, Minnesota

Table 3-1
2016 Depth-to-Groundwater and Groundwater Elevation Data
Oakdale Site

Well ID	TOC Elevation (ft MSL)	3/2/2016		6/15/2016		8/2/2016		11/30/2016		Groundwater Elevation Data			
		Depth-to-Groundwater (ft btoc)	Groundwater Elevation (ft MSL)	Depth-to-Groundwater (ft btoc)	Groundwater Elevation (ft MSL)	Depth-to-Groundwater (ft btoc)	Groundwater Elevation (ft MSL)	Depth-to-Groundwater (ft btoc)	Groundwater Elevation (ft MSL)	Minimum	Maximum	Range	Standard Deviation
Area A[1] (Upgradient of pumpout wells)													
W20	1016.64	13.30	1003.34	13.01	1003.63	13.05	1003.59	12.65	1003.99	1003.34	1003.99	0.65	0.27
W2007	1021.94	21.45	1000.49	21.36	1000.58	22.31	999.63	21.03	1000.91	999.63	1000.91	1.28	0.55
W22	1019.44	18.64	1000.80	18.75	1000.69	19.35	1000.09	18.01	1001.43	1000.09	1001.43	1.34	0.55
Area B[1] (Area of pumpout wells)													
W2001	1007.18	11.16	996.02	12.62	994.56	13.91	993.27	10.98	996.20	993.27	996.20	2.93	1.37
W2006	1007.32	13.69	993.63	16.05	991.27	18.00	989.32	14.68	992.64	989.32	993.63	4.31	1.87
W2012	1016.29	22.79	993.50	25.10	991.19	25.65	990.64	21.98	994.31	990.64	994.31	3.67	1.77
W23	1005.44	6.17	999.27	2.65	1002.79	8.73	996.71	2.76	1002.68	996.71	1002.79	6.08	2.93
W28	1012.39	14.82	997.57	13.97	998.42	16.25	996.14	13.04	999.35	996.14	999.35	3.21	1.36
W29	1016.97	20.37	996.60	18.76	998.21	20.32	996.65	18.71	998.26	996.60	998.26	1.66	0.93
W36	1016.87	16.39	1000.48	16.46	1000.41	18.35	998.52	14.86	1002.01	998.52	1002.01	3.49	1.43
Area C[1] (Upgradient of pumpout wells that were shut off in 2003)													
APZ44	1011.76	4.42	1007.34	4.22	1007.54	5.16	1006.60	4.22	1007.54	1006.60	1007.54	0.94	0.45
PW7	1007.75	13.20	994.55	18.98	988.77	17.81	989.94	14.57	993.18	988.77	994.55	5.78	2.71
PW8	1007.64	14.40	993.24	10.96	996.68	17.36	990.28	13.17	994.47	990.28	996.68	6.40	2.67
PW9	1005.59	9.48	996.11	10.35	995.24	13.61	991.98	9.40	996.19	991.98	996.19	4.21	1.98
W21R	1017.48	11.73	1005.75	11.45	1006.03	11.45	1006.03	11.38	1006.10	1005.75	1006.10	0.35	0.16
W26R	1010.89	6.82	1004.07	7.35	1003.54	8.39	1002.50	6.65	1004.24	1002.50	1004.24	1.74	0.78
Area D[1]													
W2003	1000.90	15.03	985.87	22.74	978.16	22.91	977.99	18.79	982.11	977.99	985.87	7.88	3.74
W2005	1007.47	15.72	991.75	15.47	992.00	16.48	990.99	15.70	991.77	990.99	992.00	1.01	0.44
W2008	1001.42	15.58	985.84	23.61	977.81	23.45	977.97	19.30	982.12	977.81	985.84	8.03	3.83
W2010	1006.99	15.46	991.53	15.47	991.52	16.55	990.44	15.45	991.54	990.44	991.54	1.10	0.55
W215	1007.30	12.68	994.62	12.87	994.43	14.11	993.19	12.13	995.17	993.19	995.17	1.98	0.84
W25	1000.37	5.20	995.17	4.60	995.77	5.32	995.05	5.11	995.26	995.05	995.77	0.72	0.32
W30	1006.93	13.70	993.23	12.35	994.58	15.50	991.43	12.53	994.40	991.43	994.58	3.15	1.45
W31	999.91	4.73	995.18	6.08	993.83	5.82	994.09	5.31	994.60	993.83	995.18	1.35	0.60
W32	1003.09	6.51	996.58	4.84	998.25	5.63	997.46	5.13	997.96	996.58	998.25	1.67	0.73
Platteville Monitoring Wells													
PL41	1003.74	23.66	980.08	24.40	979.34	25.04	978.70	22.07	981.67	978.70	981.67	2.97	1.28
W3	1003.05	11.71	991.34	11.61	991.44	12.43	990.62	11.23	991.82	990.62	991.82	1.20	0.50
W8	1015.50	21.32	994.18	21.76	993.74	22.47	993.03	20.62	994.88	993.03	994.88	1.85	0.78
W6102	992.70	17.51	975.19	17.85	974.85	18.71	973.99	16.90	975.80	973.99	975.80	1.81	0.76
W6104	1001.23	38.57	962.66	38.67	962.56	39.22	962.01	NM	NM	962.01	962.66	0.65	0.35
St. Peter Monitoring Wells													
SP42	1004.34	115.69	888.65	115.15	889.19	115.68	888.66	114.68	889.66	888.65	889.66	1.01	0.48
W6201	991.23	111.01	880.22	110.70	880.53	111.28	879.95	109.92	881.31	879.95	881.31	1.36	0.59
Other Wells													
APZ45	995.52	5.12	990.40	3.85	991.67	5.63	989.89	4.34	991.18	989.89	991.67	1.78	0.79
APZ46	998.57	5.96	992.61	5.56	993.01	7.65	990.92	4.93	993.64	990.92	993.64	2.72	1.16
APZ47	1004.63	11.54	993.09	11.42	993.21	12.70	991.93	11.06	993.57	991.93	993.57	1.64	0.71
APZ48	1000.02	6.94	993.08	7.27	992.75	7.39	992.63	6.69	993.33	992.63	993.33	0.70	0.32
APZ49	999.25	5.06	994.19	4.42	994.83	5.70	993.55	4.41	994.84	993.55	994.84	1.29	0.62
APZ50	1004.65	9.97	994.68	10.32	994.33	11.85	992.80	9.16	995.49	992.80	995.49	2.69	1.13
GPPZ23	998.32	5.85	992.47	6.55	991.77	6.85	991.47	6.22	992.10	991.47	992.47	1.00	0.43
RW37	1005.03	10.60	994.43	9.70	995.33	10.81	994.22	9.71	995.32	994.22	995.33	1.11	0.58
RW38	1004.11	13.15	990.96	12.59	991.52	13.50	990.61	12.89	991.22	990.61	991.52	0.91	0.39
W2009	1001.33	8.42	992.91	9.51	991.82	9.97	991.36	7.87	993.46	991.36	993.46	2.10	0.97
W203	1004.79	7.74	997.05	5.03	999.76	9.11	995.68	7.51	997.28	995.68	999.76	4.08	1.70
W205	997.79	6.05	991.74	5.47	992.32	6.75	991.04	5.41	992.38	991.04	992.38	1.34	0.62
W217	1018.58	13.35	1005.23	12.77	1005.81	12.76	1005.82	12.24	1006.34	1005.23	1006.34	1.11	0.45
W33	1001.89	7.51	994.38	9.33	992.56	10.47	991.42	7.61	994.28	991.42	994.38	2.96	1.43

ft MSL - feet above mean sea level.
ft btoc - feet below top of casing.
[1]Areas A, B, C and D shown on Figure 2-1.
NM = Not Measured

2016-OKMN-GWElev.xlsx;
Tbl-3-01--2016-RPT_Tbl

Table 3-2
Summary of Groundwater PFC Analytical Data
March 2012 through November 2016 Sampling Events
Oakdale Site, Oakdale, MN

Well ID (Unit Monitored)	Date	PFBA (ppb, µg/L)	PFPeA (ppb, µg/L)	PFHxA (ppb, µg/L)	PFHpA (ppb, µg/L)	PFOA (ppb, µg/L)	PFNA (ppb, µg/L)	PFDA (ppb, µg/L)	PFUnA (ppb, µg/L)	PFDoA (ppb, µg/L)	PFBS (ppb, µg/L)	PFHS (ppb, µg/L)	PFOS (ppb, µg/L)
Upper and Lower Alluvium Monitoring Wells													
W26R (UA)	6/13/2012	627	---	---	---	948	---	---	---	---	73.7	---	536
	11/15/2012	331	---	---	---	499	---	---	---	---	42.3	---	371
	6/12/2013	329	---	---	---	525	---	---	---	---	40.2	---	525
	11/21/2013	61.3	---	---	---	167	---	---	---	---	8.42	---	589
	6/12/2014	65.7	---	---	---	229	---	---	---	---	10.9	---	543
	11/19/2014	20.3	---	---	---	53.5	---	---	---	---	3.01	---	356
	6/16/2015	36.1	---	---	---	98.5	---	---	---	---	5.58	---	320
	11/17/2015	23.2	---	---	---	68.5	---	---	---	---	2.21	---	457
	11/2/2016	5.21	---	---	---	27.6	---	---	---	---	0.692	---	305
W2007 (LA)	11/15/2012	948	---	---	---	12.3	---	---	---	---	6.61	---	33.7
	11/26/2013	1020	---	---	---	8.42	---	---	---	---	6.91	---	29.6
	11/19/2014	996	---	---	---	9.18	---	---	---	---	7.12	---	31.2
	11/19/2015	1340	---	---	---	13.2	---	---	---	---	9.03	---	29.4
	11/3/2016	1460	---	---	---	12.5	---	---	---	---	9.38	---	31.8
PW7 (UA,LA)	11/14/2012	26.2	4.39	32.5	35.8	62.1	0.134	0.181	<0.0250	<0.0250	1.89	10.2	84.2
	11/21/2013	29.6	4.80	37.7	39.4	79.6	0.239	0.220	<0.0250	<0.0250	2.15	13.7	124
	11/18/2014	25.8	5.68	38.2	48.6	95.3	0.280	0.385	<0.0250	<0.0500	1.91	14.0	86.5
	11/18/2015	4.41	2.17	5.62	10.3	85.5	0.510	3.35	0.108	<0.0250	1.30	8.31	171
	11/3/2016	6.62	2.31	11.1	14.7	101	0.527	3.06	0.060	<0.0250	0.746	12.3	156
W33 (UA)	3/5/2012	496	---	---	---	1150	---	---	---	---	34.1	---	6340
	6/14/2012	377	---	---	---	1260	---	---	---	---	27.9	---	6860
	9/25/2012	436	---	---	---	1405	---	---	---	---	27.9	---	7650
	11/15/2012	443	121	287	321	1580	93.3	52.4	5.08	0.803	25.5	81.3	9500
	3/12/2013	409	---	---	---	1640	---	---	---	---	26.2	---	8940
	6/12/2013	269	---	---	---	1090	---	---	---	---	19.9	---	7660
	8/27/2013	303	---	---	---	1130	---	---	---	---	23.0	---	7110
	11/23/2013	386	113	237	258	1400	73.0	50.0	<0.0250	<0.0250	24.0	71.5	8870
	3/25/2014	366	---	---	---	1600	---	---	---	---	30.0	---	9980
	6/14/2014	253	---	---	---	1190	---	---	---	---	19.7	---	8610
	8/21/2014	224	---	---	---	879	---	---	---	---	17.1	---	6970
	11/20/2014	287	105	191	248	1120	44.4	30.4	<0.0250	<0.0500	21.4	61.6	7190
	3/24/2015	419	---	---	---	1560	---	---	---	---	22.3	---	6070
	6/16/2015	242	---	---	---	1350	---	---	---	---	19.5	---	6610
	9/1/2015	383	---	---	---	1410	---	---	---	---	22.3	---	6340
	11/19/2015	370	96.2	250	306	1660	34.3	21.0	2.08	<0.0250	18.6	64.8	6340
	11/2/2016	120	37.0	92.1	98.6	526	17.7	15.2	1.61	<0.0250	8.04	17.2	5080

Table 3-2 (cont'd)
Summary of Groundwater PFC Analytical Data
March 2012 through November 2016 Sampling Events
Oakdale Site, Oakdale, MN

Well ID (Unit Monitored)	Date	PFBA (ppb, µg/L)	PFPeA (ppb, µg/L)	PFHxA (ppb, µg/L)	PFHpA (ppb, µg/L)	PFOA (ppb, µg/L)	PFNA (ppb, µg/L)	PFDA (ppb, µg/L)	PFUnA (ppb, µg/L)	PFDoA (ppb, µg/L)	PFBS (ppb, µg/L)	PFHS (ppb, µg/L)	PFOS (ppb, µg/L)
Upper and Lower Alluvium Monitoring Wells (cont'd)													
W205 (UA)	3/5/2012	7.85	---	---	---	26.7	---	---	---	---	0.436	---	62.9
	6/13/2012	9.59	---	---	---	28.6	---	---	---	---	0.440	---	75.7
	9/25/2012	6.37	---	---	---	17.1	---	---	---	---	0.241	---	45.6
	11/14/2012	7.85	0.610	1.62	1.92	21.3	0.093	0.081	<0.0250	<0.0250	0.285	1.04	50.7
	3/12/2013	8.60	---	---	---	26.5	---	---	---	---	0.354	---	56.3
	6/13/2013	9.34	---	---	---	27.0	---	---	---	---	0.434	---	46.8
	8/27/2013	7.29	---	---	---	18.8	---	---	---	---	0.324	---	58.8
	11/25/2013	8.61	0.743	2.06	2.78	28.4	0.108	0.078	<0.0250	<0.0250	0.324	1.22	64.0
	3/25/2014	7.19	---	---	---	24.1	---	---	---	---	0.299	---	44.1
	6/13/2014	13.1	---	---	---	37.7	---	---	---	---	0.892	---	45.2
	8/21/2014	6.93	---	---	---	17.6	---	---	---	---	0.388	---	39.7
	11/18/2014	6.73	0.738	1.78	2.83	21.1	0.092	0.037	<0.0250	<0.0500	0.328	0.984	45.9
	3/23/2015	8.82	---	---	---	31.7	---	---	---	---	0.429	---	41.2
	6/16/2015	7.99	---	---	---	30.2	---	---	---	---	0.417	---	61.4
	8/31/2015	6.03	---	---	---	22.2	---	---	---	---	0.377	---	59.9
	11/19/2015	8.84	0.897	2.04	1.98	28.9	0.242	0.117	<0.0250	<0.0250	0.545	1.84	67.2
	10/31/2016	4.73	0.439	0.964	1.28	16.2	0.144	0.082	<0.0250	<0.0250	0.291	1.07	56.3
RW37 (UA)	3/5/2012	0.061	---	---	---	0.098	---	---	---	---	<0.0250	---	2.43
	6/13/2012	0.116	---	---	---	0.234	---	---	---	---	<0.0250	---	3.12
	9/25/2012	0.043	---	---	---	0.184	---	---	---	---	<0.0250	---	2.52
	11/13/2012	0.094	0.022	<0.0500	<0.0250	0.195	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	2.24
	3/11/2013	0.040	---	---	---	0.113	---	---	---	---	<0.0250	---	1.20
	6/11/2013	0.139	---	---	---	0.306	---	---	---	---	<0.0250	---	3.44
	8/26/2013	<0.100	---	---	---	0.130	---	---	---	---	<0.0250	---	1.83
	11/25/2013	0.059	0.031	<0.0250	<0.0250	0.162	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	1.57
	3/24/2014	0.152	---	---	---	0.168	---	---	---	---	<0.0250	---	0.934
	6/13/2014	0.088	---	---	---	0.252	---	---	---	---	<0.0250	---	3.44
	8/21/2014	0.061	---	---	---	0.075	---	---	---	---	<0.0250	---	1.28
	11/17/2014	0.057	<0.0250	0.027	<0.0250	0.100	<0.0250	<0.0250	<0.0250	<0.0500	<0.0250	<0.0250	1.15
	3/23/2015	0.118	---	---	---	0.145	---	---	---	---	<0.0250	---	1.65
	6/15/2015	0.047	---	---	---	0.214	---	---	---	---	<0.0250	---	2.70
	8/31/2015	<0.100	---	---	---	0.123	---	---	---	---	<0.0250	---	1.68
	11/19/2015	<0.100	<0.0500	<0.0250	<0.0250	0.157	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0236	3.19
	11/1/2016	0.069	<0.0250	<0.0250	<0.0250	0.107	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	3.58

Table 3-2 (cont'd)
Summary of Groundwater PFC Analytical Data
March 2012 through November 2016 Sampling Events
Oakdale Site, Oakdale, MN

Well ID (Unit Monitored)	Date	PFBA (ppb, µg/L)	PFPeA (ppb, µg/L)	PFHxA (ppb, µg/L)	PFHpA (ppb, µg/L)	PFOA (ppb, µg/L)	PFNA (ppb, µg/L)	PFDA (ppb, µg/L)	PFUnA (ppb, µg/L)	PFDoA (ppb, µg/L)	PFBS (ppb, µg/L)	PFHS (ppb, µg/L)	PFOS (ppb, µg/L)
Upper and Lower Alluvium Monitoring Wells (cont'd)													
RW38 (LA)	3/5/2012	0.203	---	---	---	0.120	---	---	---	---	<0.0250	---	0.331
	6/13/2012	0.253	---	---	---	0.100	---	---	---	---	<0.0250	---	0.105
	9/25/2012	0.224	---	---	---	0.129	---	---	---	---	<0.0250	---	0.334
	11/13/2012	0.230	<0.0250	<0.0500	<0.0250	0.078	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	0.076
	3/11/2013	0.219	---	---	---	0.140	---	---	---	---	<0.0250	---	0.187
	6/11/2013	0.238	---	---	---	0.106	---	---	---	---	<0.0250	---	0.158
	8/27/2013	0.194	---	---	---	0.080	---	---	---	---	<0.0250	---	0.096
	11/20/2013	0.234	<0.0250	<0.0250	<0.0250	0.090	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	0.081
	3/24/2014	0.236	---	---	---	0.093	---	---	---	---	<0.0250	---	0.105
	6/13/2014	0.260	---	---	---	0.232	---	---	---	---	<0.0250	---	0.988
	8/22/2014	0.221	---	---	---	0.080	---	---	---	---	<0.0250	---	0.104
	11/17/2014	0.262	<0.0250	0.038	<0.0250	0.126	<0.0250	<0.0250	<0.0250	<0.0500	<0.0250	<0.0250	0.193
	3/23/2015	0.232	---	---	---	0.087	---	---	---	---	<0.0500	---	0.125
	6/15/2015	0.227	---	---	---	0.089	---	---	---	---	<0.0250	---	0.170
	9/1/2015	0.256	---	---	---	0.133	---	---	---	---	<0.0250	---	0.455
	11/19/2015	0.258	<0.0500	<0.0250	<0.0250	0.054	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0236	0.110
	11/1/2016	0.225	<0.0250	<0.0250	<0.0250	0.073	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	0.085
Upper and Lower Alluvium Pumpout Wells													
PW1 (UA,LA)	11/15/2012	55.5	6.58	13.2	9.50	26.5	0.084	0.102	<0.0250	<0.0250	2.11	2.62	47.4
	11/25/2013	47.8	4.67	9.04	5.79	19.8	0.046	0.032	<0.0250	<0.0250	1.44	1.88	16.7
	11/20/2014	47.6	6.74	9.40	6.91	22.6	0.031	0.032	<0.0250	<0.0500	1.79	1.95	15.8
	11/18/2015	51.6	5.49	10.7	6.52	20.9	0.063	0.064	<0.0250	<0.0250	1.81	2.10	19.9
	11/3/2016	49.4	6.33	10.5	6.90	24.5	0.056	0.035	<0.0250	<0.0250	1.86	2.56	30.4
PW2 (UA,LA)	11/15/2012	46.9	2.96	5.43	2.48	10.5	<0.0250	<0.0250	<0.0250	<0.0250	1.05	1.47	0.685
	11/19/2013	56.4	3.66	7.71	3.61	16.9	<0.0250	<0.0250	<0.0250	<0.0250	1.33	2.36	1.10
	11/20/2014	55.9	4.21	6.85	3.65	12.9	<0.0250	<0.0250	<0.0250	<0.0500	1.35	1.82	0.791
	11/18/2015	59.2	3.00	5.91	2.84	12.9	<0.0250	<0.0250	<0.0250	<0.0250	0.961	1.57	4.20
	11/3/2016	63.6	3.63	6.55	3.27	13.4	<0.0250	<0.0250	<0.0250	<0.0250	1.11	1.86	1.50
PW3 (UA,LA)	11/15/2012	46.5	10.2	23.7	8.58	95.7	0.152	<0.0250	<0.0250	<0.0250	2.45	7.74	31.4
	11/25/2013	35.9	8.85	21.3	7.10	57.2	0.071	<0.0250	<0.0250	<0.0250	2.31	4.29	20.9
	11/20/2014	43.5	10.1	18.4	7.83	58.2	0.107	<0.0250	<0.0250	<0.0500	2.33	6.06	26.2
	11/18/2015	42.5	8.04	19.1	6.73	48.7	0.085	<0.0250	<0.0250	<0.0250	1.95	5.29	21.9
	11/3/2016	39.6	9.56	19.8	8.69	58.4	0.107	0.036	<0.0250	<0.0250	2.24	7.45	45.9

Table 3-2 (cont'd)
Summary of Groundwater PFC Analytical Data
March 2012 through November 2016 Sampling Events
Oakdale Site, Oakdale, MN

Well ID (Unit Monitored)	Date	PFBA (ppb, µg/L)	PFPeA (ppb, µg/L)	PFHxA (ppb, µg/L)	PFHpA (ppb, µg/L)	PFOA (ppb, µg/L)	PFNA (ppb, µg/L)	PFDA (ppb, µg/L)	PFUnA (ppb, µg/L)	PFDoA (ppb, µg/L)	PFBS (ppb, µg/L)	PFHS (ppb, µg/L)	PFOS (ppb, µg/L)
Upper and Lower Alluvium Pumpout Wells (cont'd)													
PW4 (UA,LA)	11/15/2012	106	6.79	21.9	9.13	61.0	0.122	0.084	<0.0250	<0.0250	4.26	7.97	31.0
	11/19/2013	78.9	5.60	18.4	7.39	60.6	0.082	<0.0250	<0.0250	<0.0250	4.13	8.43	27.2
	11/20/2014	69.9	6.07	16.2	7.94	48.7	0.094	<0.0250	<0.0250	<0.0500	3.80	6.78	25.2
	11/18/2015	108	9.11	30.5	14.2	101	0.350	0.209	<0.0250	<0.0250	4.85	11.6	81.0
	11/3/2016	80.2	7.27	22.7	10.0	60.6	0.122	0.049	<0.0250	<0.0250	4.87	9.76	37.5
PW6 (UA,LA)	11/15/2012	66.4	6.26	16.7	10.4	67.4	0.285	0.289	<0.0250	<0.0250	4.39	17.6	81.6
	11/19/2013	130	11.5	35.6	18.8	165	0.478	0.397	<0.0250	<0.0250	7.69	44.9	114
	11/20/2014	127	12.6	31.6	19.4	115	0.413	0.337	<0.0250	<0.0500	8.65	29.8	138
	11/18/2015	109	9.58	28.0	13.1	101	0.396	0.460	<0.0250	<0.0250	6.08	20.8	140
	11/3/2016	89.6	9.06	24.5	12.6	96.1	0.336	0.301	<0.0250	<0.0250	5.97	20.6	118
PW10 (UA,LA)	11/15/2012	440	28.1	78.4	69.5	443	2.92	1.08	<0.0250	<0.0250	5.14	15.8	1500
	11/25/2013	357	28.3	79.6	70.5	375	2.71	1.01	<0.0250	<0.0250	4.69	15.2	1210
	11/20/2014	295	28.7	66.3	81.9	433	3.13	1.18	<0.0250	<0.0500	5.22	13.8	1220
	11/18/2015	254	29.5	85.3	96.9	541	3.57	1.58	0.136	<0.0250	7.19	16.9	1340
	11/3/2016	310	34.3	90.5	121	890	6.19	1.94	0.092	<0.0250	8.23	23.6	2120
PW11 (UA,LA)	11/15/2012	115	11.0	33.4	16.3	92.7	0.343	0.249	<0.0250	<0.0250	7.38	14.0	82.0
	11/19/2013	145	12.7	44.0	20.5	133	0.430	0.259	<0.0250	<0.0250	7.73	17.0	163
	11/20/2014	102	12.4	32.2	19.4	97.7	0.339	0.187	<0.0250	<0.0500	7.41	13.7	89.8
	11/18/2015	97.5	8.37	24.6	12.1	94.1	0.333	0.327	<0.0250	<0.0250	4.77	14.6	111
	11/3/2016	98.8	12.5	35.7	19.5	127	0.398	0.136	<0.0250	<0.0250	7.22	15.4	143
PW14 (LA)	11/15/2012	33.3	5.07	14.5	11.0	84.7	0.226	0.052	<0.0250	<0.0250	2.74	5.84	30.6
	11/25/2013	29.9	3.80	12.1	8.89	77.0	0.208	<0.0250	<0.0250	<0.0250	2.05	5.28	35.9
	11/20/2014	84.4	9.09	22.4	13.3	71.0	0.248	0.168	<0.0250	<0.0500	5.22	12.2	77.5
	11/19/2015	16.8	2.24	6.80	5.43	53.9	0.174	0.054	<0.0250	<0.0250	1.26	3.20	29.1
	11/3/2016	12.4	1.75	4.78	3.88	37.7	0.105	<0.0250	<0.0250	<0.0250	0.944	2.51	24.8

Table 3-2 (cont'd)
Summary of Groundwater PFC Analytical Data
March 2012 through November 2016 Sampling Events
Oakdale Site, Oakdale, MN

Well ID (Unit Monitored)	Date	PFBA (ppb, µg/L)	PFPeA (ppb, µg/L)	PFHxA (ppb, µg/L)	PFHpA (ppb, µg/L)	PFOA (ppb, µg/L)	PFNA (ppb, µg/L)	PFDA (ppb, µg/L)	PFUnA (ppb, µg/L)	PFDoA (ppb, µg/L)	PFBS (ppb, µg/L)	PFHS (ppb, µg/L)	PFOS (ppb, µg/L)
Upper and Lower Alluvium Pumpout Wells (cont'd)													
PW15 (LA)	11/15/2012	16.3	0.665	1.75	1.06	8.11	<0.0250	<0.0250	<0.0250	<0.0250	0.314	0.596	5.66
	11/19/2013	19.4	0.805	2.30	1.28	11.2	<0.0250	<0.0250	<0.0250	<0.0250	0.359	0.756	6.89
	11/20/2014	15.2	0.792	1.92	1.31	9.07	<0.0250	<0.0250	<0.0250	<0.0500	0.345	0.662	6.05
	11/19/2015	11.4	0.575	1.58	0.922	7.80	0.032	<0.0250	<0.0250	<0.0250	0.268	0.573	5.26
	11/3/2016	9.79	0.497	1.31	0.779	6.20	<0.0250	<0.0250	<0.0250	<0.0250	0.235	0.576	6.02
PW16 (LA)	11/15/2012	18.8	1.69	4.64	4.13	30.6	0.086	0.028	<0.0250	<0.0250	0.810	1.76	23.8
	11/19/2013	19.2	2.14	6.64	6.21	50.9	0.146	0.049	<0.0250	<0.0250	0.940	2.46	35.3
	11/20/2014	28.6	3.81	8.01	9.76	65.2	0.184	<0.0250	<0.0250	<0.0500	1.53	3.06	42.1
	11/19/2015	12.7	1.40	4.16	3.62	33.8	0.128	0.052	<0.0250	<0.0250	0.773	1.88	25.1
	11/3/2016	12.0	1.30	3.50	3.09	28.7	0.094	0.033	<0.0250	<0.0250	0.744	2.04	30.3
PW17 (LA)	11/15/2012	13.6	1.24	3.75	3.26	30.6	0.110	0.065	<0.0250	<0.0250	0.958	2.26	26.1
	11/19/2013	12.8	1.25	4.95	3.46	35.9	0.145	0.098	<0.0250	<0.0250	0.939	2.57	36.1
	11/20/2014	9.12	1.22	3.79	3.20	26.3	0.114	0.036	<0.0250	<0.0500	0.823	1.89	28.1
	11/19/2015	12.0	1.20	3.68	3.15	33.7	0.132	0.089	<0.0250	<0.0250	0.934	2.41	27.3
	11/3/2016	11.5	1.46	4.06	3.63	36.1	0.138	0.075	<0.0250	<0.0250	1.13	3.19	37.5
PW18 (LA)	11/15/2012	55.3	3.20	8.04	3.66	33.7	<0.0250	<0.0250	<0.0250	<0.0250	0.828	1.20	11.1
	11/19/2013	37.0	2.29	6.20	3.39	33.0	0.046	<0.0250	<0.0250	<0.0250	0.746	1.56	18.7
	11/20/2014	21.0	1.55	3.30	2.74	21.1	0.040	<0.0250	<0.0250	<0.0500	1.05	2.11	13.3
	11/19/2015	28.5	1.49	3.82	1.98	18.3	0.033	<0.0250	<0.0250	<0.0250	0.810	1.42	8.49
	11/3/2016	25.7	1.42	3.16	1.69	13.8	<0.0250	<0.0250	<0.0250	<0.0250	0.673	1.12	5.97
PW19 (LA)	11/15/2012	36.0	2.24	4.44	2.28	18.1	<0.0250	<0.0250	<0.0250	<0.0250	0.905	1.54	7.98
	11/20/2013	27.7	1.62	3.78	1.99	17.3	<0.0250	<0.0250	<0.0250	<0.0250	0.738	1.41	7.43
	11/20/2014	23.5	1.45	2.81	1.41	8.39	<0.0250	<0.0250	<0.0250	<0.0500	0.504	0.672	3.53
	11/19/2015	27.9	1.39	3.02	1.16	7.68	<0.0250	<0.0250	<0.0250	<0.0250	0.406	0.440	2.87
	11/3/2016	30.1	1.26	2.81	1.05	5.31	<0.0250	<0.0250	<0.0250	<0.0250	0.360	0.273	3.00

Table 3-2 (cont'd)
Summary of Groundwater PFC Analytical Data
March 2012 through November 2016 Sampling Events
Oakdale Site, Oakdale, MN

Well ID (Unit Monitored)	Date	PFBA (ppb, µg/L)	PFPeA (ppb, µg/L)	PFHxA (ppb, µg/L)	PFHpA (ppb, µg/L)	PFOA (ppb, µg/L)	PFNA (ppb, µg/L)	PFDA (ppb, µg/L)	PFUnA (ppb, µg/L)	PFDoA (ppb, µg/L)	PFBS (ppb, µg/L)	PFHS (ppb, µg/L)	PFOS (ppb, µg/L)
Upper and Lower Alluvium Pumpout Wells (cont'd)													
PW20 (LA)	11/15/2012	58.7	6.05	9.29	4.33	34.0	0.077	0.029	<0.0250	<0.0250	0.613	1.24	28.9
	11/20/2013	69.4	6.96	11.3	5.06	45.3	0.112	<0.0250	<0.0250	<0.0250	0.652	1.52	42.7
	11/20/2014	92.9	10.1	24.4	14.7	85.8	0.290	0.223	<0.0250	<0.0500	6.20	16.3	94.6
	11/19/2015	45.2	4.02	6.40	3.12	26.1	0.075	0.038	<0.0250	<0.0250	0.467	0.969	26.6
	11/3/2016	43.5	4.63	6.47	3.30	27.2	0.061	0.029	<0.0250	<0.0250	0.491	1.04	33.5
PW21 (LA)	11/15/2012	6.04	0.291	0.805	0.294	1.72	<0.0250	<0.0250	<0.0250	<0.0250	0.066	0.064	0.385
	11/20/2013	5.60	0.266	0.840	0.299	1.57	<0.0250	<0.0250	<0.0250	0.059	0.064	0.062	0.368
	11/20/2014	3.94	0.238	0.641	0.228	0.950	<0.0250	<0.0250	<0.0250	<0.0500	0.047	0.037	0.218
	11/19/2015	3.82	0.211	0.628	0.166	0.769	<0.0250	<0.0250	<0.0250	<0.0250	0.038	0.032	0.238
	11/3/2016	4.63	0.244	0.569	0.175	0.839	<0.0250	<0.0250	<0.0250	<0.0250	0.046	0.031	0.216
PW22 (LA)	11/15/2012	146	11.0	30.5	20.9	139	0.682	0.357	<0.0250	<0.0250	4.40	11.9	283
	11/20/2013	20.6	1.64	4.01	2.83	26.8	0.069	<0.0250	<0.0250	<0.0250	0.576	1.43	34.1
	11/20/2014	5.74	0.886	2.24	5.10	35.7	0.114	0.027	<0.0250	<0.0500	0.335	1.10	71.6
	11/19/2015	6.02	0.748	2.12	3.82	37.3	0.159	0.064	<0.0250	<0.0250	0.293	1.11	115
	11/3/2016	6.43	1.04	2.77	6.10	52.4	0.224	0.062	<0.0250	<0.0250	0.337	1.33	150
PW23 (LA)	11/15/2012	139	9.58	30.1	15.3	103	0.315	0.201	<0.0250	<0.0250	5.67	13.2	80.1
	12/3/2013	565	31.4	113	67.8	549	1.85	0.783	<0.0250	<0.0250	30.1	83.2	313
	11/20/2014	414	33.3	112	102	607	2.13	0.680	<0.0250	<0.0500	54.4	129	387
	11/19/2015	408	22.6	87.1	64.2	575	2.06	0.640	<0.0250	<0.0250	37.3	116	466
	11/4/2016	5.10	0.479	2.36	1.10	8.90	0.039	0.058	<0.0250	<0.0250	0.338	1.04	18.8
PW24 (LA)	11/15/2012	151	10.3	31.8	22.3	151	0.640	1.71	<0.0250	<0.0250	10.2	28.4	177
	11/25/2013	154	10.3	29.2	27.6	223	1.26	4.13	<0.0250	<0.0250	14.9	68.3	321
	11/20/2014	78.6	6.22	13.1	13.7	108	0.636	3.02	<0.0250	<0.0500	8.54	30.3	206
	11/19/2015	64.0	4.62	11.0	10.3	104	0.635	2.43	<0.0250	<0.0250	7.10	25.9	217
	11/3/2016	20.8	1.45	3.20	2.10	18.6	0.056	<0.0250	<0.0250	<0.0250	0.593	1.25	22.9

Table 3-2 (cont'd)
Summary of Groundwater PFC Analytical Data
March 2012 through November 2016 Sampling Events
Oakdale Site, Oakdale, MN

Well ID (Unit Monitored)	Date	PFBA (ppb, µg/L)	PFPeA (ppb, µg/L)	PFHxA (ppb, µg/L)	PFHpA (ppb, µg/L)	PFOA (ppb, µg/L)	PFNA (ppb, µg/L)	PFDA (ppb, µg/L)	PFUnA (ppb, µg/L)	PFDoA (ppb, µg/L)	PFBS (ppb, µg/L)	PFHS (ppb, µg/L)	PFOS (ppb, µg/L)
Upper and Lower Alluvium Pumpout Wells (cont'd)													
PW25 (LA)	11/15/2012	24.8	0.810	4.29	1.54	13.3	0.050	0.132	<0.0250	<0.0250	0.568	1.39	25.1
	11/25/2013	18.5	0.664	3.78	1.39	12.5	0.054	0.102	<0.0250	<0.0250	0.443	1.30	24.8
	11/20/2014	17.9	0.556	2.49	1.07	7.56	0.040	0.055	<0.0250	<0.0500	0.370	0.868	15.9
	11/19/2015	8.65	0.465	2.19	1.10	9.77	0.055	0.079	<0.0250	<0.0250	0.372	1.10	15.3
	11/3/2016	9.34	0.509	2.36	1.14	9.44	0.039	0.043	<0.0250	<0.0250	0.364	1.04	16.8
PW26 (LA)	6/14/2012	13.7	---	---	---	24.3	---	---	---	---	1.30	---	17.9
	11/15/2012	16.2	2.78	6.43	3.99	30.1	0.090	0.045	<0.0250	<0.0250	1.72	7.01	23.7
	11/25/2013	34.5	6.24	15.2	8.82	69.6	0.215	0.104	<0.0250	<0.0250	3.58	14.4	62.8
	11/20/2014	57.5	8.35	17.4	10.9	62.2	0.218	0.200	<0.0250	<0.0500	4.44	16.0	76.3
	11/19/2015	36.7	4.92	10.7	5.72	30.3	0.095	0.042	<0.0250	<0.0250	2.61	8.78	19.8
	11/3/2016	35.5	4.69	9.88	5.47	28.8	0.076	0.040	<0.0250	<0.0250	2.57	8.72	27.1

Table 3-2 (cont'd)
Summary of Groundwater PFC Analytical Data
March 2012 through November 2016 Sampling Events
Oakdale Site, Oakdale, MN

Well ID (Unit Monitored)	Date	PFBA (ppb, µg/L)	PFPeA (ppb, µg/L)	PFHxA (ppb, µg/L)	PFHpA (ppb, µg/L)	PFOA (ppb, µg/L)	PFNA (ppb, µg/L)	PFDA (ppb, µg/L)	PFUnA (ppb, µg/L)	PFDoA (ppb, µg/L)	PFBS (ppb, µg/L)	PFHS (ppb, µg/L)	PFOS (ppb, µg/L)
Platteville Monitoring Wells													
W8 (Opg)	3/5/2012	0.164	---	---	---	<0.0240	---	---	---	---	<0.0250	---	0.047
	6/13/2012	0.190	---	---	---	0.052	---	---	---	---	<0.0250	---	0.061
	9/25/2012	0.428	---	---	---	0.080	---	---	---	---	<0.0250	---	0.067
	11/13/2012	0.428	<0.0250	0.053	<0.0250	0.113	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	0.194
	3/11/2013	0.438	---	---	---	0.084	---	---	---	---	<0.0250	---	0.072
	6/11/2013	0.439	---	---	---	0.159	---	---	---	---	0.056	---	0.171
	8/27/2013	0.659	---	---	---	0.113	---	---	---	---	<0.0250	---	0.077
	11/20/2013	0.452	<0.0250	0.047	0.039	0.075	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	0.091
	3/24/2014	0.303	---	---	---	0.096	---	---	---	---	0.029	---	0.127
	6/13/2014	0.479	---	---	---	0.136	---	---	---	---	<0.0250	---	0.441
	8/21/2014	0.762	---	---	---	0.441	---	---	---	---	<0.0250	---	4.60
	11/17/2014	0.669	0.050	0.109	0.065	0.339	<0.0250	<0.0250	<0.0250	<0.0500	<0.0250	<0.0250	3.13
	3/23/2015	0.332	---	---	---	0.083	---	---	---	---	<0.0250	---	0.096
	6/15/2015	0.587	---	---	---	0.103	---	---	---	---	<0.0250	---	0.085
	9/1/2015	0.921	---	---	---	0.263	---	---	---	---	<0.0250	---	0.678
	11/17/2015	0.937	<0.0500	0.142	0.052	0.249	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	0.025	0.640
	10/31/2016	0.877	0.046	0.120	0.041	0.195	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	0.027	0.380
PL41 (Opg)	3/5/2012	0.544	---	---	---	0.224	---	---	---	---	<0.0250	---	0.740
	6/12/2012	0.622	---	---	---	0.191	---	---	---	---	<0.0250	---	0.546
	9/25/2012	0.526	---	---	---	0.140	---	---	---	---	<0.0250	---	0.348
	11/13/2012	0.634	0.022	0.079	<0.0250	0.063	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	0.065
	3/11/2013	0.519	---	---	---	0.111	---	---	---	---	0.027	---	0.172
	6/11/2013	0.458	---	---	---	0.167	---	---	---	---	<0.0250	---	0.319
	8/27/2013	0.412	---	---	---	0.126	---	---	---	---	<0.0250	---	0.296
	11/20/2013	0.594	0.029	0.060	<0.0250	0.150	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	0.331
	3/24/2014	0.496	---	---	---	0.081	---	---	---	---	<0.0250	---	0.099
	6/13/2014	0.576	---	---	---	0.570	---	---	---	---	<0.0250	---	2.58
	8/21/2014	0.482	---	---	---	0.219	---	---	---	---	<0.0250	---	0.791
	11/17/2014	0.492	0.026	0.063	<0.0250	0.101	<0.0250	<0.0250	<0.0250	<0.0500	<0.0250	<0.0250	0.268
	3/23/2015	0.839	---	---	---	0.068	---	---	---	---	<0.0250	---	0.073
	6/15/2015	1.89	---	---	---	0.361	---	---	---	---	<0.0250	---	1.51
	9/1/2015	1.72	---	---	---	0.099	---	---	---	---	<0.0250	---	0.133
	11/16/2015	1.81	0.123	0.165	0.035	0.096	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0236	0.238
	10/31/2016	0.802	0.052	0.079	<0.0250	0.078	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	0.084

Table 3-2 (cont'd)
Summary of Groundwater PFC Analytical Data
March 2012 through November 2016 Sampling Events
Oakdale Site, Oakdale, MN

Well ID (Unit Monitored)	Date	PFBA (ppb, µg/L)	PFPeA (ppb, µg/L)	PFHxA (ppb, µg/L)	PFHpA (ppb, µg/L)	PFOA (ppb, µg/L)	PFNA (ppb, µg/L)	PFDA (ppb, µg/L)	PFUnA (ppb, µg/L)	PFDoA (ppb, µg/L)	PFBS (ppb, µg/L)	PFHS (ppb, µg/L)	PFOS (ppb, µg/L)
St. Peter Monitoring Well													
SP42 (Os)	3/5/2012	<0.0250	---	---	---	0.051	---	---	---	---	<0.0250	---	0.206
	6/12/2012	<0.0500	---	---	---	0.232	---	---	---	---	<0.0250	---	0.693
	9/25/2012	<0.0250	---	---	---	0.169	---	---	---	---	<0.0250	---	0.462
	11/13/2012	<0.0500	<0.0250	<0.0500	<0.0250	0.039	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	0.169
	3/11/2013	0.576	---	---	---	0.070	---	---	---	---	<0.0250	---	0.442
	6/11/2013	0.167	---	---	---	0.079	---	---	---	---	<0.0250	---	0.239
	8/27/2013	<0.100	---	---	---	0.030	---	---	---	---	<0.0250	---	0.161
	11/20/2013	<0.0500	<0.0250	<0.0250	<0.0250	<0.0240	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	0.119
	3/24/2014	<0.0500	---	---	---	<0.0240	---	---	---	---	<0.0250	---	0.102
	6/13/2014	<0.0500	---	---	---	<0.0240	---	---	---	---	<0.0250	---	0.055
	8/22/2014	<0.0250	---	---	---	<0.0240	---	---	---	---	<0.0250	---	0.113
	11/20/2014	<0.0500	<0.0250	<0.0250	<0.0250	0.032	<0.0250	<0.0250	<0.0250	<0.0500	<0.0250	<0.0250	0.146
	3/23/2015	0.087	---	---	---	0.049	---	---	---	---	<0.0250	---	0.265
	6/15/2015	0.044	---	---	---	<0.0480	---	---	---	---	<0.0250	---	0.316
	9/1/2015	<0.0100	---	---	---	0.049	---	---	---	---	<0.0250	---	0.387
	11/19/2015	<0.100	<0.0500	<0.0250	<0.0250	<0.0240	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0236	0.167
	11/1/2016	0.178	<0.0250	<0.0250	<0.0250	0.145	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	1.27

Notes:
Concentrations reported are the average of primary and duplicate sample analytical results.
ppb - parts per billion
µg/L - micrograms per liter
--- - Not Analyzed
UA - Upper Alluvium.
LA - Lower Alluvium.
Opg - Platteville Limestone.
Os - St. Peter Sandstone.

Table 3-3

Mann-Kendall Trend Test Summary - Monitoring Wells
PFOS, PFBS, PFOA, PFBA and PFHS
Groundwater Analytical Data
Oakdale Site

		PFOS		PFBS		PFOA		PFBA		PFHS	
Well ID	Unit Monitored	Number of Data Points	Trend	Number of Data Points	Trend	Number of Data Points	Trend	Number of Data Points	Trend	Number of Data Points	Trend
RW37	Upper Alluvium	21	NS[3]	20	ND	21	NS	19	NS	7	NS[3]
W205	Upper Alluvium	22	Decreasing	21	Decreasing[2]	22	Decreasing	19	NS	8	NS
W26 and W26R[1]	Upper Alluvium	13	Decreasing	13	Decreasing	13	Decreasing	10	Decreasing	3	NA
W33	Upper Alluvium	21	NS	21	Decreasing	22	NS	19	Decreasing	7	NS
RW38	Lower Alluvium	20	NS	19	ND	20	NS	19	Increasing	6	ND
W2007	Lower Alluvium	6	NS	6	NS	6	NS	6	NS	0	NA
PW7	Upper and Lower Alluvium	8	Increasing	7	NS	8	Increasing	7	Decreasing	6	NS
PL41	Platteville	21	NS	19	ND	21	NS	19	NS	7	ND
W8	Platteville	21	Increasing	20	ND	21	Increasing	19	Increasing	7	NS
SP42	St. Peter	21	NS	19	ND	21	NS	19	NS	7	ND

Notes:
Results are for the Mann-Kendall test for trend at a significance level of 0.05
NA = Not applicable, < five data points available, therefore the Mann-Kendall test was not applied.
ND = ≥ 75% of results are less than Laboratory Quantitation Limit (LQL) and at least the last four results are also less than the LQL.
NS = No statistically significant trend identified
Trend analysis data range = March 2005 through December 2016.
The Mann-Kendall test was applied to wells with five or more data points available.
[1]Monitoring well W26 was abandoned in November 2010 due to soil excavation activities in the area. Replacement well W26R was installed after soil excavation activities were completed.
[2]Previously no statistically significant trend identified (i.e., Mann-Kendall results presented in 2015 Annual PFC Report).
[3]Previously decreasing trend identified (i.e., Mann-Kendall results presented in 2015 Annual PFC Report).

Table 3-4

Mann-Kendall Trend Test Summary - Pumpout Wells
PFOS, PFBS, PFOA, PFBA and PFHS
Groundwater Analytical Data
Oakdale Site

	PFOS		PFBS		PFOA		PFBA		PFHS	
Well ID	Number of Data Points	Trend	Number of Data Points	Trend	Number of Data Points	Trend	Number of Data Points	Trend	Number of Data Points	Trend
PW1	8	NS	7	NS	8	NS	7	NS	6	NS
PW2	8	NS	7	NS	8	Increasing	7	Increasing	6	NS
PW3	8	NS	7	NS	8	Decreasing	7	NS	6	NS
PW4	8	NS	7	NS	8	NS	7	NS	6	NS
PW6	8	Increasing	7	NS	8	NS	7	NS	6	NS
PW10	8	NS[3]	7	NS	8	NS	7	Decreasing	6	NS
PW11	8	Increasing	7	NS	8	Increasing	7	NS	6	NS
PW14	7	NS	6	NS	7	Decreasing[1]	7	NS	5	NS
PW15	7	Decreasing	6	Decreasing[1]	7	Decreasing	7	Decreasing	5	NS
PW16	7	NS	6	NS	7	NS	7	NS	5	NS
PW17	7	Increasing[1]	6	NS	7	NS	7	NS	5	NS
PW18	7	NS	6	NS	7	Decreasing[1]	7	NS	5	NS
PW19	7	Decreasing[1]	6	Decreasing[1]	7	Decreasing[1]	7	NS[3]	5	Decreasing
PW20	7	NS	6	NS	7	NS	7	NS	5	NS
PW21	7	Decreasing[2]	6	Decreasing	7	Decreasing	7	Decreasing	5	Decreasing
PW22	7	NS	6	NS	7	NS	7	NS	5	NS
PW23	7	NS	6	NS	7	NS	7	Decreasing[1]	5	NS
PW24	7	NS	6	Decreasing[1]	7	Decreasing[1]	7	NS	5	NS
PW25	7	NS	6	NS	7	NS	7	NS	5	NS
PW26	7	NS	7	NS[2]	7	NS	7	Increasing	5	NS

Notes:
Results are for the Mann-Kendall test for trend at a significance level of 0.05
NS = No statistically significant trend identified
Trend analysis data range = March 2005 through December 2016.
The Mann-Kendall test was applied to wells with five or more data points available.
[1]Previously no statistically significant trend identified (i.e., Mann-Kendall results presented in 2015 Annual PFC Report)
[2]Previously increasing trend identified (i.e., Mann-Kendall results presented in 2015 Annual PFC Report).
[3]Previously decreasing trend identified (i.e., Mann-Kendall results presented in 2015 Annual PFC Report).

Table 3-5
Summary of Oakdale PFC Surface Water Analytical Data (2010-2016)
Oakdale Disposal Site
Oakdale, MN

Location	Date	PFBA (µg/L)	PFOA (µg/L)	PFBS (µg/L)	PFOS (µg/L)
Raleigh Creek - Surface Water					
SW01	11/17/2010	0.782	1.43	NA	4.00
	3/13/2012	0.860	0.847	0.029	3.92
	6/13/2012	---	---	---	---
	9/25/2012	---	---	---	---
	11/14/2012	---	---	---	---
	3/12/2013	---	---	---	---
	6/13/2013	0.630	1.97	0.056	6.63
	8/27/2013	---	---	---	---
	11/25/2013	---	---	---	---
	3/25/2014	---	---	---	---
	6/14/2014	0.586	2.00	0.048	6.39
	8/22/2014	0.437	0.425	0.027	1.71
	11/18/2014	---	---	---	---
	3/23/2015	---	---	---	---
	6/16/2015	0.549	1.21	0.031	4.43
	9/1/2015	0.414	1.01	<0.0250	4.99
	11/20/2015	0.727	1.90	0.048	4.54
	11/3/2016	0.798	1.55	0.063	3.47
SW12	11/17/2010	0.805	1.17	NA	2.35
	3/13/2012	0.435	0.361	<0.025	1.17
	6/13/2012	---	---	---	---
	9/25/2012	---	---	---	---
	11/14/2012	---	---	---	---
	3/12/2013	---	---	---	---
	6/13/2013	0.545	1.16	0.036	3.38
	8/27/2013	---	---	---	---
	11/25/2013	---	---	---	---
	3/25/2014	---	---	---	---
	6/14/2014	0.726	1.69	0.047	5.44
	8/22/2014	0.868	0.791	0.033	3.10
	11/18/2014	---	---	---	---
	3/23/2015	0.806	0.572	<0.0250	1.47
	6/16/2015	0.650	1.02	<0.0250	3.52
	9/1/2015	0.658	0.866	<0.0250	3.02
	11/20/2015	0.709	1.75	0.046	3.52
	11/3/2016	0.684	0.992	0.037	2.40

Table 3-5 (cont'd)
Summary of Oakdale PFC Surface Water Analytical Data (2010-2016)
Oakdale Disposal Site
Oakdale, MN

Location	Date	PFBA (µg/L)	PFOA (µg/L)	PFBS (µg/L)	PFOS (µg/L)
Raleigh Creek - Surface Water					
SW13	11/17/2010	0.761	1.00	NA	2.00
	3/13/2012	0.323	0.257	<0.025	0.933
	6/13/2012	---	---	---	---
	9/25/2012	---	---	---	---
	11/14/2012	---	---	---	---
	3/12/2013	---	---	---	---
	6/13/2013	0.434	0.821	<0.0250	2.88
	8/27/2013	---	---	---	---
	11/25/2013	---	---	---	---
	3/25/2014	---	---	---	---
	6/14/2014	0.666	1.53	0.041	4.76
	8/22/2014	0.684	0.728	0.030	2.81
	11/18/2014	---	---	---	---
	3/23/2015	---	---	---	---
	6/16/2015	0.562	0.974	<0.0250	3.92
	9/1/2015	0.580	0.817	<0.0250	3.11
	11/20/2015	0.597	1.36	0.037	2.72
	11/3/2016	0.569	0.820	0.033	2.35
SW14	11/17/2010	0.644	0.779	NA	1.54
	3/13/2012	0.166	0.012	<0.025	0.965
	6/13/2012	---	---	---	---
	9/25/2012	---	---	---	---
	11/14/2012	---	---	---	---
	3/12/2013	---	---	---	---
	6/13/2013	0.294	0.341	<0.0250	1.16
	8/27/2013	---	---	---	---
	11/25/2013	---	---	---	---
	3/25/2014	---	---	---	---
	6/14/2014	0.540	1.17	0.037	3.91
	8/22/2014	---	---	---	---
	11/18/2014	---	---	---	---
	3/23/2015	---	---	---	---
	6/16/2015	---	---	---	---
	9/1/2015	---	---	---	---
	11/20/2015	0.569	1.31	0.038	2.56
	11/3/2016	---	---	---	---

Table 3-5 (cont'd)
Summary of Oakdale PFC Surface Water Analytical Data (2010-2016)
Oakdale Disposal Site
Oakdale, MN

Location	Date	PFBA (µg/L)	PFOA (µg/L)	PFBS (µg/L)	PFOS (µg/L)
Raleigh Creek - Surface Water					
SW15	11/17/2010	0.570	0.686	NA	1.33
	3/13/2012	0.132	0.079	<0.025	0.591
	6/13/2012	---	---	---	---
	9/25/2012	---	---	---	---
	11/14/2012	---	---	---	---
	3/12/2013	---	---	---	---
	6/13/2013	0.309	0.586	<0.0250	2.18
	8/27/2013	---	---	---	---
	11/25/2013	---	---	---	---
	3/25/2014	---	---	---	---
	6/14/2014	---	---	---	---
	8/22/2014	---	---	---	---
	11/18/2014	---	---	---	---
	3/23/2015	---	---	---	---
	6/16/2015	---	---	---	---
	9/1/2015	---	---	---	---
	11/20/2015	0.524	1.20	0.032	2.04
	11/3/2016	---	---	---	---
SW16	11/17/2010	0.553	0.626	NA	1.22
	3/13/2012	0.098	0.041	<0.025	0.388
	6/13/2012	---	---	---	---
	9/25/2012	---	---	---	---
	11/14/2012	---	---	---	---
	3/12/2013	---	---	---	---
	6/13/2013	0.197	0.261	<0.0250	0.950
	8/27/2013	---	---	---	---
	11/25/2013	---	---	---	---
	3/25/2014	---	---	---	---
	6/14/2014	0.085	<0.0240	<0.0250	<0.0232
	8/22/2014	0.076	<0.0240	<0.0250	<0.0232
	11/18/2014	---	---	---	---
	3/23/2015	---	---	---	---
	6/16/2015	---	---	---	---
	9/1/2015	<0.100	<0.0240	<0.0250	<0.0232
	11/20/2015	0.261	0.370	<0.0250	0.722
	11/3/2016	0.076	<0.0240	<0.0250	<0.0232

NA = Not analyzed

µg/L = Micrograms per liter.

--- = Surface water samples could not be collected as sampling locations were either frozen or dry.

Table 3-6

Mann-Kendall Trend Test Summary - Surface Water
PFOS, PFBS, PFOA, PFBA and PFHS
Surface Water Analytical Data
Oakdale Site

Location ID	PFOS		PFBS		PFOA		PFBA		PFHS	
	Number of Data Points	Trend	Number of Data Points	Trend	Number of Data Points	Trend	Number of Data Points	Trend	Number of Data Points	Trend
SW01	10	NS	9	NS	10	NS	9	NS	3	NA
SW12	10	NS	9	NS	10	NS	10	NS	2	NA
SW13	9	NS	8	NS	9	NS	9	NS	2	NA
SW14	5	NS	4	NA	5	NS	5	NS	1	NA
SW16	9	NS	8	ND	9	NS	9	NS	2	NA

Notes:
Results are for the Mann-Kendall test for trend at a significance level of 0.05
NA = Not applicable, < five data points available, therefore the Mann-Kendall test was not applied.
ND = ≥ 75% of results are less than Laboratory Quantitation Limit (LQL) and at least the last four results are also less than the LQL.
NS = No statistically significant trend identified
Trend analysis data range = March 2005 through December 2016.
The Mann-Kendall test was applied to wells with five or more data points available.

4. GROUNDWATER PUMPOUT TREATMENT SYSTEM OPERATION AND MAINTENANCE

4.1 FLOW DATA

Groundwater pumpout system flow data are summarized in Table 4-1. The average operational pumping rate for the pumpout system in 2016 was approximately 68 gpm, based on a 24/7 continuous operation.

Approximately 36 million gallons of water were removed by the groundwater pumpout system in 2016. As shown in Table 4-1, the 3Q2016 and 4Q2016 flow totals were higher compared to the 1Q2016 and 2Q2016. Above normal precipitation that occurred in the Site area during the third and fourth quarters that provided higher recharge to the alluvium aquifer is the likely reason for higher pumping rates in these quarters. In the third and fourth quarters in 2016, 28.8 in. of precipitation was recorded in the Site area compared to an average of 18.3 in. (www.climate.umn.edu). The individual monthly discharge reports for the Site are included in Appendix A. These monthly reports include the discharge of City Water as well as the treated pumpout water.

4.2 WELL OPERATION MAINTENANCE

Regular maintenance/rehabilitation is performed, as needed, to reduce the amounts of biological growth and particulate matter that accumulate in the pumpout wells and discharge lines to maximize total operational running times for each pumpout well. This maintenance and cleaning is typically performed once per year, although it may occur more frequently if operating parameters (i.e., flow) indicate it may be needed. The complete rehabilitation of the pumpout wells was performed in November 2016. The well maintenance/rehabilitation performed in pumpout wells PW1, PW2, PW3, PW4, PW10, PW11, PW14, PW20, PW22, PW23 and PW24 consisted of the following:

- Removing and cleaning of the pump in each well;
- Treating each well using an appropriate volume (as recommended by the manufacturer) of specialty chemicals to remove iron and a biological growth;

- Using a surge block within the screened interval of each well for approximately 30 minutes to disperse the chemicals;
- Flushing the piping between each well and the treatment building using a combination of compressed air and water;
- Re-installing each submersible pump in the pumpout wells;
- Restarting the pumps in each well while containerizing the water affected by the chemical solution until the pH of the discharge water returned to normal;
- Adding the necessary amount of buffer to adjust the pH of the containerized water prior to disposal to the MCES sewer system;
- Removing sediment from each well was performed during the well rehab program. Pumpout wells PW1, PW2, PW3, PW4, PW10, PW11, PW22, PW23 and PW24 contained a significant amount of sediment that was removed.
- The pumps and drop pipe in the remaining pumpout wells were inspected (PW6, PW14 through PW21, and PW25 and PW26), but no significant bacterial growth or particulate matter was observed. In addition, depth-to-groundwater measurements collected in these wells indicated no significant decline in performance. Therefore, no maintenance activities were required to be performed in these pumpout wells during 2016.

4.3 TREATMENT SYSTEM OPERATIONS AND MAINTENANCE

The groundwater treatment vessels and equipment provide equalization, chemical conditioning, aeration, clarification, granular activated carbon adsorption, and off-gas treatment. The system is operated automatically using a programmable logic controller; monitoring and maintenance are performed by the operator. Normal operation and maintenance activities that were performed during 2016 included:

- Regular inspections (4-5 days/week);
- Clarifier maintenance (leveling the sludge blanket, sludge wasting, monitoring sludge level and iron concentration);

- Building maintenance (as required);
- Replacement of activated carbon (performed four times during 2016);
- Cleaning and repair of chemical feed pumps;
- Cleaning of aerator (twice during 2016);
- Inspection of off-gas treatment bio-mound.

In addition to normal operator maintenance on the clarifier sludge blanket, floating sludge is occasionally removed, diluted and discharged.

Table 4-1
2016 Quarterly Flow Totals - Pumpout Wells
Oakdale Site

Total Flow (gallons)					
Well	**1st Quarter**	**2nd Quarter**	**3rd Quarter**	**4th Quarter**	**2016 Total**
PW1	83,862	103,282	132,113	115,755	435,012
PW2	218,030	431,870	299,813	288,972	1,238,685
PW3	79,194	65,265	52,666	51,904	249,029
PW4	403,723	326,841	648,655	498,396	1,877,615
PW6	1,488,290	1,229,900	1,282,160	1,373,270	5,373,620
PW10	9,952	8,552	8,973	8,360	35,837
PW11	6,892	545,923	610,201	625,972	1,788,988
PW14	338,977	331,656	321,867	223,929	1,216,429
PW15	1,217,594	1,465,517	953,550	1,091,715	4,728,376
PW16	508,599	825,095	894,742	753,311	2,981,747
PW17	454,622	256,460	833,100	756,699	2,300,881
PW18	576,798	697,507	697,063	778,124	2,749,492
PW19	575,926	315,652	806,542	859,953	2,558,073
PW20	308,628	184,773	220,631	185,782	899,814
PW21	129,682	176,671	343,589	417,722	1,067,664
PW22	104,918	125,938	132,276	112,946	476,078
PW23	80,221	84,860	112,939	86,417	364,437
PW24	15,030	14,624	9,465	16,953	56,072
PW25	1,243,910	1,249,200	1,069,651	830,998	4,393,759
PW26	89,418	213,346	470,103	481,371	1,254,238
All Pumpout Wells Total [1]	**7,934,266**	**8,652,932**	**9,900,099**	**9,558,549**	**36,045,846**

1 - Water pumped, treated and discharged to sewer.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 GROUNDWATER CAPTURE

The groundwater elevation contour maps (Figures 3-4 through 3-11) continue to demonstrate that the groundwater pumpout system is maintaining groundwater capture at the Site. Quarterly Site groundwater elevation data collected in 2016 indicates that the pumpout system remains effective at providing hydraulic gradient control laterally and vertically. The cone of depression in the groundwater surface is more pronounced in the north-central site area compared to the southeast Site area. In the southeast Site area, the higher transmissivity of the lower alluvium aquifer reduces the amount of drawdown in this unit. Groundwater flow within the lower alluvium aquifer is primarily horizontal while groundwater flow in the upper alluvium is primarily vertically downward toward the more transmissive lower alluvium aquifer. Due to its higher transmissivity, the lower alluvium acts as a drain for the overlying upper alluvium in the southeast area of the Site.

5.2 GROUNDWATER ANALYTICAL DATA

The following is a summary of the findings regarding the PFC groundwater analytical data through November 2016:

- PFC concentrations have significantly declined as shown in the groundwater analytical results for upper alluvium monitoring well W26R, located north of Highway 14. The Mann-Kendall statistical analysis results for well W26R indicate a statistically significant decreasing trend in PFOS, PFBS, PFOA and PFBA concentrations over time. The Mann-Kendall results for pumpout well PW26 indicates a statistically significant increasing trend in PFBA, and no statistically significant trend for PFOS, PFBS, PFOA and PFHS.

- PFC concentrations remain highest in the groundwater samples collected from upper alluvium monitoring well W33 and pumpout well PW10 in the central “isthmus” area of the Site. The low-permeability of the alluvial aquifer limits the migration of PFCs in the isthmus area. A decrease in PFC concentrations was

observed in the 2016 analytical results for well W33, and nearby pumpout wells PW22, PW23 and PW24, compared to historical data. The Mann-Kendall results for monitoring well W33 indicate a statistically significant decreasing trend in PFBS and PFBA concentrations, and no statistically significant trend identified for PFOS and PFOA. The Mann-Kendall results for pumpout wells PW10, PW22, PW23 and PW24 indicate no statistically significant trend except for the following: a statistically significant decreasing trend for PFBA in pumpout wells PW10 and PW23, and a statistically significant decreasing trend for PFBS and PFOA concentrations in pumpout well PW24.

- In the north-central area of the Site, total PFC concentrations were higher in pumpout wells PW4, PW6 and PW11 compared to total PFC concentrations in pumpout wells PW1, PW2 and PW3. No statistically significant trend was identified using the Mann-Kendall statistical method for these wells, except the following: PW2 - a statistically significant increasing trend for PFOA and PFBA; PW3 - a statistically significant decreasing trend for PFOA; PW6 - a statistically significant increasing trend for PFOS; PW11 - a statistically significant increasing trend for PFOA and PFOA.

- In the southeastern Site area, PFOS and PFOA concentrations have declined over time in monitoring well W205. The Mann-Kendall statistical results indicate a statistically significant decreasing trend for PFOS, PFBS and PFOA concentrations, and no statistically significant trend for PFBA or PFHS. Nearby pumpout wells PW14, PW15, PW16 and PW17 are effectively reducing PFC concentrations in groundwater in this area of the Site.

- PFCs remain in the low µg/L range in groundwater samples collected from the upper and lower alluvium monitoring wells RW37 and RW38, respectively, located in the southeastern corner of the Site. The Mann-Kendall statistical results indicate a statistically significant increasing PFBA trend for well RW38 although concentrations remain below 0.3 µg/L. No statistically significant trend or a “ND” was identified for the remaining PFCs in wells RW37 and RW38.

- PFCs also remain in the low µg/L range in groundwater samples collected from Platteville monitoring wells W8 and PL41. PFC concentrations have fluctuated over time at these wells, but the 2016 PFBA, PFOA and PFOS analytical results were lower compared to the previous sampling event performed in November 2015. The Mann-Kendall trend test results indicate either no statistically significant trend or a "ND" for PFCs in monitoring well PL41. In addition, a "ND" and no statistically significant trend for PFHS and PFBS, respectively, for monitoring well W8. A statistically significant increasing trend for PFBA, PFOA and PFOS was identified for monitoring well W8. The PFBA concentration in well W8 was less than 1.0 µg/L, and PFOS and PFOA concentrations were less than 0.4 µg/L in well W8 in the 2016 results.

- PFBA, PFOA and PFOS concentrations in 2016 were higher compared to November 2015 PFC concentrations in St. Peter Sandstone monitoring well SP42. PFBA and PFOA concentrations were within the historical range detected in well SP42 while the PFOS concentration was higher compared to the previous results. Historical PFBA, PFOA and PFOS analytical data for well SP42 have shown short-term fluctuations. Long-term PFC trends evaluated using the Mann-Kendall trend test indicate no statistically significant trend for PFOS, PFOA and PFBA concentrations. A "ND" was identified for PFBS and PFHS concentrations over time.

- Surface water samples for PFC analyses were collected at four of the six sampling locations during the annual sampling event performed in late October/early November 2016. No surface water flow was present at locations SW14 and SW15. In 2016, PFC concentrations in surface water are comparable to historical data. The Mann-Kendall results indicate either no statistically significant trend or "ND" for the PFC analytical results for surface water sampling locations SW01, SW12, SW13, SW14 and SW16. Insufficient data (i.e. < 5 sampling events) is available to provide a meaningful trend analysis for sampling location SW15.

5.3 OPERATIONAL EFFECTIVENESS FOR 2016

The average flow rate discharged through the groundwater treatment system in 2016 was 68 gpm, which is comparable to prior years. Discharge rates in the 3Q2016 and 4Q2016 were higher compared to the 1Q2016 and 2Q2016. The higher discharge rates in the 3Q2016 and 4Q2016 were likely attributable to higher recharge to the alluvium aquifer during this period due to above normal precipitation. The annual well maintenance/rehabilitation activities performed in November 2016 were successful in cleaning the pumpout wells and discharge piping. Additional well rehabilitation events were performed on an as needed basis to remove excessive iron buildup in several wells (e.g. PW1, PW11, PW22, PW23 and PW24).

5.4 FUTURE COURSE OF ACTION

As discussed in Section 3.1, the long-term operation of the groundwater pumpout network has created a pronounced depression in the groundwater surface immediately south of Highway 14. WESTON has reviewed the pumpout system effectiveness including evaluation of the groundwater elevation data, and believes that a reduction in pumping rates could be made while maintaining capture of the PFCs (and VOCs) at the Site. The concept of reducing the pumping rates at the Site has been discussed in multiple meetings with the MPCA and in previous correspondence.

As discussed in Section 3.2.2, a short-term aquifer testing program (to assess the viability of reducing pumping at the site) will not be performed until additional PFC analytical data is collected and these data indicate stable or declining PFC concentrations in wells W8 and PL41. MPCA will be informed when the short-term pumping tests will begin and when they are completed. The final results of the short-term pumping tests will be submitted to MPCA after completion of the tests.

The groundwater elevation monitoring and analytical sample collection for 2017 will continue in accordance with the January 25, 2011 Groundwater and Surface Water Sampling Plan. Regular maintenance will be performed on the pumpout wells as needed to maintain optimal performance. Based on our operating experience, iron removal and

cleaning will be conducted for the pumps and piping on an annual basis (at a minimum). Routine treatment plant operation and reporting will continue as outlined in Section 4.

6. REFERENCES

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APPENDIX A
2016 MONTHLY DISCHARGE REPORTS

Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380
610-701-3000 Fax 610-701-3186
www.westonsolutions.com

Feb uary 1, 201)

Ms. Jill Crisp
Util ty Clerk, City of Oakdale
158 4 Hadley A enue North
Oakdale, Minnesota 55128

RE: Januar 2016 Discharge Report
3M Oa dale Site

Dear Ms. Crisp:

On ehalf of 3 1, we are providing the January 20 16 discharg volumes to the sanitary sew er from the 3M Oakdale Disposal Site pump-ou t system in Table 1.

Please feel free to contact me (at 610-701-3676) or Denver Martin (at 715-222-7116) wit any questi ns or comments.

Very t uly yours,
WESTON SOLUTIONS, INC.

Dave Cairns
Project Scientist

c: Fred Ca npbell, MPCA
Justin Pettinelli, 3M
James Kotsmith, 3M

February 1, 2016

Table 1 – January 2016 Discharge Volume Summary
3M Oakdale Site, Oakdale, MN

Well Number	December 31, 2015 Meter Readings (gallons)	February 1, 2016 Meter Readings (gallons)	January 2016 Discharge Volume (gallons)
PW-1	2,539,504	2,560,868	21,364
PW-2	9,904,123	9,965,581	61,458
PW-3	1,353,170	1,382,091	28,921
PW-4	5,262,478	5,410,301	147,823
PW-6	10,240,300	10,802,420	562,120
PW-10	179,026	182,608	3,582
PW-11	9,645,551	9,645,609	58
PW-14	3,163,847	3,286,061	122,214
PW-15	5,579,432	6,013,836	434,404
PW-16	7,442,550	7,620,327	177,777
PW-17	9,038,421	9,218,128	179,707
PW-18	7,988,465	8,190,844	202,379
PW-19	10,519,243	10,722,321	203,078
PW-20	7,887,190	7,972,236	85,046
PW-21	7,859,944	7,899,837	39,893
PW-22	1,889,503	1,925,157	35,654
PW-23	991,861	1,018,257	26,396
PW-24	243,067	248,761	5,694
PW-25	8,641,130	9,078,170	437,040
PW-26	2,363,520	2,397,233	33,713
City Meter	5,709,907	5,838,221	128,314
		Total:	2,936,635

January 2016 operational days: 31

Weston Solutions, Inc.
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West Chester, Pennsylvania 19380
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www.westonsolutions.com

March 1, 2016

Ms. Jill Crisp
Utility Clerk, City of Oakdale
1584 Hadley Avenue North
Oakdale, Minnesota 55128

RE: February 2016 Discharge Report
3M Oakdale Site

Dear Ms. Crisp:

On behalf of 3M, we are providing the February discharge volumes to the sanitary sewer from the 3M Oakdale Disposal Site pump-out system in Table 1.

Please feel free to contact me (at 610-701-3676) or Denver Martin (at 715-222-7116) with any questions or comments.

Very truly yours,
WESTON SOLUTIONS, INC.

Dave Cairns
Project Scientist

c: Fred Campbell, MPCA
Justin Pettinelli, 3M
James Kotsmith, 3M
Denver Martin, WESTON

March 1, 2016

Table 1 – February 2016 Discharge Volume Summary
3M Oakdale Site, Oakdale, MN

Well Number	February 1, 2016 Meter Readings (gallons)	February 29, 2016 Meter Readings (gallons)	February 2016 Discharge Volume (gallons)
PW-1	2,560,868	2,591,949	31,081
PW-2	9,965,581	10,012,111	46,530
PW-3	1,382,091	1,405,401	23,310
PW-4	5,410,301	5,527,573	117,272
PW-6	10,802,420	11,265,810	463,390
PW-10	182,608	185,683	3,075
PW-11*	9,645,609	9,645,712	103
PW-14	3,286,061	3,384,460	98,399
PW-15	12,907,415	13,261,333	353,918
PW-16	7,620,327	7,793,274	172.947
PW-17	9,218,128	9,331,622	113,494
PW-18	8,190,844	8,384,341	193,497
PW-19	10,722,321	10,870,813	148,492
PW-20	7,972,236	8,077,737	105,501
PW-21	7,899,837	7,924,388	24,551
PW-22	1,925,157	1,947,995	22,838
PW-23	1,018,257	1,045,440	27,183
PW-24	248,761	253,591	4,830
PW-25	13,134,874	13,499,984	365,110
PW-26	2,397,233	2,420,963	23,730
City Meter	5,838,221	6,026,153	187,193
		Total:	2,527,183

February 2016 operational days: 28

*- Pumpout well PW-11 has an electrical issue that is scheduled to be repaired in March 2016.

Weston Solutions, Inc.
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West Chester, Pennsylvania 19380
610-701-3000 Fax 610-701-3186
www.westonsolutions.com

April 1, 2016

Ms. Jill Crisp
Utility Clerk, City of Oakdale
1584 Hadley Avenue North
Oakdale, Minnesota 55128

RE: March 2016 Discharge Report
3M Oakdale Site

Dear Ms. Crisp:

On behalf of 3M, we are providing the March discharge volumes to the sanitary sewer from the 3M Oakdale Disposal Site pump-out system in Table 1.

Please feel free to contact me (at 610-701-3676) or Denver Martin (at 715-222-7116) with any questions or comments.

Very truly yours,
WESTON SOLUTIONS, INC.

Dave Cairns
Project Scientist

c: Fred Campbell, MPCA
Justin Pettinelli, 3M
James Kotsmith, 3M
Denver Martin, WESTON

April 1, 2016

Table 1 – March 2016 Discharge Volume Summary
3M Oakdale Site, Oakdale, MN

Well Number	February 29, 2016 Meter Readings (gallons)	April 1, 2016 Meter Readings (gallons)	March 2016 Discharge Volume (gallons)
PW-1	2,591,949	2,623,366	31,417
PW-2	10,012,111	10,122,153	110,042
PW-3	1,405,401	1,432,364	26,963
PW-4	5,527,573	5,666,201	138,628
PW-6	11,265,810	11,728,590	462,780
PW-10	185,683	188,978	3,295
PW-11	9,645,712	9,652,443	6,731
PW-14	3,384,460	3,502,824	118,364
PW-15	13,261,333	13,690,578	429,245
PW-16	7,793,274	7,951,149	157,875
PW-17	9,331,622	9,493,043	161,421
PW-18	8,384,341	8,565,263	180,922
PW-19	10,870,813	11,095,169	224,356
PW-20	8,077,737	8,195,818	118,081
PW-21	7,924,388	7,989,626	65,238
PW-22	1,947,995	1,994,421	46,426
PW-23	1,045,440	1,072,082	26,642
PW-24	253,591	258,097	4,506
PW-25	13,499,984	13,937,744	437,760
PW-26	2,420,963	2,452,938	31,975
City Meter	6,026,153	6,125,582	99,429
		Total:	2,882,096

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Ma 2, 2016

Ms. Jill Crisp
Utility Clerk, City of Oakdale
1584 Hadley Avenue North
Oakdale, Minnesota 55128

RE: April 2016 Discharge Report
3M Oakdale Site

Dear Ms. Crisp:

On behalf of 3M, we are providing the April discharge volumes to the sanitary sewer from the 3M Oakdale Disposal Site pump-out system in Table 1.

Please feel free to contact me (at 610-701-3676) or Denver Martin (at 715-222-7116) with any questions or comments.

Very truly yours,
WESTON SOLUTIONS, INC.

Dave Cairns
Project Scientist

c: Fred Campbell, MPCA
Justin Pettinelli, 3M
James Kotsmith, 3M
Denver Martin, WESTON

May 2, 2016

Table 1 – April 2016 Discharge Volume Summary
3M Oakdale Site, Oakdale, MN

Well Number	April 1, 2016 Meter Readings (gallons)	May 1, 2016 Meter Readings (gallons)	April 2016 Discharge Volume (gallons)
PW-1	2,623,366	2,651,005	27,639
PW-2	10,122,153	10,300,549	178,396
PW-3	1,432,364	1,455,859	23,495
PW-4	5,666,201	5,746,733	80,532
PW-6	11,728,590	12,009,930	281,340
PW-10	188,978	191,957	2,979
PW-11	9,652,443	9,729,904	77,461
PW-14	3,502,824	3,615,895	113,071
PW-15	13,690,578	14,175,377	484,799
PW-16	7,951,149	8,128,925	177,776
PW-17	9,493,043	9,629,659	136,616
PW-18	8,565,263	8,724,348	159,085
PW-19	11,095,169	11,285,934	190,765
PW-20	8,195,818	8,298,338	102,520
PW-21	7,989,626	8,052,718	63,092
PW-22	1,994,421	2,044,574	50,153
PW-23	1,072,082	1,094,052	21,970
PW-24	258,097	264,020	5,923
PW-25	13,937,744	14,362,644	424,900
PW-26	2,452,938	2,506,291	53,353
City Meter	6,125,582	6,292,097	166,515
		Total:	2,655,865

April 2016 operational days: 30

Weston Solutions, Inc.
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Jun 2, 2016

Ms. Jill Crisp
Utility Clerk, City of Oakdale
1584 Hadley Avenue North
Oakdale, Minnesota 55128

RE: May 2016 Discharge Report
3M Oakdale Site

Dear Ms. Crisp:

On behalf of 3M, we are providing the May discharge volumes to the sanitary sewer from the 3M Oakdale Disposal Site pump-out system in Table 1.

Please feel free to contact me (at 610-701-3676) or Denver Martin (at 715-222-7116) with any questions or comments.

Very truly yours,
WESTON SOLUTIONS, INC.

Dave Cairns
Project Scientist

c: Fred Campbell, MPCA
Justin Pettinelli, 3M
James Kotsmith, 3M
Denver Martin, WESTON

June 2, 2016

Table 1 – May 2016 Discharge Volume Summary
3M Oakdale Site, Oakdale, MN

Well Number	May 1, 2016 Meter Readings (gallons)	May 31, 2016 Meter Readings (gallons)	May 2016 Discharge Volume (gallons)
PW-1	2,651,005	2,690,529	39,524
PW-2	10,300,549	10,441,559	141,010
PW-3	1,455,859	1,477,776	21,917
PW-4	5,746,733	5,809,247	62,514
PW-6	12,009,930	12,490,660	480,730
PW-10	191,957	194,759	2,802
PW-11	9,729,904	9,927,336	197,432
PW-14	3,615,895	3,726,357	110,462
PW-15	14,175,377	14,680,344	504,967
PW-16	8,128,925	8,407,308	278,383
PW-17	9,629,659	9,668,580	38,921
PW-18	8,724,348	8,973,730	249,382
PW-19	11,285,934	11,330,300	44,366
PW-20	8,298,338	8,350,129	51,791
PW-21	8,052,718	8,099,269	46,551
PW-22	2,044,574	2,081,152	36,578
PW-23	1,094,052	1,132,871	38,819
PW-24	264,020	269,393	5,373
PW-25	14,362,644	14,778,014	415,370
PW-26	2,506,291	2,554,207	47,916
City Meter	6,292,097	6,367,438	75,341
		Total:	2,890,149

May operational days: 29

Weston Solutions, Inc.
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July 1, 2016

Ms. Jill Crisp
Utility Clerk, City of Oakdale
1584 Hadley Avenue North
Oakdale, Minnesota 55128

RE: June 2016 Discharge Report
3M Oakdale Site

Dear Ms. Crisp:

On behalf of 3M, we are providing the June 2016 discharge volumes to the sanitary sewer from the 3M Oakdale Disposal Site pump-out system in Table 1.

Please feel free to contact me (at 610-701-3676) or Denver Martin (at 715-222-7116) with any questions or comments.

Very truly yours,
WESTON SOLUTIONS, INC.

Dave Cairns
Project Scientist

c: Fred Campbell, MPCA
Justin Pettinelli, 3M
James Kotsmith, 3M
Denver Martin, WESTON

July 1, 2016

Table 1 – June 2016 Discharge Volume Summary
3M Oakdale Site, Oakdale, MN

Well Number	May 31, 2016 Meter Readings (gallons)	June 30, 2016 Meter Readings (gallons)	June 2016 Discharge Volume (gallons)
PW-1	2,690,529	2,726,648	36,119
PW-2	10,441,559	10,554,023	112,464
PW-3	1,477,776	1,497,629	19,853
PW-4	5,809,247	5,993,042	183,795
PW-6	12,490,660	12,958,490	467,830
PW-10	194,759	197,530	2,771
PW-11	9,927,336	10,198,366	271,030
PW-14	3,726,357	3,834,480	108,123
PW-15	14,680,344	15,156,095	475,751
PW-16	8,407,308	8,776,244	368,936
PW-17	9,668,580	9,749,503	80,923
PW-18	8,973,730	9,262,770	289,040
PW-19	11,330,300	11,410,821	80,521
PW-20	8,350,129	8,380,591	30,462
PW-21	8,099,269	8,166,297	67,028
PW-22	2,081,152	2,120,359	39,207
PW-23	1,132,871	1,156,942	24,071
PW-24	269,393	272,721	3,328
PW-25	14,778,014	15,186,944	408,930
PW-26	2,554,207	2,666,284	112,077
City Meter	6,367,438	6,412,282	44,844
		Total:	3,227,438

June operational days: 30

Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380
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www.westonsolutions.com

August 1, 2016

Ms. Jill Crisp
Utility Clerk, City of Oakdale
1584 Hadley Avenue North
Oakdale, Minnesota 55128

RE: July 2016 Discharge Report
3M Oakdale Site

Dear Ms. Crisp:

On behalf of 3M, we are providing the July 2016 discharge volumes to the sanitary sewer from the 3M Oakdale Disposal Site pump-out system in Table 1.

Please feel free to contact me (at 610-701-3676) or Denver Martin (at 715-222-7116) with any questions or comments.

Very truly yours,
WESTON SOLUTIONS, INC.

Dave Cairns
Project Scientist

c: Fred Campbell, MPCA
Justin Pettinelli, 3M
James Kotsmith, 3M
Denver Martin, WESTON

August 1, 2016

Table 1 – July 2016 Discharge Volume Summary
3M Oakdale Site, Oakdale, MN

Well Number	June 30, 2016 Meter Readings (gallons)	August 1, 2016 Meter Readings (gallons)	July 2016 Discharge Volume (gallons)
PW-1	2,726,648	2,769,716	43,068
PW-2	10,554,023	10,669,358	115,335
PW-3	1,497,629	1,516,956	19,327
PW-4	5,993,042	6,243,218	250,176
PW-6	12,958,490	13,424,150	465,660
PW-10	197,530	200,448	2,918
PW-11	10,198,366	10,463,467	265,101
PW-14	3,834,480	3,944,307	109,827
PW-15	15,156,095	15,498,636	342,541
PW-16	8,776,244	9,144,909	368,665
PW-17	9,749,503	10,081,820	332,317
PW-18	9,262,770	9,547,436	284,666
PW-19	11,410,821	11,743,720	332,899
PW-20	8,380,591	8,413,895	33,304
PW-21	8,166,297	8,289,247	122,950
PW-22	2,120,359	2,173,480	53,121
PW-23	1,156,942	1,197,463	40,521
PW-24	272,721	277,898	5,177
PW-25	15,186,944	15,595,174	408,230
PW-26	2,666,284	2,844,928	178,644
City Meter	6,412,282	6,507,043	94,761
		Total:	3,869,208

July operational days: 31

Weston Solutions, Inc.
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September 1, 2016

Ms. Jill Crisp
Utility Clerk, City of Oakdale
1584 Hadley Avenue North
Oakdale, Minnesota 55128

RE: August 2016 Discharge Report
3M Oakdale Site

Dear Ms. Crisp:

On behalf of 3M, we are providing the August discharge volumes to the sanitary sewer from the 3M Oakdale Disposal Site pump-out system in Table 1.

Please feel free to contact me (at 610-701-3676) or Denver Martin (at 715-222-7116) with any questions or comments.

Very truly yours,
WESTON SOLUTIONS, INC.

Dave Cairns
Project Scientist

c: Fred Campbell, MPCA
Justin Pettinelli, 3M
James Kotsmith, 3M
Denver Martin, WESTON

September 1, 2016

Table 1 – August 2016 Discharge Volume Summary
3M Oakdale Site, Oakdale, MN

Well Number	August 1, 2016 Meter Readings (gallons)	August 31, 2016 Meter Readings (gallons)	August 2016 Discharge Volume (gallons)
PW-1	2,769,716	2,811,644	41,928
PW-2	10,669,358	10,766,603	97,245
PW-3	1,516,956	1,533,001	16,045
PW-4	6,243,218	6,438,458	195,240
PW-6	13,424,150	13,824,560	400,410
PW-10	200,448	203,324	2,876
PW-11	10,463,467	10,647,887	184,420
PW-14	3,944,307	4,043,958	99,651
PW-15	15,498,636	15,814,841	316,205
PW-16	9,144,909	9,426,307	281,398
PW-17	10,081,820	10,333,333	251,513
PW-18	9,547,436	9,766,046	218,610
PW-19	11,743,720	11,995,066	251,346
PW-20	8,413,895	8,485,357	71,462
PW-21	8,289,247	8,392,228	102,981
PW-22	2,173,480	2,214,847	41,367
PW-23	1,197,463	1,235,416	37,953
PW-24	277,898	282,018	4,120
PW-25	15,595,174	15,923,204	328,030
PW-26	2,844,928	2,992,200	147,272
City Meter	6,507,043	6,577,544	70,501
		Total:	3,160,573

August operational days: 29

Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380
610-701-3000 Fax 610-701-3186
www.westonsolutions.com

October 21, 2016

Ms. Jill Crisp
Utility Clerk, City of Oakdale
1584 Hadley Avenue North
Oakdale, Minnesota 55128

RE: Corrected September 2016 Discharge Report
3M Oakdale Site

Dear Ms. Crisp:

In the September 2016 discharge report sent in an email dated October 3, 2016, an incorrect total volume discharged from the 3M Oakdale Disposal Site to the sanitary sewer was reported. The correct total volume discharged in September 2016 was 3,152,625 gallons which is 7,948 gallons less than the value reported (3,160,573 gallons). This value has been corrected in the attached Table 1.

Please feel free to contact me (at 610-701-3676) or Denver Martin (at 715-222-7116) with any questions or comments.

Very truly yours,
WESTON SOLUTIONS, INC.

Dave Cairns
Project Scientist

c: Fred Campbell, MPCA
Justin Pettinelli, 3M
Denver Martin, WESTON

September 30, 2016

Table 1 – September 2016 Discharge Volume Summary
3M Oakdale Site, Oakdale, MN

Well Number	August 31, 2016 Meter Readings (gallons)	September 30, 2016 Meter Readings (gallons)	September 2016 Discharge Volume (gallons)
PW-1	2,811,644	2,858,761	47,117
PW-2	10,766,603	10,853,836	87,233
PW-3	1,533,001	1,550,295	17,294
PW-4	6,438,458	6,641,697	203,239
PW-6	13,824,560	14,240,650	416,090
PW-10	203,324	206,503	3,179
PW-11	10,647,887	10,808,567	160,680
PW-14	4,043,958	4,156,347	112,389
PW-15	15,814,841	16,109,645	294,804
PW-16	9,426,307	9,670,986	244,679
PW-17	10,333,333	10,582,603	249,270
PW-18	9,766,046	9,959,833	193,787
PW-19	11,995,066	12,217,363	222,297
PW-20	8,485,357	8,601,222	115,865
PW-21	8,392,228	8,509,886	117,658
PW-22	2,214,847	2,252,635	37,788
PW-23	1,235,416	1,269,881	34,465
PW-24	282,018	282,186	168
PW-25	15,923,204	16,256,595	333,391
PW-26	2,992,200	3,136,387	144,187
City Meter	6,577,544	6,694,589	117,045
		Total:	3,152,625

September operational days: 30

Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380
610-701-3000 Fax 610-701-3186
www.westonsolutions.com

November 2, 2016

Ms. Jill Crisp
Utility Clerk, City of Oakdale
1584 Hadley Avenue North
Oakdale, Minnesota 55128

RE: October 2016 Discharge Report
3M Oakdale Site

Dear Ms. Crisp:

On behalf of 3M, we are providing the October discharge volumes to the sanitary sewer from the 3M Oakdale Disposal Site pump-out system in Table 1.

Please feel free to contact me (at 610-701-3676) or Denver Martin (at 715-222-7116) with any questions or comments.

Very truly yours,
WESTON SOLUTIONS, INC.

Dave Cairns
Project Scientist

c: Fred Campbell, MPCA
Justin Pettinelli, 3M
James Kotsmith, 3M
Denver Martin, WESTON

November 2, 2016

Table 1 – October 2016 Discharge Volume Summary
3M Oakdale Site, Oakdale, MN

Well Number	September 30, 2016 Meter Readings (gallons)	November 1, 2016 Meter Readings (gallons)	October 2016 Discharge Volume (gallons)
PW-1	2,858,761	2,906,664	47,903
PW-2	10,853,836	10,937,321	83,485
PW-3	1,550,295	1,568,796	18,501
PW-4	6,641,697	6,853,101	211,404
PW-6	14,240,650	14,715,640	474,990
PW-10	206,503	209,547	3,044
PW-11	10,808,567	11,028,091	219,524
PW-14	4,156,347	4,273,922	117,575
PW-15	16,109,645	16,471,655	362,010
PW-16	9,670,986	9,969,822	298,836
PW-17	10,582,603	10,865,292	282,689
PW-18	9,959,833	10,197,923	238,090
PW-19	12,217,363	12,503,425	286,062
PW-20	8,601,222	8,705,070	103,848
PW-21	8,509,886	8,634,095	124,209
PW-22	2,252,635	2,290,462	37,827
PW-23	1,269,881	1,291,341	21,460
PW-24	282,186	285,785	3,599
PW-25	16,256,595	16,639,374	382,779
PW-26	3,136,387	3,282,853	146,466
City Meter	6,694,589	6,904,041	209,452
		Total:	3,673,753

October operational days: 30

Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380
610-701-3000 Fax 610-701-3186
www.westonsolutions.com

December 1, 2016

Ms. Jill Crisp
Utility Clerk, City of Oakdale
1584 Hadley Avenue North
Oakdale, Minnesota 55128

RE: November 2016 Discharge Report
3M Oakdale Site

Dear Ms. Crisp:

On behalf of 3M, we are providing the November discharge volumes to the sanitary sewer from the 3M Oakdale Disposal Site pump-out system in Table 1.

Please feel free to contact me (at 610-701-3676) or Denver Martin (at 715-222-7116) with any questions or comments.

Very truly yours,
WESTON SOLUTIONS, INC.

Dave Cairns
Project Scientist

c: Fred Campbell, MPCA
Justin Pettinelli, 3M
James Kotsmith, 3M
Denver Martin, WESTON

December 1, 2016

Table 1 – November 2016 Discharge Volume Summary
3M Oakdale Site, Oakdale, MN

Well Number	November 1, 2016 Meter Readings (gallons)	December 1, 2016 Meter Readings (gallons)	November 2016 Discharge Volume (gallons)
PW-1	2,906,664	2,944,064	37,400
PW-2	10,937,321	10,961,278	23,957
PW-3	1,568,796	1,587,406	18,610
PW-4	6,853,101	7,036,052	182,951
PW-6	14,715,640	15,153,630	437,990
PW-10	209,547	213,796	4,249
PW-11	11,028,091	11,225,301	197,210
PW-14	4,273,922	4,329,646	55,724
PW-15	16,471,655	16,755,228	283,573
PW-16	9,969,822	10,228,095	258,273
PW-17	10,865,292	11,108,528	243,236
PW-18	10,197,923	10,447,056	249,133
PW-19	12,503,425	12,913,120	409,695
PW-20	8,705,070	8,743,578	38,508
PW-21	8,634,095	8,764,451	130,356
PW-22	2,290,462	2,320,377	29,915
PW-23	1,291,341	1,326,620	35,279
PW-24	285,785	294,495	8,710
PW-25	16,639,374	16,922,344	282,970
PW-26	3,282,853	3,435,707	152,854
City Meter	6,904,041	7,352,245	448,204
		Total:	3,528,797

November operational days: 28.5

Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380
610-701-3000 Fax 610-701-3186
www.westonsolutions.com

December 30, 2016

Ms. Jill Crisp
Utility Clerk, City of Oakdale
1584 Hadley Avenue North
Oakdale, Minnesota 55128

RE: December 2016 Discharge Report
3M Oakdale Site

Dear Ms. Crisp:

On behalf of 3M, we are providing the December discharge volumes to the sanitary sewer from the 3M Oakdale Disposal Site pump-out system in Table 1.

Please feel free to contact me (at 610-701-3676) or Denver Martin (at 715-222-7116) with any questions or comments.

Very truly yours,
WESTON SOLUTIONS, INC.

Dave Cairns
Project Scientist

c: Fred Campbell, MPCA
Justin Pettinelli, 3M
James Kotsmith, 3M
Denver Martin, WESTON

December 30, 2016

Table 1 – December 2016 Discharge Volume Summary
3M Oakdale Site, Oakdale, MN

Well Number	December 1, 2016 Meter Readings (gallons)	December 30, 2016 Meter Readings (gallons)	December 2016 Discharge Volume (gallons)
PW-1	2,944,064	2,974,516	30,452
PW-2	10,961,278	11,142,808	181,530
PW-3	1,587,406	1,602,199	14,793
PW-4	7,036,052	7,140,093	104,041
PW-6	15,153,630	15,613,920	460,290
PW-10	213,796	214,863	1,067
PW-11	11,225,301	11,434,539	209,238
PW-14	4,329,646	4,380,276	50,630
PW-15	16,755,228	17,201,360	446,132
PW-16	10,228,095	10,424,297	196,202
PW-17	11,108,528	11,339,302	230,774
PW-18	10,447,056	10,737,957	290,901
PW-19	12,913,120	13,077,316	164,196
PW-20	8,743,578	8,787,004	43,426
PW-21	8,764,451	8,927,608	163,157
PW-22	2,320,377	2,365,581	45,204
PW-23	1,326,620	1,356,298	29,678
PW-24	294,495	299,139	4,644
PW-25	16,922,344	17,087,593	165,249
PW-26	3,435,707	3,617,758	182,051
City Meter	7,352,245	7,678,955	326,710
		Total:	3,340,365

December operational days: 30

APPENDIX B
SUMMARY OF WELL CONSTRUCTION INFORMATION

Summary of Well Information
Former Oakdale Disposal Site
Oakdale, MN

Well ID	MDH Unique Well Number	TOC Elevation (ft MSL)	Depth to Top of Screen* (ft BGS)	Depth to Bottom of Screen* (ft BGS)	Total Depth* (ft BGS)	Well Diameter/ Casing Material*	Aquifer	Northing (UTM meters)	Easting (UTM meters)
APZ44	---	1011.76	5	15	15	2" PVC	Upper Alluvium	4982851	502295
APZ45	---	995.52	5	15	15	2" PVC	Upper Alluvium	4982418	502752
APZ46	---	998.57	5	15	15	2" PVC	Upper Alluvium	4982265	502728
APZ47	---	1004.63	10	20	20	2" PVC	Upper Alluvium	4982194	502602
APZ48	---	1000.02	5	15	15	2" PVC	Upper Alluvium	4982338	502573
APZ49	---	999.25	5	15	15	2" PVC	Upper Alluvium	4982268	502504
APZ50	---	1004.65	5	15	15	2" PVC	Upper Alluvium	4982380	502373
GPPZ23	---	998.32	33	38	38	1" PVC	Lower Alluvium	4982393	502461
PC45 (ABD)	737655	1011.08	284.4	294.4	294.4	2" SS	Prairie du Chien	4981485	501958
PL41	737656	1003.74	71.4	81.4	81.4	2" SS	Platteville	4982165	502761
PW1	403786	1017.09	6	83	83	6" SS	Upper Alluvium, Lower Alluvium	4982637	502033
PW2	403787	1021.51	5.5	91	91	6" SS	Upper Alluvium, Lower Alluvium	4982607	502079
PW3	403788	1018.66	6	67	67	6" SS	Upper Alluvium, Lower Alluvium	4982635	502127
PW4	403789	1017.23	6	79	79	6" SS	Upper Alluvium, Lower Alluvium	4982605	502175
PW6	403791	1003.75	6	51	51	6" SS	Upper Alluvium, Lower Alluvium	4982600	502260
PW7	403792	1007.75	6	46	46	6" SS	Upper Alluvium, Lower Alluvium	4982637	502313
PW8	403793	1007.64	6	52.5	52.5	6" SS	Upper Alluvium, Lower Alluvium	4982608	502356
PW9	403794	1005.59	6	29	29	6" SS	Upper Alluvium, Lower Alluvium	4982638	502391
PW10	403795	1000.37	6	32	32	6" SS	Upper Alluvium, Lower Alluvium	4982392	502437
PW11	403796	1006.12	6	68	68	6" SS	Upper Alluvium, Lower Alluvium	4982570	502193
PW14	761336	995.40	15.4	30.4	30.4	6" SS	Lower Alluvium	4982360	502772
PW15	761337	995.60	20.9	50.9	50.9	6" SS	Lower Alluvium	4982413	502718
PW16	761338	996.18	19.1	39.1	39.1	6" SS	Lower Alluvium	4982371	502698
PW17	761339	996.75	18.6	38.6	38.6	6" SS	Lower Alluvium	4982327	502659
PW18	761340	996.86	17	57	57	6" SS	Lower Alluvium	4982347	502599
PW19	761341	1000.53	28.9	53.9	53.9	6" SS	Lower Alluvium	4982331	502564
PW20	761342	1000.24	31.5	51.5	51.5	6" SS	Lower Alluvium	4982337	502524
PW21	761343	998.41	37.5	57.5	57.5	6" SS	Lower Alluvium	4982282	502502
PW22	761344	998.47	15	25	25	6" SS	Lower Alluvium	4982354	502475
PW23	761345	1000.75	32.2	57.2	57.2	6" SS	Lower Alluvium	4982429	502440
PW24	761346	999.42	12.7	32.7	32.7	6" SS	Lower Alluvium	4982431	502390
PW25	761347	1003.21	20.2	60.2	60.2	6" SS	Lower Alluvium	4982230	502650
PW26	785569	1011.25	24.5	44.5	44.5	6" SS	Lower Alluvium	4982739	502314
RW37	727752	1005.03	5.28	15.28	15.28	4" SS	Upper Alluvium	4982157	502754
RW38	727753	1004.11	48.49	58.49	58.49	4" SS	Lower Alluvium	4982161	502745

Summary of Well Information (cont'd)
Former Oakdale Disposal Site
Oakdale, MN

Well ID	MDH Unique Well Number	TOC Elevation (ft MSL)	Depth to Top of Screen* (ft BGS)	Depth to Bottom of Screen* (ft BGS)	Total Depth* (ft BGS)	Well Diameter/ Casing Material*	Aquifer	Northing (UTM meters)	Easting (UTM meters)
SP42	737657	1004.34	115.17	125.17	125.17	2" SS	St. Peter Sandstone	4982167	502758
SP44 (ABD)	737654	1010.81	125.0	135.0	135.0	2" SS	St. Peter Sandstone	4981485	501962
W3		1003.05	NA	NA	94.7	4" CS (OH?)	Platteville	4982520	502512
W8		1015.50	NA	NA	97.4	4" CS (OH?)	Platteville	4982570	502028
W1103		NA	NA	NA	87.23 (TOC)[1]		Platteville	4983689	503213
W20		1016.64	15	25	25	2" SS	Upper Alluvium	4982748	502156
W2001		1007.18	31	33	33	2" SS	Lower Alluvium	4982648	502237
W2003		1000.90	50	52	52	2" SS	Lower Alluvium	4982542	502305
W2005		1007.47	41	43	43	2" SS	Lower Alluvium	4982382	502266
W2006		1007.32	62	64	64	2" SS	Lower Alluvium	4982645	502237
W2007		1021.94	44	46	46	2" SS	Lower Alluvium	4982735	502108
W2008		1001.42	60	62	62	2" SS	Lower Alluvium	4982543	502304
W2009		1001.33	35	37	37	2" SS	Lower Alluvium	4982396	502438
W2010		1006.99	74	76	76	2" SS	Lower Alluvium	4982382	502264
W2012		1016.29			53.87	2" SS	Lower Alluvium	4982579	502129
W203		1004.79	4	15	13.85	2" SS	Upper Alluvium	4982653	502451
W205		997.79	2	13	10.84	2" SS	Upper Alluvium	4982353	502698
W215		1007.30	7	15.5	15.5	2" SS	Upper Alluvium	4982383	502265
W217		1018.58	8.5	20	19.72	2" SS	Upper Alluvium	4982649	501898
W21R	785567	1017.48	9.90	19.9	19.9	2" PVC	Upper Alluvium	4982781	502275
W22		1019.44	19	29	27.57	2" SS	Upper Alluvium	4982733	502109
W23		1005.44	NA	NA	17.22	2" SS	Upper Alluvium	4982646	502238
W25		1000.37	0.5	12	11.09	2" SS	Upper Alluvium	4982520	502231
W26R	785568	1010.89	14.6	24.6	24.6	2" PVC	Upper Alluvium	4982735	502345
W28		1012.39	11	20.5	20.5	2" SS	Upper Alluvium	4982581	502059
W29		1016.97	17	25.5	25.5	2" SS	Upper Alluvium	4982622	502189
W30		1006.93	10	15	15	2" SS	Upper Alluvium	4982601	502357
W31		999.91	7	12	12	2" SS	Upper Alluvium	4982543	502306
W32		1003.09	5	15	15	2" SS	Upper Alluvium	4982485	502063
W33		1001.89	12	15.5	15.5	2" SS	Upper Alluvium	4982396	502433
W36		1016.87	NA	NA	22.84	2" SS	Upper Alluvium	4982581	502129
W6102	190335	992.70	94	105	105	4" OH	Platteville	4981766	501196
W6104		1001.23	NA	NA	102.89 (TOC)[1]	4" CS (OH?)	Platteville	4982031	501973
W6201		991.23	109	124	124	4" SS	St. Peter Sandstone	4981790	501197

Notes:

* - Information obtained from well completion reports.
ft BGS - Feet below ground surface.
ft MSL - Feet above mean sea level.
NA - Not Available
--- - Piezometers (do not require MDH #)
[1] - Total depth measured from Top of Casing.

CS - Carbon Steel
SS - Stainless Steel
OH - Open Hole
ABD - Abandoned

APPENDIX C
LABORATORY ANALYTICAL REPORT
OCTOBER/NOVEMBER 2016

Final Report

Analysis of Groundwater and Surface Water at the Oakdale Remediation Site
4th Quarter 2016 Sampling

Laboratory Request Number: ISO11-01-01-20

Report Date – Date of Last Signature

Testing Laboratory

3M Environment, Health, Safety and Sustainability
3M Environmental Laboratory
Building 260-5N-17
Maplewood, MN 55144-1000

Requester

Justin Pettinelli
3M Environment, Health, Safety and Sustainability
3M Building 224-5W-17
Saint Paul, MN 55144-1000
Phone: (651) 737-3481

The testing reported herein meets the requirements of ANSI/ISO/IEC 17025:2005 "General Requirements for the Competence of Testing and Calibration Laboratories", in accordance with the A2LA Certificate # 2052.01. Additionally, the laboratory's quality system has been audited and was determined to be in conformance with the EPA GLPs (40 CFR 792) by an independent assessment.

3M Environmental Laboratory

3M Environmental Laboratory Technical Director: William K. Reagen, Ph.D.
3M Principal Analytical Investigator: Susan Wolf
Report Author: Scott Porcher

Analytical Report ISO11-01-01-20

Analysis of Groundwater and Surface Water at the Oakdale Remediation Site
4th Quarter 2016 Sampling

Report Date: Date of Last Signature

1 Introduction/Summary

The 3M Environmental Laboratory prepared and analyzed groundwater and surface water samples collected by Weston Solutions personnel from the 3M Oakdale site. Samples were collected on October 31 – November 4, 2016. Samples were returned to the 3M Environmental Laboratory on November 4, 2016 on ice for the analysis of perfluorinated compounds under laboratory project number ISO11-01-01-20.

The 3M Environmental Laboratory prepared sample containers for thirty groundwater wells and six surface water locations at the Oakdale site. For each sampling location, a sample and sample duplicate was collected. Target analyte field matrix spikes (FMSs) were collected at select locations for each of the groundwater well type and surface water. Each empty container was marked with a "fill to here" line that corresponded to a final volume of 200 mL. Containers reserved for field matrix spikes were fortified with an appropriate matrix spike solution containing all analytes prior to being sent to the field for sample collection. All sample bottles were fortified with internal standards and surrogate recovery standards prior to being sent to the field for sample collection. No samples were collected from surface well locations SW14 or SW15.

Samples were prepared and analyzed for PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFNA, PFDA, PFUnA, PFDoA, PFBS, PFHS, PFOS, and the surrogate recovery standards [$^{13}C_3$]-PFBA, [$^{13}C_4$]-PFOA, [$^{13}C_2$]-PFUnA, and [$^{13}C_4$]-PFOS with the exception of W2007 and W26R. These locations were only analyzed for PFBA, PFOA, PFBS and PFOS and their appropriate surrogate recovery standards. All samples were analyzed using method ETS-8-044.3 "Method of Analysis for the Determination of Perfluorinated Compounds in Water by LC/MS/MS; Direct Injection Analysis". Internal standards were used to aid in the data quality objectives for select samples and analytes.

Table 1 summarizes the sample results using the analytical method identified above. All results for quality control samples prepared and analyzed with the samples will be reported and discussed elsewhere in this report.

The testing reported herein meets the requirements of ANSI/ISO/IEC 17025:2005 "General Requirements for the Competence of Testing and Calibration Laboratories", in accordance with the A2LA Certificate # 2052.01. Additionally, the laboratory's quality system has been audited and was determined to be in conformance with the EPA GLPs (40 CFR 792) by an independent assessment.

Table 1. Sample Results Summary [1]

		Sample Concentration (ng/mL)			
3M LIMS ID	**Sample Description**	**PFBA**	**PFOA**	**PFBS**	**PFOS**
ISO11-01-01-20-001	OKMN-GW-W2007-0-161103	1450	12.8	9.61	32.7
ISO11-01-01-20-001-DUP	OKMN-GW-W2007-DB-161103	1460	12.2	9.15	30.8
	Average	**1460 [2]**	**12.5**	**9.38**	**31.8**
	%RPD Sample/Sample Dup	**0.69**	**4.8**	**4.9**	**6.0**
ISO11-01-01-20-002	OKMN-GW-W26R-0-161102	5.02	26.0	0.692	296
ISO11-01-01-20-002-DUP	OKMN-GW-W26R-DB-161102	5.39	29.1	0.691	313
	Average	**5.21**	**27.6**	**0.692**	**305 [2]**
	%RPD Sample/Sample Dup	**7.1**	**11**	**0.14**	**5.6**

		Sample Concentration (ng/mL)											
3M LIMS ID	**Sample Description**	**PFBA**	**PFPeA**	**PFHxA**	**PFHpA**	**PFOA**	**PFNA**	**PFDA**	**PFUnA**	**PFDoA**	**PFBS**	**PFHS**	**PFOS**
ISO11-01-01-20-003	OKMN-GW-PW01-0-161103	51.6	6.58	11.2	7.12	25.0	0.0575	0.0330	<0.0250	<0.0250	1.99	2.72	33.2
ISO11-01-01-20-003-DUP	OKMN-GW-PW01-DB-161103	47.2	6.08	9.85	6.67	24.0	0.0543	0.0365	<0.0250	<0.0250	1.73	2.40	27.6
	Average	**49.4**	**6.33**	**10.5**	**6.90**	**24.5**	**0.0559**	**0.0348**	**<0.0250**	**<0.0250**	**1.86**	**2.56**	**30.4**
	%RPD Sample/Sample Dup	**8.9**	**7.9**	**13**	**6.5**	**4.1**	**5.7**	**10**	**NA**	**NA**	**14**	**13**	**18**
ISO11-01-01-20-004	OKMN-GW-PW02-0-161103	66.0	3.67	6.79	3.28	14.1	<0.0250	<0.0250	<0.0250	<0.0250	1.17	1.91	1.48
ISO11-01-01-20-004-DUP	OKMN-GW-PW02-DB-161103	61.2	3.58	6.30	3.25	12.7	<0.0250	<0.0250	<0.0250	<0.0250	1.05	1.80	1.51
	Average	**63.6**	**3.63**	**6.55**	**3.27**	**13.4**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**1.11**	**1.86**	**1.50**
	%RPD Sample/Sample Dup	**7.5**	**2.5**	**7.5**	**0.92**	**10**	**NA**	**NA**	**NA**	**NA**	**11**	**5.9**	**2.0**
ISO11-01-01-20-005	OKMN-GW-PW03-0-161103	39.3	9.84	19.7	8.70	59.2	0.108	0.0382	<0.0250	<0.0250	2.22	7.31	48.7
ISO11-01-01-20-005-DUP	OKMN-GW-PW03-DB-161103	39.9	9.27	19.9	8.68	57.6	0.105	0.0329	<0.0250	<0.0250	2.25	7.59	43.1
	Average	**39.6**	**9.56**	**19.8**	**8.69**	**58.4**	**0.107**	**0.0356**	**<0.0250**	**<0.0250**	**2.24**	**7.45**	**45.9**
	%RPD Sample/Sample Dup	**1.5**	**6.0**	**1.0**	**0.23**	**2.7**	**2.8**	**15**	**NA**	**NA**	**1.3**	**3.8**	**12**
ISO11-01-01-20-006	OKMN-GW-PW04-0-161103	78.5	7.20	22.7	9.87	60.9	0.129	0.0540	<0.0250	<0.0250	4.83	9.57	38.9
ISO11-01-01-20-006-DUP	OKMN-GW-PW04-DB-161103	81.8	7.33	22.6	10.2	60.2	0.114	0.0445	<0.0250	<0.0250	4.91	9.95	36.0
	Average	**80.2**	**7.27**	**22.7**	**10.0**	**60.6**	**0.122**	**0.0493**	**<0.0250**	**<0.0250**	**4.87**	**9.76**	**37.5**
	%RPD Sample/Sample Dup	**4.1**	**1.8**	**0.44**	**3.3**	**1.2**	**12**	**19**	**NA**	**NA**	**1.6**	**3.9**	**7.7**

NA = Not Applicable

(1) Reported results from samples prepared and analyzed by ETS-8-044.3 using internal standard calibration unless noted otherwise. The analytical data uncertainties associated with the reported results are as follows: PFBA ± 14%, PFPeA ± 15%, PFHxA ± 11%, PFHpA ± 12%, PFOA ± 11%, PFNA ± 15%, PFDA ± 16%, PFUnA ± 18%, PFDoA ± 16%, PFBS ± 13%, PFHS ± 17%, and PFOS ± 13%.

(2) Sample set prepared and analyzed by ETS-8-044.3 using external standard calibration. The analytical data uncertainties associated with the reported results are as follows: PFBA ± 21%, PFOA ± 23%, and PFOS ± 22%.

(3) The data uncertainty has been expanded for location PW23 for PFHpA to ±44% based on field matrix spike recovery. See section 4 of the report for additional information.

Table 1 continued. Sample Results Summary (1)

		Sample Concentration (ng/mL)											
3M LIMS ID	**Sample Description**	**PFBA**	**PFPeA**	**PFHxA**	**PFHpA**	**PFOA**	**PFNA**	**PFDA**	**PFUnA**	**PFDoA**	**PFBS**	**PFHS**	**PFOS**
ISO11-01-01-20-007	OKMN-GW-PW06-0-161103	92.1	9.12	25.3	13.0	98.9	0.364	0.318	<0.0250	<0.0250	5.95	21.1	121
ISO11-01-01-20-007-DUP	OKMN-GW-PW06-DB-161103	87.1	8.99	23.7	12.1	93.3	0.308	0.283	<0.0250	<0.0250	5.98	20.1	114
	Average	**89.6**	**9.06**	**24.5**	**12.6**	**96.1**	**0.336**	**0.301**	**<0.0250**	**<0.0250**	**5.97**	**20.6**	**118**
	%RPD Sample/Sample Dup	**5.6**	**1.4**	**6.5**	**7.2**	**5.8**	**17**	**12**	**NA**	**NA**	**0.50**	**4.9**	**6.0**
ISO11-01-01-20-008	OKMN-GW-PW07-0-161103	6.60	2.33	11.1	15.0	99.4	0.532	3.03	0.0625	<0.0250	0.752	12.4	154
ISO11-01-01-20-008-DUP	OKMN-GW-PW07-DB-161103	6.64	2.28	11.0	14.4	103	0.521	3.08	0.0573	<0.0250	0.740	12.1	158
	Average	**6.62**	**2.31**	**11.1**	**14.7**	**101**	**0.527**	**3.06**	**0.0599**	**<0.0250**	**0.746**	**12.3**	**156**
	%RPD Sample/Sample Dup	**0.60**	**2.2**	**0.90**	**4.1**	**3.6**	**2.1**	**1.6**	**8.7**	**NA**	**1.6**	**2.4**	**2.6**
ISO11-01-01-20-009	OKMN-GW-PW10-0-161103	307	35.5	92.5	120	874	6.19	1.93	0.0934	<0.0250	8.37	23.9	2060
ISO11-01-01-20-009-DUP	OKMN-GW-PW10-DB-161103	312	33.1	88.5	121	906	6.19	1.94	0.0914	<0.0250	8.08	23.3	2180
	Average	**310 (2)**	**34.3**	**90.5**	**121**	**890 (2)**	**6.19**	**1.94**	**0.0924**	**<0.0250**	**8.23**	**23.6**	**2120 (2)**
	%RPD Sample/Sample Dup	**1.6**	**7.0**	**4.4**	**0.83**	**3.6**	**0.0**	**0.52**	**2.2**	**NA**	**3.5**	**2.5**	**5.7**
ISO11-01-01-20-010	OKMN-GW-PW11-0-161103	99.1	12.4	35.4	19.0	123	0.376	0.125	<0.0250	<0.0250	7.11	15.0	137
ISO11-01-01-20-010-DUP	OKMN-GW-PW11-DB-161103	98.5	12.6	36.0	19.9	131	0.419	0.147	<0.0250	<0.0250	7.33	15.7	149
	Average	**98.8**	**12.5**	**35.7**	**19.5**	**127 (2)**	**0.398**	**0.136**	**<0.0250**	**<0.0250**	**7.22**	**15.4**	**143 (2)**
	%RPD Sample/Sample Dup	**0.61**	**1.6**	**1.7**	**4.6**	**6.3**	**11**	**16**	**NA**	**NA**	**3.0**	**4.6**	**8.4**
ISO11-01-01-20-011	OKMN-GW-PW14-0-161103	12.5	1.76	4.76	3.88	36.1	0.102	<0.0250	<0.0250	<0.0250	0.944	2.51	24.0
ISO11-01-01-20-011-DUP	OKMN-GW-PW14-DB-161103	12.3	1.73	4.80	3.88	39.2	0.108	<0.0250	<0.0250	<0.0250	0.944	2.50	25.6
	Average	**12.4**	**1.75**	**4.78**	**3.88**	**37.7**	**0.105**	**<0.0250**	**<0.0250**	**<0.0250**	**0.944**	**2.51**	**24.8**
	%RPD Sample/Sample Dup	**1.6**	**1.7**	**0.84**	**0.0**	**8.2**	**5.7**	**NA**	**NA**	**NA**	**0.0**	**0.40**	**6.5**
ISO11-01-01-20-012	OKMN-GW-PW15-0-161103	9.73	0.480	1.28	0.791	6.43	<0.0250	<0.0250	<0.0250	<0.0250	0.239	0.576	6.46
ISO11-01-01-20-012-DUP	OKMN-GW-PW15-DB-161103	9.84	0.514	1.34	0.766	5.96	<0.0250	<0.0250	<0.0250	<0.0250	0.230	0.575	5.58
	Average	**9.79**	**0.497**	**1.31**	**0.779**	**6.20**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**0.235**	**0.576**	**6.02**
	%RPD Sample/Sample Dup	**1.1**	**6.8**	**4.6**	**3.2**	**7.6**	**NA**	**NA**	**NA**	**NA**	**3.8**	**0.17**	**15**

NA = Not Applicable

(1) Reported results from samples prepared and analyzed by ETS-8-044.3 using internal standard calibration unless noted otherwise. The analytical data uncertainties associated with the reported results are as follows: PFBA ± 14%, PFPeA ± 15%, PFHxA ± 11%, PFHpA ± 12%, PFOA ± 11%, PFNA ± 15%, PFDA ± 16%, PFUnA ± 18%, PFDoA ± 16%, PFBS ± 13%, PFHS ± 17%, and PFOS ± 13%.

(2) Sample set prepared and analyzed by ETS-8-044.3 using external standard calibration. The analytical data uncertainties associated with the reported results are as follows: PFBA ± 21%, PFOA ± 23%, and PFOS ± 22%.

(3) The data uncertainty has been expanded for location PW23 for PFHpA to ±44% based on field matrix sp ke recovery. See section 4 of the report for additional information.

Table 1 continued. Sample Results Summary (1)

		Sample Concentration (ng/mL)											
3M LIMS ID	**Sample Description**	**PFBA**	**PFPeA**	**PFHxA**	**PFHpA**	**PFOA**	**PFNA**	**PFDA**	**PFUnA**	**PFDoA**	**PFBS**	**PFHS**	**PFOS**
ISO11-01-01-20-013	OKMN-GW-PW16-0-161103	11.2	1.20	3.40	2.87	27.3	0.0943	0.0334	<0.0250	<0.0250	0.697	1.93	29.5
ISO11-01-01-20-013-DUP	OKMN-GW-PW16-DB-161103	12.8	1.40	3.60	3.31	30.0	0.0936	0.0325	<0.0250	<0.0250	0.790	2.15	31.0
	Average	**12.0**	**1.30**	**3.50**	**3.09**	**28.7**	**0.0940**	**0.0330**	**<0.0250**	**<0.0250**	**0.744**	**2.04**	**30.3**
	%RPD Sample/Sample Dup	**13**	**15**	**5.7**	**14**	**9.4**	**0.75**	**2.7**	**NA**	**NA**	**13**	**11**	**5.0**
ISO11-01-01-20-014	OKMN-GW-PW17-0-161103	11.3	1.44	3.93	3.69	37.9	0.147	0.0792	<0.0250	<0.0250	1.12	3.36	39.3
ISO11-01-01-20-014-DUP	OKMN-GW-PW17-DB-161103	11.7	1.48	4.19	3.56	34.3	0.129	0.0698	<0.0250	<0.0250	1.14	3.02	35.7
	Average	**11.5**	**1.46**	**4.06**	**3.63**	**36.1**	**0.138**	**0.0745**	**<0.0250**	**<0.0250**	**1.13**	**3.19**	**37.5**
	%RPD Sample/Sample Dup	**3.5**	**2.7**	**6.4**	**3.6**	**10**	**13**	**13**	**NA**	**NA**	**1.8**	**11**	**9.6**
ISO11-01-01-20-015	OKMN-GW-PW18-0-161103	25.7	1.40	3.17	1.73	14.1	<0.0250	<0.0250	<0.0250	<0.0250	0.671	1.11	6.09
ISO11-01-01-20-015-DUP	OKMN-GW-PW18-DB-161103	25.6	1.43	3.14	1.64	13.5	<0.0250	<0.0250	<0.0250	<0.0250	0.674	1.13	5.84
	Average	**25.7**	**1.42**	**3.16**	**1.69**	**13.8**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**0.673**	**1.12**	**5.97**
	%RPD Sample/Sample Dup	**0.39**	**2.1**	**0.95**	**5.3**	**4.3**	**NA**	**NA**	**NA**	**NA**	**0.45**	**1.8**	**4.2**
ISO11-01-01-20-016	OKMN-GW-PW19-0-161103	30.2	1.25	2.79	1.08	5.26	<0.0250	<0.0250	<0.0250	<0.0250	0.369	0.282	2.82
ISO11-01-01-20-016-DUP	OKMN-GW-PW19-DB-161103	30.0	1.27	2.82	1.02	5.35	<0.0250	<0.0250	<0.0250	<0.0250	0.351	0.264	3.17
	Average	**30.1**	**1.26**	**2.81**	**1.05**	**5.31**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**0.360**	**0.273**	**3.00**
	%RPD Sample/Sample Dup	**0.66**	**1.6**	**1.1**	**5.7**	**1.7**	**NA**	**NA**	**NA**	**NA**	**5.0**	**6.6**	**12**
ISO11-01-01-20-017	OKMN-GW-PW20-0-161103	43.1	4.56	6.37	3.34	27.8	0.0617	0.0306	<0.0250	<0.0250	0.485	1.03	32.7
ISO11-01-01-20-017-DUP	OKMN-GW-PW20-DB-161103	43.8	4.70	6.56	3.26	26.5	0.0597	0.0280	<0.0250	<0.0250	0.497	1.04	34.2
	Average	**43.5**	**4.63**	**6.47**	**3.30**	**27.2**	**0.0607**	**0.0293**	**<0.0250**	**<0.0250**	**0.491**	**1.04**	**33.5**
	%RPD Sample/Sample Dup	**1.6**	**3.0**	**2.9**	**2.4**	**4.8**	**3.3**	**8.9**	**NA**	**NA**	**2.4**	**0.97**	**4.5**
ISO11-01-01-20-018	OKMN-GW-PW21-0-161103	4.75	0.233	0.584	0.182	0.864	<0.0250	<0.0250	<0.0250	<0.0250	0.0453	0.0291	0.229
ISO11-01-01-20-018-DUP	OKMN-GW-PW21-DB-161103	4.51	0.255	0.554	0.168	0.814	<0.0250	<0.0250	<0.0250	<0.0250	0.0474	0.0329	0.202
	Average	**4.63**	**0.244**	**0.569**	**0.175**	**0.839**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**0.0464**	**0.0310**	**0.216**
	%RPD Sample/Sample Dup	**5.2**	**9.0**	**5.3**	**8.0**	**6.0**	**NA**	**NA**	**NA**	**NA**	**4.5**	**12**	**13**

NA = Not Applicable

(1) Reported results from samples prepared and analyzed by ETS-8-044.3 using internal standard calibration unless noted otherwise. The analytical data uncertainties associated with the reported results are as follows: PFBA ± 14%, PFPeA ± 15%, PFHxA ± 11%, PFHpA ± 12%, PFOA ± 11%, PFNA ± 15%, PFDA ± 16%, PFUnA ± 18%, PFDoA ± 16%, PFBS ± 13%, PFHS ± 17%, and PFOS ± 13%.

(2) Sample set prepared and analyzed by ETS-8-044.3 using external standard calibration. The analytical data uncertainties associated with the reported results are as follows: PFBA ± 21%, PFOA ± 23%, and PFOS ± 22%.

(3) The data uncertainty has been expanded for location PW23 for PFHpA to ±44% based on field matrix sp ke recovery. See section 4 of the report for additional information.

Table 1 continued. Sample Results Summary (1)

		Sample Concentration (ng/mL)											
3M LIMS ID	**Sample Description**	**PFBA**	**PFPeA**	**PFHxA**	**PFHpA**	**PFOA**	**PFNA**	**PFDA**	**PFUnA**	**PFDoA**	**PFBS**	**PFHS**	**PFOS**
ISO11-01-01-20-019	OKMN-GW-PW22-0-161103	6.70	1.06	2.87	6.27	54.2	0.245	0.0676	<0.0250	<0.0250	0.358	1.40	163
ISO11-01-01-20-019-DUP	OKMN-GW-PW22-DB-161103	6.16	1.01	2.67	5.92	50.6	0.202	0.0558	<0.0250	<0.0250	0.316	1.26	137
	Average	**6.43**	**1.04**	**2.77**	**6.10**	**52.4**	**0.224**	**0.0617**	**<0.0250**	**<0.0250**	**0.337**	**1.33**	**150**
	%RPD Sample/Sample Dup	**8.4**	**4.8**	**7.2**	**5.7**	**6.9**	**19**	**19**	**NA**	**NA**	**12**	**11**	**17**
ISO11-01-01-20-020	OKMN-GW-PW23-0-161104	4.84	0.465	2.37	1.12	9.00	0.0418	0.0607	<0.0250	<0.0250	0.339	1.05	19.3
ISO11-01-01-20-020-DUP	OKMN-GW-PW23-DB-161104	5.35	0.492	2.34	1.07	8.79	0.0366	0.0556	<0.0250	<0.0250	0.337	1.02	18.3
	Average	**5.10 (2)**	**0.479**	**2.36**	**1.10 (3)**	**8.90 (2)**	**0.0392**	**0.0582**	**<0.0250**	**<0.0250**	**0.338**	**1.04**	**18.8 (2)**
	%RPD Sample/Sample Dup	**10**	**5.6**	**1.3**	**4.6**	**2.4**	**13**	**8.8**	**NA**	**NA**	**0.59**	**2.9**	**5.3**
ISO11-01-01-20-021	OKMN-GW-PW24-0-161103	20.3	1.48	3.17	2.07	18.7	0.0552	<0.0250	<0.0250	<0.0250	0.583	1.25	23.2
ISO11-01-01-20-021-DUP	OKMN-GW-PW24-DB-161103	21.2	1.41	3.22	2.13	18.4	0.0557	<0.0250	<0.0250	<0.0250	0.602	1.25	22.6
	Average	**20.8**	**1.45**	**3.20**	**2.10**	**18.6**	**0.0555**	**<0.0250**	**<0.0250**	**<0.0250**	**0.593**	**1.25**	**22.9**
	%RPD Sample/Sample Dup	**4.3**	**4.8**	**1.6**	**2.9**	**1.6**	**0.90**	**NA**	**NA**	**NA**	**3.2**	**0.0**	**2.6**
ISO11-01-01-20-022	OKMN-GW-PW25-0-161103	9.17	0.504	2.31	1.10	9.46	0.0385	0.0442	<0.0250	<0.0250	0.353	1.02	16.1
ISO11-01-01-20-022-DUP	OKMN-GW-PW25-DB-161103	9.51	0.514	2.41	1.17	9.41	0.0393	0.0417	<0.0250	<0.0250	0.375	1.05	17.5
	Average	**9.34**	**0.509**	**2.36**	**1.14**	**9.44**	**0.0389**	**0.0430**	**<0.0250**	**<0.0250**	**0.364**	**1.04**	**16.8**
	%RPD Sample/Sample Dup	**3.6**	**2.0**	**4.2**	**6.2**	**0.53**	**2.1**	**5.8**	**NA**	**NA**	**6.0**	**2.9**	**8.3**
ISO11-01-01-20-023	OKMN-GW-PW26-0-161103	33.9	4.46	9.36	5.14	27.3	0.0735	0.0389	<0.0250	<0.0250	2.45	8.23	25.0
ISO11-01-01-20-023-DUP	OKMN-GW-PW26-DB-161103	37.1	4.92	10.4	5.80	30.3	0.0784	0.0407	<0.0250	<0.0250	2.68	9.21	29.2
	Average	**35.5**	**4.69**	**9.88**	**5.47**	**28.8**	**0.0760**	**0.0398**	**<0.0250**	**<0.0250**	**2.57**	**8.72**	**27.1**
	%RPD Sample/Sample Dup	**9.0**	**9.8**	**11**	**12**	**10**	**6.5**	**4.5**	**NA**	**NA**	**9.0**	**11**	**15**
ISO11-01-01-20-024	OKMN-GW-W08-0-161031	0.847	0.0446	0.111	0.0382	0.186	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	0.385
ISO11-01-01-20-024-DUP	OKMN-GW-W08-DB-161031	0.907	0.0481	0.129	0.0441	0.203	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	0.0272	0.374
	Average	**0.877**	**0.0464**	**0.120**	**0.0412**	**0.195**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**0.0272**	**0.380**
	%RPD Sample/Sample Dup	**6.8**	**7.6**	**15**	**14**	**8.7**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**2.9**

NA = Not Applicable

(1) Reported results from samples prepared and analyzed by ETS-8-044.3 using internal standard calibration unless noted otherwise. The analytical data uncertainties associated with the reported results are as follows: PFBA ± 14%, PFPeA ± 15%, PFHxA ± 11%, PFHpA ± 12%, PFOA ± 11%, PFNA ± 15%, PFDA ± 16%, PFUnA ± 18%, PFDoA ± 16%, PFBS ± 13%, PFHS ± 17%, and PFOS ± 13%.

(2) Sample set prepared and analyzed by ETS-8-044.3 using external standard calibration. The analytical data uncertainties associated with the reported results are as follows: PFBA ± 21%, PFOA ± 23%, and PFOS ± 22%.

(3) The data uncertainty has been expanded for location PW23 for PFHpA to ±44% based on field matrix sp ke recovery. See section 4 of the report for additional information.

Table 1 continued. Sample Results Summary (1)

		Sample Concentration (ng/mL)											
3M LIMS ID	**Sample Description**	**PFBA**	**PFPeA**	**PFHxA**	**PFHpA**	**PFOA**	**PFNA**	**PFDA**	**PFUnA**	**PFDoA**	**PFBS**	**PFHS**	**PFOS**
ISO11-01-01-20-025	OKMN-GW-PL41-0-161031	0.811	0.0566	0.0749	<0.0250	0.0835	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	0.0831
ISO11-01-01-20-025-DUP	OKMN-GW-PL41-DB-161031	0.792	0.0465	0.0824	<0.0250	0.0717	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	0.0855
	Average	**0.802**	**0.0516**	**0.0787**	**<0.0250**	**0.0776**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**0.0843**
	%RPD Sample/Sample Dup	**2.4**	**20**	**9.5**	**NA**	**15**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**2.8**
ISO11-01-01-20-026	OKMN-GW-SP42-0-161101	0.177	<0.0250	<0.0250	<0.0250	0.148	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	1.18
ISO11-01-01-20-026-DUP	OKMN-GW-SP42-DB-161101	0.178	<0.0250	<0.0250	<0.0250	0.141	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	1.35
	Average	**0.178**	**<0.0250**	**<0.0250**	**<0.0250**	**0.145**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**1.27**
	%RPD Sample/Sample Dup	**0.56**	**NA**	**NA**	**NA**	**4.8**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**13**
ISO11-01-01-20-027	OKMN-GW-W33-0-161102	121	38.3	93.2	99.6	537	18.0	15.7	1.62	<0.0250	8.30	18.0	5090
ISO11-01-01-20-027-DUP	OKMN-GW-W33-DB-161102	118	35.6	91.0	97.5	515	17.4	14.6	1.60	<0.0250	7.78	16.4	5070
	Average	**120**	**37.0**	**92.1**	**98.6**	**526 (2)**	**17.7**	**15.2**	**1.61**	**<0.0250**	**8.04**	**17.2**	**5080 (2)**
	%RPD Sample/Sample Dup	**2.5**	**7.3**	**2.4**	**2.1**	**4.2**	**3.4**	**7.3**	**1.2**	**NA**	**6.5**	**9.3**	**0.39**
ISO11-01-01-20-028	OKMN-GW-W205-0-161031	5.00	0.465	0.995	1.34	16.9	0.152	0.0875	<0.0250	<0.0250	0.305	1.15	57.1
ISO11-01-01-20-028-DUP	OKMN-GW-W205-DB-161031	4.46	0.412	0.932	1.22	15.4	0.135	0.0763	<0.0250	<0.0250	0.277	0.983	55.4
	Average	**4.73**	**0.439**	**0.964**	**1.28**	**16.2**	**0.144**	**0.0819**	**<0.0250**	**<0.0250**	**0.291**	**1.07**	**56.3**
	%RPD Sample/Sample Dup	**11**	**12**	**6.5**	**9.4**	**9.3**	**12**	**14**	**NA**	**NA**	**9.6**	**16**	**3.0**
ISO11-01-01-20-029	OKMN-GW-RW37-0-161101	0.0674	<0.0250	<0.0250	<0.0250	0.105	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	3.59
ISO11-01-01-20-029-DUP	OKMN-GW-RW37-DB-161101	0.0699	<0.0250	<0.0250	<0.0250	0.109	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	3.56
	Average	**0.0687**	**<0.0250**	**<0.0250**	**<0.0250**	**0.107**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**3.58**
	%RPD Sample/Sample Dup	**3.6**	**NA**	**NA**	**NA**	**3.7**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.84**
ISO11-01-01-20-030	OKMN-GW-RW38-0-161101	0.220	<0.0250	<0.0250	<0.0250	0.0726	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	0.0819
ISO11-01-01-20-030-DUP	OKMN-GW-RW38-DB-161101	0.230	<0.0250	<0.0250	<0.0250	0.0728	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	0.0872
	Average	**0.225**	**<0.0250**	**<0.0250**	**<0.0250**	**0.0727**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**0.0846**
	%RPD Sample/Sample Dup	**4.4**	**NA**	**NA**	**NA**	**0.28**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**6.3**

NA = Not Applicable

(1) Reported results from samples prepared and analyzed by ETS-8-044.3 using internal standard calibration unless noted otherwise. The analytical data uncertainties associated with the reported results are as follows: PFBA ± 14%, PFPeA ± 15%, PFHxA ± 11%, PFHpA ± 12%, PFOA ± 11%, PFNA ± 15%, PFDA ± 16%, PFUnA ± 18%, PFDoA ± 16%, PFBS ± 13%, PFHS ± 17%, and PFOS ± 13%.

(2) Sample set prepared and analyzed by ETS-8-044.3 using external standard calibration. The analytical data uncertainties associated with the reported results are as follows: PFBA ± 21%, PFOA ± 23%, and PFOS ± 22%.

(3) The data uncertainty has been expanded for location PW23 for PFHpA to ±44% based on field matrix sp ke recovery. See section 4 of the report for additional information.

Table 1 continued. Sample Results Summary (1)

		Sample Concentration (ng/mL)											
3M LIMS ID	**Sample Description**	**PFBA**	**PFPeA**	**PFHxA**	**PFHpA**	**PFOA**	**PFNA**	**PFDA**	**PFUnA**	**PFDoA**	**PFBS**	**PFHS**	**PFOS**
ISO11-01-01-20-031	OKMN-SW-SW01-0-161103	0.819	0.0855	0.169	0.171	1.54	<0.0250	<0.0250	<0.0250	<0.0250	0.0655	0.149	3.45
ISO11-01-01-20-031-DUP	OKMN-SW-SW01-DB-161103	0.777	0.0786	0.174	0.172	1.55	<0.0250	<0.0250	<0.0250	<0.0250	0.0604	0.152	3.48
	Average	**0.798**	**0.0821**	**0.172**	**0.172**	**1.55**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**0.0630**	**0.151**	**3.47**
	%RPD Sample/Sample Dup	**5.3**	**8.4**	**2.9**	**0.58**	**0.65**	**NA**	**NA**	**NA**	**NA**	**8.1**	**2.0**	**0.87**
ISO11-01-01-20-032	OKMN-SW-SW12-0-161103	0.683	0.0484	0.132	0.108	1.02	<0.0250	<0.0250	<0.0250	<0.0250	0.0356	0.0899	2.40
ISO11-01-01-20-032-DUP	OKMN-SW-SW12-DB-161103	0.684	0.0572	0.117	0.113	0.963	<0.0250	<0.0250	<0.0250	<0.0250	0.0379	0.0991	2.39
	Average	**0.684**	**0.0528**	**0.125**	**0.111**	**0.992**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**0.0368**	**0.0945**	**2.40**
	%RPD Sample/Sample Dup	**0.15**	**17**	**12**	**4.5**	**5.7**	**NA**	**NA**	**NA**	**NA**	**6.3**	**9.7**	**0.42**
ISO11-01-01-20-033	OKMN-SW-SW13-0-161103	0.578	0.0412	0.105	0.0869	0.821	<0.0250	<0.0250	<0.0250	<0.0250	0.0335	0.0794	2.26
ISO11-01-01-20-033-DUP	OKMN-SW-SW13-DB-161103	0.560	0.0408	0.0970	0.0824	0.818	<0.0250	<0.0250	<0.0250	<0.0250	0.0324	0.0828	2.44
	Average	**0.569**	**0.0410**	**0.101**	**0.0847**	**0.820**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**0.0330**	**0.0811**	**2.35**
	%RPD Sample/Sample Dup	**3.2**	**0.98**	**7.9**	**5.3**	**0.37**	**NA**	**NA**	**NA**	**NA**	**3.3**	**4.2**	**7.7**
ISO11-01-01-20-036	OKMN-SW-SW16-0-161103	0.0773	<0.0250	<0.0250	<0.0250	<0.0240	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0232
ISO11-01-01-20-036-DUP	OKMN-SW-SW16-DB-161103	0.0740	<0.0250	<0.0250	<0.0250	<0.0240	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0232
	Average	**0.0757**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0240**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0250**	**<0.0232**
	%RPD Sample/Sample Dup	**4.4**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
ISO11-01-01-20-038	OKMN-GW-PW08-RB01-0-161101	<0.0250	<0.0250	<0.0250	<0.0250	<0.0240	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0232
ISO11-01-01-20-039	OKMN-GW-W2007-RB02-0-161102	<0.0250	<0.0250	<0.0250	<0.0250	<0.0240	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0232
ISO11-01-01-20-040	OKMN-GW-PW02-RB03-0-161103	<0.0250	<0.0250	<0.0250	<0.0250	<0.0240	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0232
ISO11-01-01-20-037	OKMN-GW-TRIP-0-161031	<0.0250	<0.0250	<0.0250	<0.0250	<0.0240	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0232

NA = Not Applicable

(1) Reported results from samples prepared and analyzed by ETS-8-044.3 using internal standard calibration unless noted otherwise. The analytical data uncertainties associated with the reported results are as follows: PFBA ± 14%, PFPeA ± 15%, PFHxA ± 11%, PFHpA ± 12%, PFOA ± 11%, PFNA ± 15%, PFDA ± 16%, PFUnA ± 18%, PFDoA ± 16%, PFBS ± 13%, PFHS ± 17%, and PFOS ± 13%.

(2) Sample set prepared and analyzed by ETS-8-044.3 using external standard calibration. The analytical data uncertainties associated with the reported results are as follows: PFBA ± 21%, PFOA ± 23%, and PFOS ± 22%.

(3) The data uncertainty has been expanded for location PW23 for PFHpA to ±44% based on field matrix sp ke recovery. See section 4 of the report for additional information.

2 Methods - Analytical and Preparatory

2.1 Methods

Analysis was completed following 3M Environmental Laboratory method ETS-8-044.3 "Method of Analysis for the Determination of Perfluorinated Compounds in Water by LC/MS/MS; Direct Injection Analysis".

Table 2. Target Analytes

Target Analytes	Acronym	Reference Material Structure
Perfluorobutanoic Acid (C4 Acid)	PFBA	Linear
Perfluoropentanoic Acid (C5 Acid)	PFPeA	Linear
Perfluorohexanoic Acid (C6 Acid)	PFHxA	Linear
Perfluoroheptanoic Acid (C7 Acid)	PFHpA	Linear
Perfluorooctanoic Acid (C8 Acid)	PFOA	Linear + Branched
Perfluorononanoic Acid (C9 Acid)	PFNA	Linear
Perfluorodecanoic Acid (C10 Acid)	PFDA	Linear
Perfluoroundecanoic Acid (C11 Acid)	PFUnA	Linear
Perfluorododecanoic Acid (C12 Acid)	PFDoA	Linear
Perfluorobutanesulfonate (C4 Sulfonate)	PFBS	Linear
Perfluorohexanesulfonate (C6 Sulfonate)	PFHS	Linear
Perfluorooctanesulfonate (C8 Sulfonate)	PFOS	Linear + Branched

2.2 Sample Collection

Samples were collected on October 31 – November 4, 2016 in Nalgene™ (high-density polyethylene) bottles prepared at the 3M Environmental Laboratory. Prior to sample collection, bottles designated for field matrix spikes were spiked in the laboratory with a known volume of an appropriate matrix sp king solution containing the analytes of interest. All sample bottles were spiked with a mixture of mass-labeled internal standards at a nominal concentration of 1 ng/mL and a mixture of surrogate standards at a nominal concentration of 0.1 ng/mL. Collected sample bottles were returned to the laboratory on ice on November 4, 2016.

Table 3. Sample Description Key Code.

String Number	String Descriptor	Example: OKMN-GW-SP42-0-161101
1	Sample Location	OKMN = Oakdale, Minnesota
2	Sample Type	GW = Ground Water SW = Surface Water
3	Well Identifier	Example: SP42
4	Sample Type	0 = primary sample DB = duplicate sample FMS = Field Matrix Spike RB = Rinseate Blank
5	Sampling Date	161101 – November 1, 2016

2.3 Sample Preparation

Samples were prepared by removing a 0.4 mL aliquot of the well mixed sample and diluting it with 0.4 mL of methanol (dilution factor of 2).

During the preparation of the laboratory control samples, an aliquot of a separate internal standard spiking solution was added to the laboratory control samples (nominal concentration of 1 ng/mL). The sample bottles were spiked with an internal standard mix at a nominal concentration of 1 ng/mL prior to being sent to the field for sample collection. The laboratory control samples were then diluted with methanol in the same manner as the samples.

Sampling locations W2007, W26R, PW10, PW11, PW23, and W33 required further dilution for at least one target analyte. All samples were prepared by removing a 0.1 mL aliquot of the well mixed sample and diluting it with 9.9 mL of methanol and 0.01 mL of surrogate recovery standard solution (dilution factor of 100). All diluted samples were refortified with surrogate recovery standards at a nominal concentration of 1 ng/mL extract. Samples were analyzed using external standard calibration.

2.4 Analysis

All samples and quality control samples were analyzed for twelve target analytes, with the exception of W2007 and W26R, which were analyzed for PFBA, PFOA, PFBS and PFOS only, along with the appropriate surrogates. Analysis was performed using high performance liquid chromatography/tandem mass spectrometry (HPLC/MS/MS). Pertinent instrument parameters, the liquid chromatography gradient program, and the specific mass transitions analyzed are described in the tables below.

Due to the nature of the sample, the wide range of concentrations found in the sample, and the environmental occurrence of multiple isomers of the laboratory's analytes of interest, the software used for processing the analytical results is not able to consistently integrate the analytical peak, manual integration of the analytical peak is necessary. All manual integrations are performed following the procedures outlined in method ETS-12-010. The consistency of the laboratory's integration is ensured through the training of laboratory personnel, the peer review process required for all manual integrations, the review of manual integrations by the QAU, and where necessary the review of manual integrations by laboratory management.

Table 4. Instrument Parameters.

Instrument Name	ETS Kirk	ETS DaVinci
Liquid Chromatograph	Agilent 1260	Agilent 1290
Analysis Method	ETS-8-044.3	ETS-8-044.3
Analysis Date	11/28/16 – External standard calibration	11/15/16 - Internal standard cal bration 11/22/16 – Internal standard cal bration
Guard column	Prism RP (2.1 mm X 50 mm), 5 µ	Prism RP (2.1 mm X 50 mm), 5 µ
Analytical column	Betasil C18 (2.1 mm X 100 mm), 5 µ	Betasil C18 (2.1 mm X 100 mm), 5 µ
Injection Volume	5 µL	10 µL
Mass Spectrometer	AB SCIEX Triple Quad 5500	AB SCIEX Triple Quad 6500
Ion Source	Turbo Spray	Turbo Spray
Polarity	Negative	Negative
Software	Analyst 1.6.2	Analyst 1.6.2

Table 5. Liquid Chromatography Gradient Program.

Step Number	Total Time (min)	Flow Rate (µL/min)	Percent A (2 mM Ammonium Acetate)	Percent B (Methanol)
ETS-8-044.3				
0	0.00	300	90.0	10.0
1	0.50	300	90.0	10.0
2	0.70	300	60.0	40.0
3	9.00	300	5.0	95.0
4	11.0	300	5.0	95.0
5	12.0	300	90.0	10.0
6	14.0	300	90.0	10.0

Table 6. Mass Transitions

Analyte	Mass Transition Q1/Q3	Internal Standard (1)	Mass Transition Q1/Q3
PFBA	213/169	[$^{13}C_4$]-PFBA	217/172
PFPeA	263/219	[$^{13}C_5$]-PFPeA	268/223
PFHxA	313/119	[$^{13}C_2$]-PFHxA	315/270
	313/269		
PFHpA	363/319	[$^{13}C_4$]-PFHpA	367/322
	363/119		
PFOA	413/369	[$^{13}C_8$]-PFOA	421/376
	413/219		
	413/169		
PFNA	463/419	[$^{13}C_9$]-PFNA	472/427
	463/219		
	463/169		
PFDA	513/469	[$^{13}C_6$]-PFDA	519/474
	513/219		
	513/269		
PFUnA	563/519	[$^{13}C_7$]-PFUnA	570/525
	563/269		
	563/219		
PFDoA	613/569	[$^{13}C_2$]-PFDoA	615/570
	613/319		
	613/269		
PFBS	299/80	[$^{18}O_2$]-PFBS	303/84
	299/99		
PFHS	399/99	[$^{13}C_3$]-PFHS	402/80
	399/80		
PFOS	499/99	[$^{13}C_8$]-PFOS	507/80
	499/80		
	499/130		
[$^{13}C_3$]-PFBA surrogate	216/172	[$^{13}C_4$]-PFBA	217/172
[$^{13}C_4$]-PFOA surrogate	417/372	[$^{13}C_8$]-PFOA	421/376
[$^{13}C_4$]-PFOS surrogate	503/80	[$^{13}C_8$]-PFOS	507/80
[$^{13}C_2$]-PFUnA surrogate	565/520	[$^{13}C_7$]-PFUnA	570/525

The individual transitions were summed to produce a "total ion chromatogram" (TIC), which was used for quantitation.

(1) Internal standards were not used for the analysis of samples analyzed on 11/28/16.

3 Data Analysis

3.1 Calibration

3.1.1 Analysis by internal standard calibration on 11/15/16 and 11/22/16

Samples were analyzed against a matrix-matched stable isotope internal standard calibration curve. Calibration standards were prepared by spiking known amounts of stock solutions into 50 mL of 50:50 laboratory reagent water:methanol. The calibration standards contained an internal standard mix at a nominal concentration of 0.5 ng/mL. A total of fourteen calibration standards ranging from 0.0125 ng/mL to 100 ng/mL (nominal) (except for 11/22/15 when ten calibration standards were used ranging from 0.0125 ng/mL to 10 ng/mL (nominal)) were analyzed with the prepared samples. Of these calibration standards, ten contained the surrogates at concentrations ranging from 0.0125 ng/mL to 10 ng/mL nominal. A quadratic, 1/x weighted, calibration curve of the ratio of the standard peak area counts over the internal standard peak area counts was used to fit the data for each analyte. The data were not forced through zero during the fitting process. Calculating the standard concentrations using the peak area ratios and the resultant calibration curve confirmed accuracy of each curve point. The reference standards of PFOA and PFOS used to prepare the calibration standards consisted of both linear and branched isomers.

3.1.2 Analysis by external standard calibration on 11/28/16

Diluted samples were analyzed against an external standard calibration curve. Calibration standards were prepared by spiking known amounts of the stock solutions into 90:10 methanol:Milli-Q water. A total of twelve standards ranging from 0.02 ng/mL to 100 ng/mL (nominal) were analyzed. Of these twelve calibration standards, ten contained the surrogates at concentrations ranging from 0.02 ng/mL to 25 ng/mL nominal. A quadratic, 1/x weighted, calibration curve of the peak area counts was used to fit the data for each analyte. The data were not forced through zero during the fitting process. Calculating the standard concentrations using the peak area confirmed accuracy of each curve point. The reference standards of PFOA and PFOS used to prepare the calibration standards consisted of both linear and branched isomers.

For all analyses, each curve point was quantitated using the overall calibration curve and reviewed for accuracy. Method calibration accuracy requirements of 100±25% (100±30% for the lowest curve point) were met for all analytes. The correlation coefficient (r) was greater than 0.995 for all analytes.

3.2 System Suitability

A calibration standard was analyzed four times at the beginning of the analytical sequence to demonstrate overall system suitability. The acceptance criteria for system suitability samples of less than or equal to 5% relative standard deviation (RSD) for peak area ratio and retention time criteria of less than or equal to 2% RSD, were met for all analytes.

3.3 Limit of Quantitation (LOQ)

The LOQ as defined in method ETS-8-044.3 is the lowest non-zero calibration standard in the curve that meets linearity and accuracy requirements and for which the area counts are at least twice those of the appropriate blanks. The LOQs associated with the sample analysis are listed in the Table 7 below.

Table 7. LOQ

Analyte	LOQ, ng/mL[1] 11/15/16 Analysis Internal standard	LOQ, ng/mL [1] 11/22/16 Analysis Internal standard	LOQ, ng/mL[2] 11/28/16 Analysis External standard
PFBA	0.0250	NA	2.00
PFPeA	0.0250	0.0250	NA
PFHxA	0.0250	0.0250	NA
PFHpA	0.0250	0.0250	NA
PFOA	0.0240	0.0240	1.92
PFNA	0.0250	0.0250	NA
PFDA	0.0250	0.0250	NA
PFUnA	0.0250	0.0250	NA
PFDoA	0.0250	0.0250	NA
PFBS	0.0250	NA	NA
PFHS	0.0250	NA	NA
PFOS	0.0232	0.0232	1.85

NA = Not Applicable
(1) A dilution factor of 2 was applied to the LOQ.
(2) A dilution factor of 100 was applied to the LOQ.

3.4 Continuing Calibration

During the course of the analytical sequence, several continuing calibration verification samples (CCVs) were analyzed to confirm that the instrument response and the initial calibration curve were still in control. All reported results were bracketed by CCVs that met method acceptance criteria of 100%±25%.

3.5 Blanks

Three types of blanks were prepared and analyzed with the samples: method/solvent blanks, field/trip blanks, and sampling equipment blanks. Each blank result was reviewed and used to evaluate method performance to determine the LOQ for each analyte.

3.6 Lab Control Spikes (LCSs)

Low, mid, and high lab control spikes were prepared for the target analytes and analyzed in triplicate, while only low and high lab control spikes were prepared for the surrogates. LCSs were prepared by spiking known amounts of the analytes into laboratory reagent water to produce the desired concentration. The LCSs were then diluted with methanol in the same manner as the samples. Method ETS-8-044.3 states that the average recovery of LCSs at each spiking level must be within 80%-120% with a RSD ≤20%. All LCSs met method acceptance criteria with the following exceptions:

- Analysis on 11/15/16, high level LCSs for PFPeA were spiked above the resulting upper limit of quantitation (ULOQ) when a dilution factor of 2 was applied. The low and mid-range LCSs were more appropriate as compared to the sample concentrations and the data are reported.
- Analysis on 11/28/16, high level LCSs for PFOS had an average recovery of 122%.

All LCSs were used in the determination of the analytical method uncertainty in section 3.7 of the report. The following calculations were used to generate data in Table 8.

$$\text{LCS Percent Recovery} = \frac{\text{Calculated Concentration}}{\text{Spike Concentration}} * 100\%$$

$$\text{LCS\% RSD} = \frac{\text{standard deviation LCS replicates}}{\text{average LCS recovery}} * 100\%$$

Table 8. Lab Control Spike Results.

ETS-8-044.3 Analyzed 11/15/16 Internal standard	PFBA			PFPeA		
Lab ID	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**
LCS-161115-1	0.198	0.202	102	0.198	0.196	98.8
LCS-161115-2	0.198	0.209	105	0.198	0.197	99.7
LCS-161115-3	0.198	0.195	98.4	0.198	0.205	103
Average ± %RSD	**102% ± 3.2%**			**101% ± 2.2%**		
LCS-161115-4	19.8	19.3	97.5	19.8	18.0	90.8
LCS-161115-5	19.8	18.6	93.9	19.8	18.0	91.1
LCS-161115-6	19.8	19.4	98.2	19.8	17.0	85.9
Average ± %RSD	**96.5% ± 2.4%**			**89.3% ± 3.3%**		
LCS-161115-7	139	138	99.2	139	>ULOQ (1)	NA
LCS-161115-8	139	132	95.2	139	>ULOQ (1)	NA
LCS-161115-9	139	132	95.3	139	>ULOQ (1)	NA
Average ± %RSD	**96.6% ± 2.4%**			**NA**		

ETS-8-044.3 Analyzed 11/15/16 Internal standard	PFHxA			PFHpA		
Lab ID	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**
LCS-161115-1	0.198	0.187	94.6	0.198	0.201	101
LCS-161115-2	0.198	0.192	97.0	0.198	0.194	97.8
LCS-161115-3	0.198	0.184	92.9	0.198	0.193	97.6
Average ± %RSD	**94.8% ± 2.2%**			**98.8% ± 1.9%**		
LCS-161115-4	19.8	18.5	93.7	19.8	18.8	95.1
LCS-161115-5	19.8	18.8	94.7	19.8	18.9	95.7
LCS-161115-6	19.8	19.0	95.9	19.8	19.1	96.6
Average ± %RSD	**94.8% ± 1.2%**			**95.8% ± 0.79%**		
LCS-161115-7	139	139	99.7	139	135	97.1
LCS-161115-8	139	138	99.0	139	133	95.6
LCS-161115-9	139	139	99.8	139	130	93.3
Average ± %RSD	**99.5% ± 0.44%**			**95.3% ± 2.0%**		

NA = Not Applicable
ULOQ = Upper Limit of Quantification
(1) LCSs sp ked above the resulting cal bration range.
(2) LCSs were sp ked post dilution, but reported with the dilution factor applied.
(3) LCSs recovery exceeded method acceptance criteria of 100±20%.

Table 8 continued. Lab Control Spike Results.

ETS-8-044.3 Analyzed 11/15/16 Internal standard	PFOA (Linear + Branched)			PFNA		
Lab ID	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**
LCS-161115-1	0.190	0.183	96.3	0.198	0.188	95.1
LCS-161115-2	0.190	0.174	91.8	0.198	0.187	94.6
LCS-161115-3	0.190	0.180	95.0	0.198	0.194	98.0
Average ± %RSD	**94.4% ± 2.5%**			**95.9% ± 1.9%**		
LCS-161115-4	19.0	18.0	94.8	19.8	18.7	94.5
LCS-161115-5	19.0	18.4	96.8	19.8	20.0	101
LCS-161115-6	19.0	18.2	95.6	19.8	19.5	98.4
Average ± %RSD	**95.7% ± 1.1%**			**98.0% ± 3.3%**		
LCS-161115-7	133	123	92.8	139	136	98.2
LCS-161115-8	133	125	94.2	139	134	96.6
LCS-161115-9	133	129	97.2	139	136	97.8
Average ± %RSD	**94.7% ± 2.4%**			**97.5% ± 0.85%**		

ETS-8-044.3 Analyzed 11/15/16 Internal standard	PFDA			PFUnA		
Lab ID	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**
LCS-161115-1	0.198	0.190	95.8	0.198	0.170	85.7
LCS-161115-2	0.198	0.186	94.0	0.198	0.169	85.2
LCS-161115-3	0.198	0.190	96.1	0.198	0.164	82.6
Average ± %RSD	**95.3% ± 1.2%**			**84.5% ± 2.0%**		
LCS-161115-4	19.8	19.4	98.0	19.8	17.9	90.3
LCS-161115-5	19.8	18.4	93.0	19.8	17.1	86.2
LCS-161115-6	19.8	18.9	95.6	19.8	18.0	90.7
Average ± %RSD	**95.5% ± 2.6%**			**89.1% ± 2.8%**		
LCS-161115-7	139	134	96.7	139	129	92.7
LCS-161115-8	139	131	93.9	139	132	94.6
LCS-161115-9	139	129	92.5	139	137	98.4
Average ± %RSD	**94.4% ± 2.3%**			**95.2% ± 3.0%**		

NA = Not Applicable
ULOQ = Upper Limit of Quantification
(1) LCSs spiked above the resulting calibration range.
(2) LCSs were spiked post dilution, but reported with the dilution factor applied.
(3) LCSs recovery exceeded method acceptance criteria of 100±20%.

Table 8 continued. Lab Control Spike Results.

ETS-8-044.3 Analyzed 11/15/16 Internal standard	PFDoA			PFBS		
Lab ID	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**
LCS-161115-1	0.198	0.212	107	0.198	0.204	103
LCS-161115-2	0.198	0.191	96.5	0.198	0.195	98.3
LCS-161115-3	0.198	0.183	92.5	0.198	0.188	94.9
Average ± %RSD	**98.7% ± 7.6%**			**98.7% ± 4.1%**		
LCS-161115-4	19.8	19.1	96.6	19.8	19.3	97.3
LCS-161115-5	19.8	19.1	96.7	19.8	19.2	96.8
LCS-161115-6	19.8	18.3	92.6	19.8	18.5	93.3
Average ± %RSD	**95.3% ± 2.5%**			**95.8% ± 2.3%**		
LCS-161115-7	139	135	97.0	139	139	99.8
LCS-161115-8	139	132	94.8	139	131	94.2
LCS-161115-9	139	141	101	139	134	96.4
Average ± %RSD	**97.6% ± 3.2%**			**96.8% ± 2.9%**		

ETS-8-044.3 Analyzed 11/15/16 Internal standard	PFHS			PFOS (Linear + Branched)		
Lab ID	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**
LCS-161115-1	0.198	0.188	94.8	0.184	0.196	106
LCS-161115-2	0.198	0.192	97.2	0.184	0.164	89.0
LCS-161115-3	0.198	0.181	91.2	0.184	0.175	94.9
Average ± %RSD	**94.4% ± 3.2%**			**96.6% ± 8.9%**		
LCS-161115-4	19.8	19.0	96.1	18.4	17.3	94.1
LCS-161115-5	19.8	19.0	95.7	18.4	18.3	99.3
LCS-161115-6	19.8	18.8	95.2	18.4	18.0	97.6
Average ± %RSD	**95.7% ± 0.47%**			**97.0% ± 2.7%**		
LCS-161115-7	139	136	97.6	129	122	94.3
LCS-161115-8	139	130	93.3	129	125	97.1
LCS-161115-9	139	143	103	129	128	99.2
Average ± %RSD	**98.0% ± 5.0%**			**96.9% ± 2.5%**		

NA = Not Applicable
ULOQ = Upper Limit of Quantification
(1) LCSs sp ked above the resulting cal bration range.
(2) LCSs were sp ked post dilution, but reported with the dilution factor applied.
(3) LCSs recovery exceeded method acceptance criteria of 100±20%.

Table 8 continued. Lab Control Spike Results.

ETS-8-044.3 Analyzed 11/15/16 Internal standard	[$^{13}C_3$]-PFBA surrogate			[$^{13}C_4$]-PFOA surrogate		
Lab ID	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**
LCS-161115-1	0.197	0.191	97.0	0.198	0.191	96.6
LCS-161115-2	0.197	0.192	97.3	0.198	0.182	92.1
LCS-161115-3	0.197	0.189	96.0	0.198	0.197	99.4
Average ± %RSD	**96.8% ± 0.70%**			**96.0% ± 3.8%**		
LCS-161115-4	1.97	1.93	97.8	1.98	1.91	96.2
LCS-161115-5	1.97	1.81	91.6	1.98	1.92	96.9
LCS-161115-6	1.97	1.91	96.8	1.98	1.89	95.5
Average ± %RSD	**95.4% ± 3.5%**			**96.2% ± 0.73%**		

ETS-8-044.3 Analyzed 11/15/16 Internal standard	[$^{13}C_2$]-PFUnA surrogate			[$^{13}C_4$]-PFOS surrogate		
Lab ID	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**
LCS-161115-1	0.198	0.187	94.4	0.189	0.189	100
LCS-161115-2	0.198	0.187	94.5	0.189	0.171	90.6
LCS-161115-3	0.198	0.191	96.6	0.189	0.197	104
Average ± %RSD	**95.2% ± 1.3%**			**98.2% ± 7.0%**		
LCS-161115-4	1.98	1.98	99.9	1.89	1.85	98.0
LCS-161115-5	1.98	1.90	96.0	1.89	1.78	94.2
LCS-161115-6	1.98	1.93	97.4	1.89	1.77	93.6
Average ± %RSD	**97.8% ± 2.0%**			**95.3% ± 2.5%**		

NA = Not Applicable
ULOQ = Upper Limit of Quantification
(1) LCSs sp ked above the resulting cal bration range .
(2) LCSs were sp ked post dilution, but reported with the dilution factor applied.
(3) LCSs recovery exceeded method acceptance criteria of 100±20%.

Table 8 continued. Lab Control Spike Results.

ETS-8-044.3 Analyzed 11/22/16 Internal standard	PFPeA			PFHxA		
Lab ID	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**
LCS-161122-1	0.198	0.184	93.2	0.198	0.177	89.4
LCS-161122-2	0.198	0.192	96.9	0.198	0.185	93.6
LCS-161122-3	0.198	0.186	93.7	0.198	0.191	96.4
Average ± %RSD	**94.6% ± 2.1%**			**93.1% ± 3.8%**		
LCS-161122-4	1.98	2.23	113	1.98	1.97	99.4
LCS-161122-5	1.98	2.00	101	1.98	1.85	93.4
LCS-161122-6	1.98	1.93	97.6	1.98	1.86	94.0
Average ± %RSD	**104% ± 7.8%**			**95.6% ± 3.5%**		
LCS-161122-7	13.9	13.3	95.5	13.9	12.9	93.0
LCS-161122-8	13.9	13.3	95.9	13.9	12.8	92.2
LCS-161122-9	13.9	13.0	93.5	13.9	13.1	93.9
Average ± %RSD	**95.0% ± 1.4%**			**93.0% ± 0.91%**		

ETS-8-044.3 Analyzed 11/22/16 Internal standard	PFHpA			PFOA (Linear + Branched)		
Lab ID	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**
LCS-161122-1	0.198	0.195	98.7	0.190	0.185	97.4
LCS-161122-2	0.198	0.185	93.6	0.190	0.188	99.2
LCS-161122-3	0.198	0.195	98.5	0.190	0.182	95.9
Average ± %RSD	**96.9% ± 3.0%**			**97.5% ± 1.7%**		
LCS-161122-4	1.98	2.05	104	1.90	1.93	102
LCS-161122-5	1.98	1.94	98.1	1.90	1.88	99.1
LCS-161122-6	1.98	1.98	100	1.90	1.89	99.4
Average ± %RSD	**101% ± 3.0%**			**100% ± 1.6%**		
LCS-161122-7	13.9	13.3	95.8	13.3	12.9	96.8
LCS-161122-8	13.9	13.2	95.0	13.3	12.5	94.3
LCS-161122-9	13.9	13.1	94.2	13.3	12.3	92.8
Average ± %RSD	**95.0% ± 0.84%**			**94.6% ± 2.1%**		

NA = Not Applicable
ULOQ = Upper Limit of Quantification
(1) LCSs spiked above the resulting calibration range.
(2) LCSs were spiked post dilution, but reported with the dilution factor applied.
(3) LCSs recovery exceeded method acceptance criteria of 100±20%.

Table 8 continued. Lab Control Spike Results

ETS-8-044.3 Analyzed 11/22/16 Internal standard	PFNA			PFDA		
Lab ID	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**
LCS-161122-1	0.198	0.188	94.9	0.198	0.197	99.4
LCS-161122-2	0.198	0.182	91.8	0.198	0.181	91.5
LCS-161122-3	0.198	0.203	103	0.198	0.195	98.3
Average ± %RSD	**96.6% ± 6.0%**			**96.4% ± 4.4%**		
LCS-161122-4	1.98	1.99	101	1.98	2.01	102
LCS-161122-5	1.98	1.91	96.4	1.98	1.88	95.2
LCS-161122-6	1.98	1.89	95.5	1.98	1.94	97.8
Average ± %RSD	**97.6% ± 3.0%**			**98.3% ± 3.5%**		
LCS-161122-7	13.9	13.2	94.7	13.9	13.5	97.3
LCS-161122-8	13.9	13.4	96.4	13.9	13.0	93.5
LCS-161122-9	13.9	13.0	93.7	13.9	12.9	93.0
Average ± %RSD	**94.9% ± 1.4%**			**94.6% ± 2.5%**		

ETS-8-044.3 Analyzed 11/22/16 Internal standard	PFUnA			PFDoA		
Lab ID	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**
LCS-161122-1	0.198	0.186	93.9	0.198	0.196	99.2
LCS-161122-2	0.198	0.175	88.5	0.198	0.189	95.7
LCS-161122-3	0.198	0.186	93.8	0.198	0.193	97.2
Average ± %RSD	**92.1% ± 3.4%**			**97.4% ± 1.8%**		
LCS-161122-4	1.98	1.87	94.5	1.98	1.95	98.4
LCS-161122-5	1.98	1.83	92.5	1.98	1.90	96.1
LCS-161122-6	1.98	1.92	96.7	1.98	1.95	98.3
Average ± %RSD	**94.6% ± 2.2%**			**97.6% ± 1.3%**		
LCS-161122-7	13.9	12.2	87.9	13.9	12.6	91.0
LCS-161122-8	13.9	11.9	85.7	13.9	12.9	92.6
LCS-161122-9	13.9	12.4	89.0	13.9	12.8	91.8
Average ± %RSD	**87.5% ± 1.9%**			**91.8% ± 0.87%**		

NA = Not Applicable
ULOQ = Upper Limit of Quantification
(1) LCSs sp ked above the resulting cal bration range.
(2) LCSs were sp ked post dilution, but reported with the dilution factor applied.
(3) LCSs recovery exceeded method acceptance criteria of 100±20%.

Table 8 continued. Lab Control Spike Results

ETS-8-044.3 Analyzed 11/22/16 Internal standard	PFOS (Linear + Branched)			[$^{13}C_4$]-PFOS surrogate		
Lab ID	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**
LCS-161122-1	0.184	0.181	98.6	0.189	0.182	96.3
LCS-161122-2	0.184	0.190	103	0.189	0.166	87.6
LCS-161122-3	0.184	0.194	105	0.189	0.190	101
Average ± %RSD	**102% ± 3.2%**			**95.0% ± 7.2%**		
LCS-161122-4	1.84	1.91	104	1.89	1.90	100
LCS-161122-5	1.84	1.80	98.0	1.89	1.75	92.8
LCS-161122-6	1.84	1.73	94.1	1.89	1.68	88.6
Average ± %RSD	**98.7% ± 5.1%**			**93.8% ± 6.1%**		
LCS-161122-7	12.9	11.7	91.1			
LCS-161122-8	12.9	12.7	98.3			
LCS-161122-9	12.9	11.8	91.8			
Average ± %RSD	**93.7% ± 4.2%**					

ETS-8-044.3 Analyzed 11/22/16 Internal standard	[$^{13}C_4$]-PFOA surrogate			[$^{13}C_2$]-PFUnA surrogate		
Lab ID	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**
LCS-161122-1	0.198	0.202	102	0.198	0.196	99.0
LCS-161122-2	0.198	0.202	102	0.198	0.197	99.4
LCS-161122-3	0.198	0.202	102	0.198	0.194	98.2
Average ± %RSD	**102% ± 0.0%**			**98.9% ± 0.62%**		
LCS-161122-4	1.98	2.02	102	1.98	1.96	98.9
LCS-161122-5	1.98	1.97	99.5	1.98	1.93	97.6
LCS-161122-6	1.98	1.96	98.9	1.98	1.94	97.9
Average ± %RSD	**100% ± 1.6%**			**98.1% ± 0.69%**		

NA = Not Applicable
ULOQ = Upper Limit of Quantification
(1) LCSs sp ked above the resulting cal bration range.
(2) LCSs were sp ked post dilution, but reported with the dilution factor applied.
(3) LCSs recovery exceeded method acceptance criteria of 100±20%.

Table 8 continued. Lab Control Spike Results

ETS-8-044.3 Analyzed 11/28/16 External standard	PFBA			PFOA (Linear + Branched)		
Lab ID	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**
LCS-161128-1	20.0	19.4	97.1	20.0	22.6	113
LCS-161128-2	20.0	19.1	95.5	20.0	21.8	109
LCS-161128-3	20.0	20.1	100	20.0	22.3	111
Average ± %RSD	**97.5% ± 2.3%**			**111% ± 1.8%**		
LCS-161128-4	998	1070	107	998	1120	112
LCS-161128-5	998	1040	104	998	1100	111
LCS-161128-6	998	1050	106	998	1120	112
Average ± %RSD	**106% ± 1.4%**			**112% ± 0.52%**		
LCS-161128-7	6970	7680	110	6970	6300	90.4
LCS-161128-8	6970	7410	106	6970	6110	87.7
LCS-161128-9	6970	7380	106	6970	6080	87.3
Average ± %RSD	**107% ± 2.2%**			**88.5% ± 1.9%**		

ETS-8-044.3 Analyzed 11/28/16 External standard	PFOS (Linear + Branched)			[$^{13}C_4$]-PFOS surrogate (2)		
Lab ID	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**
LCS-161128-1	20.0	20.9	104	19.1	20.1	105
LCS-161128-2	20.0	22.1	110	19.1	20.2	106
LCS-161128-3	20.0	20.0	100	19.1	19.6	102
Average ± %RSD	**105% ± 4.8%**			**104% ± 2.0%**		
LCS-161128-4	998	1140	114	191	202	106
LCS-161128-5	998	1100	110	191	194	102
LCS-161128-6	998	1120	112	191	192	101
Average ± %RSD	**112% ± 1.8%**			**103% ± 2.6%**		
LCS-161128-7	6970	8670	124			
LCS-161128-8	6970	8560	123			
LCS-161128-9	6970	8380	120			
Average ± %RSD	**122% (3) ± 1.7%**					

NA = Not Applicable
ULOQ = Upper Limit of Quantification
(1) LCSs spiked above the resulting calibration range.
(2) LCSs were spiked post dilution, but reported with the dilution factor applied.
(3) LCSs recovery exceeded method acceptance criteria of 100±20%.

Table 8 continued. Lab Control Spike Results

ETS-8-044.3 Analyzed 11/28/16 External standard	$[^{13}C_4]$-PFOA surrogate (2)			$[^{13}C_3]$-PFBA surrogate (2)		
Lab ID	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**	**Spiked Concentration (ng/mL)**	**Calculated Concentration (ng/mL)**	**%Recovery**
LCS-161128-1	19.9	19.4	97.7	19.9	19.6	98.5
LCS-161128-2	19.9	20.9	105	19.9	20.8	105
LCS-161128-3	19.9	20.6	104	19.9	20.2	102
Average ± %RSD	**102% ± 3.9%**			**102% ± 3.2%**		
LCS-161128-7	199	204	103	199	209	105
LCS-161128-8	199	198	99.3	199	202	101
LCS-161128-9	199	198	99.4	199	205	103
Average ± %RSD	**101% ± 2.1%**			**103% ± 1.9%**		

NA = Not Applicable
ULOQ = Upper Limit of Quantification
(1) LCSs sp ked above the resulting cal bration range.
(2) LCSs were sp ked post dilution, but reported with the dilution factor applied.
(3) LCSs recovery exceeded method acceptance criteria of 100±20%.

3.7 Analytical Data Uncertainty

Analytical uncertainty is based on historical QC data that is control charted and used to evaluate method accuracy and precision. The method uncertainty is calculated following ETS-12-012.3. The standard deviation is calculated for the set of accuracy results (in %) obtained for the QC samples. For method ETS-8-044.3, the most recent fifty QC samples were used. The expanded uncertainty is calculated by multiplying the standard deviation by a factor of 2, which corresponds to a confidence level of 95%. The analytical data uncertainty assigned to the sample results is based on analytical method uncertainty, as well as sample preparation batch QC data and field QC data. The analytical data uncertainty for this project and can be found in Table 9 below.

- The analytical method uncertainty calculated using ETS-12-012.4 by internal standard calibration for PFOS was 15%. However, based on the %bias of the high-level LCSs analyzed on 11/28/16, the data uncertainty has been expanded for PFOS by external standard calibration to ±22%.

Table 9. Analytical Data Uncertainty.

Analyte	Calibration	Standard Deviation (%)	Data Uncertainty
PFBA	Internal standard	7.0	±14%
PFPeA	Internal standard	7.4	±15%
PFHxA	Internal standard	5.7	±11%
PFHpA	Internal standard	6.2	±12%
PFOA	Internal standard	5.7	±11%
PFNA	Internal standard	7.3	±15%
PFDA	Internal standard	7.9	±16%
PFUnA	Internal standard	8.9	±18%
PFDoA	Internal standard	8.0	±16%
PFBS	Internal standard	6.3	±13%
PFHS	Internal standard	8.3	±17%
PFOS	Internal standard	6.3	±13%
PFBA	External standard	10	±21%
PFOA	External standard	11	±23%
PFOS	External standard	NA	±22%

NA = Not Applicable

3.8 Field Matrix Spikes (FMS)

Target analyte field matrix spikes were collected at select locations for each of the well types. Field matrix spikes are generated by adding a measured volume of field sample to a container spiked by the laboratory with the target analytes prior to shipping sample containers for sample collection. Not all target analytes were included in the spiking standard used to spike the high FMS level. Field matrix spikes must be at least 50% of the analyte concentration to be considered an appropriate spike level. Field matrix spike recoveries within method acceptance criteria of 100±30% confirm that "unknown" components in the sample matrix do not significantly interfere with the extraction and analysis of the analytes of interest. The standards used for the preparation of the field matrix spiking solutions contained reference materials comprised of both linear and branched isomers for PFOS and PFOA. Field matrix spike levels can be found in Table 10 below. Field matrix spike results are presented in section 4 of this report.

The following calculation was used to generate data in section 4.

$$\text{FMS Recovery} = \frac{(\text{Sample Concentration of FMS} - \text{Average Concentration: Field Sample \& Field Sample Dup.})}{\text{Spike Concentration}} * 100\%$$

In addition to target analyte field matrix spikes, each sample bottle contained stable isotope surrogate recovery spikes of [$^{13}C_3$]-PFBA, [$^{13}C_4$]-PFOA, [$^{13}C_2$]-PFUnA, and [$^{13}C_4$]-PFOS, which were added at a nominal concentration of 0.1 ng/mL to all sample bottles prior to sample collection. The [$^{13}C_3$]-PFBA and [$^{13}C_4$]- PFOA were selected to represent perfluorocarboxylic acids from C4-C8. The [$^{13}C_2$]-labeled PFUnA was selected to represent perfluorocarboxylic acids from C9-C12. The [$^{13}C_4$]-labeled PFOS was selected to represent the C4, C6, C8 perfluorosulfonic acids. Surrogate matrix spike recoveries within method acceptance criteria of 100±30% confirm that "unknown" components in the sample matrix do not significantly interfere with the preparation and analysis of the analytes of interest. The surrogate spike recoveries are included in section 4 of this report.

Due to the high concentration of all analytes detected in some of the sampling locations' samples, surrogate recovery standards were added to the diluted samples during sample preparation at a nominal concentration of 1 ng/mL.

Table 10. Field Matrix Spike Concentrations

	Final Concentration (ng/mL)						
Location	**PFBA**	**PFPeA**	**PFHxA**	**PFHpA**	**PFOA**	**PFNA**	**PFDA**
W2007	20.0	NA	NA	NA	20.0	NA	NA
PW02, PW18 and W205	10.3	0.250	0.250	0.250	10.2	0.250	0.250
W33	20.0	20.0	20.0	20.0	19.2	20.0	20.0
PW04 and PW11	101	0.500	0.500	0.500	100	0.500	0.500
PW23	502	2.00	2.00	2.00	502	2.00	2.00
RW37	0.250	0.250	0.250	0.250	0.240	0.250	0.250
SW16	0.500	0.500	0.500	0.500	0.479	0.500	0.500
Trip Blank	10.3	0.250	0.250	0.250	10.2	0.250	0.250

	Final Concentration (ng/mL)				
Location	**PFUnA**	**PFDoA**	**PFBS**	**PFHS**	**PFOS**
W2007	NA	NA	20.0	20.0	20.0
PW02, PW18 and W205	0.250	0.250	10.3	10.2	10.2
W33	20.0	20.0	20.0	20.0	18.5
PW04 and PW11	0.500	0.500	101	100	100
PW23	2.00	2.00	502	502	502
RW37	0.250	0.250	0.250	0.250	0.232
SW16	0.500	0.500	0.500	0.500	0.464
Trip Blank	0.250	0.250	10.3	10.2	10.2

NA = Not Applicable; Spiking solution did not contain the target analyte.

4 Data Summary and Discussion

The tables below summarize the sample results and field matrix spike recoveries for those sampling locations where a target analyte field matrix spike sample was prepared, as well as the Trip Blank set. Each table provides the average concentration and the relative percent difference (%RPD) of the sample and sample duplicate. Results and average values are rounded to three significant figures. Percent relative difference (%RPD) values are rounded to two significant figures. Because of rounding, values vary slightly from those listed in the raw data. Surrogate recovery standard results can be found in Table 21. Field matrix sp kes meeting the method acceptance criteria of ±30%, demonstrate that the method is appropriate for the given matrix.

The method indicates that the target analyte FMS samples should be spiked at approximately 0.5-10 times the expected analyte concentration in the sample. The field matrix sp ke concentrations were selected based on previous results for the Oakdale samples. As a result the spike level, at times, exceeded the recommended upper limit of 10 times the analyte concentration. In these instances the FMS recovery was reported and flagged as above 10 times the sample concentration.

For those analytes where the field matrix sp ke level was not appropriate as compared to the sample concentration, the surrogate recovery standards were used to assess method accuracy. All field matrix spike recoveries and all surrogate recovery standards met method acceptance criteria.

PW23: The FMS recovery for PFHpA was outside method acceptance criteria of 100±30% with a recovery of 144%. The sample location was re-prepared and analyzed to confirm the FMS recovery. There was no change in the data, therefore the initial sample results are reported. The data uncertainty for the sample location has been expanded to ±44% for PFHpA.

Table 11. OKMN GW W2007 161103 (1)

		PFBA (2)		PFOA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-001	OKMN-GW-W2007-0-161103	1450	NA	12.8	NA
ISO11-01-01-20-001-DUP	OKMN-GW-W2007-DB-161103	1460	NA	12.2	NA
ISO11-01-01-20-001-FMS	OKMN-GW-W2007-FMS-161103	1500	NC	32.3	99.0
Average Concentration (ng/mL) ± %RPD		**1460 ng/mL ± 0.69%**		**12.5 ng/mL ± 4.8%**	

		PFBS		PFOS	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-001	OKMN-GW-W2007-0-161103	9.61	NA	32.7	NA
ISO11-01-01-20-001-DUP	OKMN-GW-W2007-DB-161103	9.15	NA	30.8	NA
ISO11-01-01-20-001-FMS	OKMN-GW-W2007-FMS-161103	29.6	101	51.1	96.8
Average Concentration (ng/mL) ± %RPD		**9.38 ng/mL ± 4.9%**		**31.8 ng/mL ± 6.0%**	

NA = Not Applicable
NC = Not Calculated; Sp ke level was less than 0.5 times the endogenous sample concentration.
(1) Samples were analyzed by internal standard cal bration except where otherwise noted.
(2) Sample were analyzed by external standard calibration.

Table 12. OKMN GW PW02 161103 (1)

		PFBA		PFPeA		PFHxA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-004	OKMN-GW-PW02-0-161103	66.0	NA	3.67	NA	6.79	NA
ISO11-01-01-20-004-DUP	OKMN-GW-PW02-DB-161103	61.2	NA	3.58	NA	6.30	NA
ISO11-01-01-20-004-FMS	OKMN-GW-PW02-FMS-161103	70.7	NC	3.43	NC	6.47	NC
Average Concentration (ng/mL) ± %RPD		**63.6 ng/mL ± 7.5%**		**3.63 ng/mL ± 2.5%**		**6.55 ng/mL ± 7.5%**	

		PFHpA		PFOA		PFNA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-004	OKMN-GW-PW02-0-161103	3.28	NA	14.1	NA	<0.0250	NA
ISO11-01-01-20-004-DUP	OKMN-GW-PW02-DB-161103	3.25	NA	12.7	NA	<0.0250	NA
ISO11-01-01-20-004-FMS	OKMN-GW-PW02-FMS-161103	3.45	NC	23.2	95.7	0.261	104 (2)
Average Concentration (ng/mL) ± %RPD		**3.27 ng/mL ± 0.92%**		**13.4 ng/mL ± 10%**		**<0.0250 ng/mL**	

		PFDA		PFUnA		PFDoA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-004	OKMN-GW-PW02-0-161103	<0.0250	NA	<0.0250	NA	<0.0250	NA
ISO11-01-01-20-004-DUP	OKMN-GW-PW02-DB-161103	<0.0250	NA	<0.0250	NA	<0.0250	NA
ISO11-01-01-20-004-FMS	OKMN-GW-PW02-FMS-161103	0.252	101 (2)	0.215	86.0 (2)	0.251	100 (2)
Average Concentration (ng/mL) ± %RPD		**<0.0250 ng/mL**		**<0.0250 ng/mL**		**<0.0250 ng/mL**	

NA = Not Applicable
NC = Not Calculated; Spike level was less than 0.5 times the endogenous sample concentration.
(1) Samples were analyzed by internal standard calibration.
(2) FMS spike level was greater than 10 times the endogenous sample concentration.

Table 12 continued. OKMN GW PW02 161103 (1)

		PFBS		PFHS		PFOS	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-004	OKMN-GW-PW02-0-161103	1.17	NA	1.91	NA	1.48	NA
ISO11-01-01-20-004-DUP	OKMN-GW-PW02-DB-161103	1.05	NA	1.80	NA	1.51	NA
ISO11-01-01-20-004-FMS	OKMN-GW-PW02-FMS-161103	11.4	100	12.7	106	11.7	99.7
Average Concentration (ng/mL) ± %RPD		**1.11 ng/mL ± 11%**		**1.86 ng/mL ± 5.9%**		**1.50 ng/mL ± 2.0%**	

NA = Not Applicable
NC = Not Calculated; Spike level was less than 0.5 times the endogenous sample concentration.
(1) Samples were analyzed by internal standard calibration.
(2) FMS spike level was greater than 10 times the endogenous sample concentration.

Table 13. OKMN GW PW04 161103 (1)

		PFBA		PFPeA		PFHxA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-006	OKMN-GW-PW04-0-161103	78.5	NA	7.20	NA	22.7	NA
ISO11-01-01-20-006-DUP	OKMN-GW-PW04-DB-161103	81.8	NA	7.33	NA	22.6	NA
ISO11-01-01-20-006-FMS	OKMN-GW-PW04-FMS-161103	171	90.4	8.27	NC	23.8	NC
Average Concentration (ng/mL) ± %RPD		**80.2 ng/mL ± 4.1%**		**7.27 ng/mL ± 1.8%**		**22.7 ng/mL ± 0.44%**	

		PFHpA		PFOA		PFNA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-006	OKMN-GW-PW04-0-161103	9.87	NA	60.9	NA	0.129	NA
ISO11-01-01-20-006-DUP	OKMN-GW-PW04-DB-161103	10.2	NA	60.2	NA	0.114	NA
ISO11-01-01-20-006-FMS	OKMN-GW-PW04-FMS-161103	11.0	NC	143	82.1	0.652	106
Average Concentration (ng/mL) ± %RPD		**10.0 ng/mL ± 3.3%**		**60.6 ng/mL ± 1.2%**		**0.122 ng/mL ± 12%**	

		PFDA		PFUnA		PFDoA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-006	OKMN-GW-PW04-0-161103	0.0540	NA	<0.0250	NA	<0.0250	NA
ISO11-01-01-20-006-DUP	OKMN-GW-PW04-DB-161103	0.0445	NA	<0.0250	NA	<0.0250	NA
ISO11-01-01-20-006-FMS	OKMN-GW-PW04-FMS-161103	0.562	103 (2)	0.450	90.0 (2)	0.516	103 (2)
Average Concentration (ng/mL) ± %RPD		**0.0493 ng/mL ± 19%**		**<0.0250 ng/mL**		**<0.0250 ng/mL**	

NA = Not Applicable
NC = Not Calculated; Spike level was less than 0.5 times the endogenous sample concentration.
(1) Samples were analyzed by internal standard calibration.
(2) FMS spike level was greater than 10 times the endogenous sample concentration.

Table 13 continued. OKMN GW PW04 161103 (1)

		PFBS		PFHS		PFOS	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-006	OKMN-GW-PW04-0-161103	4.83	NA	9.57	NA	38.9	NA
ISO11-01-01-20-006-DUP	OKMN-GW-PW04-DB-161103	4.91	NA	9.95	NA	36.0	NA
ISO11-01-01-20-006-FMS	OKMN-GW-PW04-FMS-161103	101	95.7 (2)	105	94.8 (2)	127	89.1
Average Concentration (ng/mL) ± %RPD		**4.87 ng/mL ± 1.6%**		**9.76 ng/mL ± 3.9%**		**37.5 ng/mL ± 7.7%**	

NA = Not Applicable
NC = Not Calculated; Spike level was less than 0.5 times the endogenous sample concentration.
(1) Samples were analyzed by internal standard calibration.
(2) FMS spike level was greater than 10 times the endogenous sample concentration.

Table 14. OKMN GW PW11 161103 (1)

		PFBA		PFPeA		PFHxA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-010	OKMN-GW-PW11-0-161103	99.1	NA	12.4	NA	35.4	NA
ISO11-01-01-20-010-DUP	OKMN-GW-PW11-DB-161103	98.5	NA	12.6	NA	36.0	NA
ISO11-01-01-20-010-FMS	OKMN-GW-PW11-FMS-161103	186	86.8	13.0	NC	37.3	NC
Average Concentration (ng/mL) ± %RPD		**98.8 ng/mL ± 0.61%**		**12.5 ng/mL ± 1.6%**		**35.7 ng/mL ± 1.7%**	

		PFHpA		PFOA (2)		PFNA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-010	OKMN-GW-PW11-0-161103	19.0	NA	123	NA	0.376	NA
ISO11-01-01-20-010-DUP	OKMN-GW-PW11-DB-161103	19.9	NA	131	NA	0.419	NA
ISO11-01-01-20-010-FMS	OKMN-GW-PW11-FMS-161103	20.7	NC	224	96.5	0.871	94.7
Average Concentration (ng/mL) ± %RPD		**19.5 ng/mL ± 4.6%**		**127 ng/mL ± 6.3%**		**0.398 ng/mL ± 11%**	

		PFDA		PFUnA		PFDoA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-010	OKMN-GW-PW11-0-161103	0.125	NA	<0.0250	NA	<0.0250	NA
ISO11-01-01-20-010-DUP	OKMN-GW-PW11-DB-161103	0.147	NA	<0.0250	NA	<0.0250	NA
ISO11-01-01-20-010-FMS	OKMN-GW-PW11-FMS-161103	0.657	104	0.468	93.6 (3)	0.526	105 (3)
Average Concentration (ng/mL) ± %RPD		**0.0136 ng/mL ± 16%**		**<0.0250 ng/mL**		**<0.0250 ng/mL**	

NA = Not Applicable
NC = Not Calculated; Spike level was less than 0.5 times the endogenous sample concentration.
(1) Samples were analyzed by internal standard calibration except where otherwise noted.
(2) Sample were analyzed by external standard calibration.
(3) FMS spike level was greater than 10 times the endogenous sample concentration.

Table 14 continued. OKMN GW PW11 161103 (1)

		PFBS		PFHS		PFOS (2)	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-010	OKMN-GW-PW11-0-161103	7.11	NA	15.0	NA	137	NA
ISO11-01-01-20-010-DUP	OKMN-GW-PW11-DB-161103	7.33	NA	15.7	NA	149	NA
ISO11-01-01-20-010-FMS	OKMN-GW-PW11-FMS-161103	100	92.3 (3)	112	96.2	240	96.6
Average Concentration (ng/mL) ± %RPD		**7.22 ng/mL ± 3.0%**		**15.4 ng/mL ± 4.6%**		**143 ng/mL ± 8.4%**	

NA = Not Applicable
NC = Not Calculated; Sp ke level was less than 0.5 times the endogenous sample concentration.
(1) Samples were analyzed by internal standard cal bration except where otherwise noted.
(2) Sample were analyzed by external standard calibration.
(3) FMS spike level was greater than 10 times the endogenous sample concentration.

Table 15. OKMN GW PW18 161103 (1)

		PFBA		PFPeA		PFHxA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-015	OKMN-GW-PW18-0-161103	25.7	NA	1.40	NA	3.17	NA
ISO11-01-01-20-015-DUP	OKMN-GW-PW18-DB-161103	25.6	NA	1.43	NA	3.14	NA
ISO11-01-01-20-015-FMS	OKMN-GW-PW18-FMS-161103	36.0	NC	1.73	NC	3.54	NC
Average Concentration (ng/mL) ± %RPD		**25.7 ng/mL ± 0.39%**		**1.42 ng/mL ± 2.1%**		**3.16 ng/mL ± 0.95%**	

		PFHpA		PFOA		PFNA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-015	OKMN-GW-PW18-0-161103	1.73	NA	14.1	NA	<0.0250	NA
ISO11-01-01-20-015-DUP	OKMN-GW-PW18-DB-161103	1.64	NA	13.5	NA	<0.0250	NA
ISO11-01-01-20-015-FMS	OKMN-GW-PW18-FMS-161103	2.06	NC	25.1	110	0.277	111 (2)
Average Concentration (ng/mL) ± %RPD		**1.69 ng/mL ± 5.3%**		**13.8 ng/mL ± 4.3%**		**<0.0250 ng/mL**	

		PFDA		PFUnA		PFDoA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-015	OKMN-GW-PW18-0-161103	<0.0250	NA	<0.0250	NA	<0.0250	NA
ISO11-01-01-20-015-DUP	OKMN-GW-PW18-DB-161103	<0.0250	NA	<0.0250	NA	<0.0250	NA
ISO11-01-01-20-015-FMS	OKMN-GW-PW18-FMS-161103	0.269	108 (2)	0.232	92.8 (2)	0.259	104 (2)
Average Concentration (ng/mL) ± %RPD		**<0.0250 ng/mL**		**<0.0250 ng/mL**		**<0.0250 ng/mL**	

NA = Not Applicable
NC = Not Calculated; Spike level was less than 0.5 times the endogenous sample concentration.
(1) Samples were analyzed by internal standard calibration except where otherwise noted.
(2) FMS spike level was greater than 10 times the endogenous sample concentration.

Table 15 continued. OKMN GW PW18 161103 (1)

		PFBS		PFHS		PFOS	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-015	OKMN-GW-PW18-0-161103	0.671	NA	1.11	NA	6.09	NA
ISO11-01-01-20-015-DUP	OKMN-GW-PW18-DB-161103	0.674	NA	1.13	NA	5.84	NA
ISO11-01-01-20-015-FMS	OKMN-GW-PW18-FMS-161103	10.7	97.8 (2)	11.4	100 (2)	16.7	105
Average Concentration (ng/mL) ± %RPD		**0.673 ng/mL ± 0.45%**		**1.12 ng/mL ± 1.8%**		**5.97 ng/mL ± 4.2%**	

NA = Not Applicable
NC = Not Calculated; Sp ke level was less than 0.5 times the endogenous sample concentration.
(1) Samples were analyzed by internal standard cal bration except where otherwise noted.
(2) FMS spike level was greater than 10 times the endogenous sample concentration.

Table 16. OKMN GW PW23 161104 (1)

		PFBA (2)		PFPeA		PFHxA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-020	OKMN-GW-PW23-0-161104	4.84	NA	0.465	NA	2.37	NA
ISO11-01-01-20-020-DUP	OKMN-GW-PW23-DB-161104	5.35	NA	0.492	NA	2.34	NA
ISO11-01-01-20-020-FMS	OKMN-GW-PW23-FMS-161104	501	98.8 (3)	2.54	103	4.21	92.8
Average Concentration (ng/mL) ± %RPD		**5.10 ng/mL ± 10%**		**0.479 ng/mL ± 5.6%**		**2.36 ng/mL ± 1.3%**	

		PFHpA		PFOA (2)		PFNA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-020	OKMN-GW-PW23-0-161104	1.12	NA	9.00	NA	0.0418	NA
ISO11-01-01-20-020-DUP	OKMN-GW-PW23-DB-161104	1.07	NA	8.79	NA	0.0366	NA
ISO11-01-01-20-020-FMS	OKMN-GW-PW23-FMS-161104	3.97	144 (4)	519	102 (3)	1.79	87.5 (3)
Average Concentration (ng/mL) ± %RPD		**1.10 ng/mL ± 4.6% (5)**		**8.90 ng/mL ± 2.4%**		**0.0392 ng/mL ± 13%**	

		PFDA		PFUnA		PFDoA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-020	OKMN-GW-PW23-0-161104	0.0607	NA	<0.0250	NA	<0.0250	NA
ISO11-01-01-20-020-DUP	OKMN-GW-PW23-DB-161104	0.0556	NA	<0.0250	NA	<0.0250	NA
ISO11-01-01-20-020-FMS	OKMN-GW-PW23-FMS-161104	1.95	94.6 (3)	1.54	77.0 (3)	1.78	89.0 (3)
Average Concentration (ng/mL) ± %RPD		**0.0582 ng/mL ± 8.8%**		**<0.0250 ng/mL**		**<0.0250 ng/mL**	

NA = Not Applicable
NC = Not Calculated; Sp ke level was less than 0.5 times the endogenous sample concentration.
ULOQ = Upper Limit of Quantitation
(1) Samples were analyzed by internal standard cal bration except where otherwise noted.
(2) Sample were analyzed by external standard calibration.
(3) FMS spike level was greater than 10 times the endogenous sample concentration.
(4) FMS exceeded meet criteria of 100±30%.
(5) The data uncertainty has been expanded to ±44% for PFHpA.
(6) Sample was spiked at an inappropriate level, more than 100x the endogenous sample concentration.

Table 16 continued. OKMN GW PW23 161104 (1)

		PFBS		PFHS		PFOS (2)	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-020	OKMN-GW-PW23-0-161104	0.339	NA	1.05	NA	19.3	NA
ISO11-01-01-20-020-DUP	OKMN-GW-PW23-DB-161104	0.337	NA	1.02	NA	18.3	NA
ISO11-01-01-20-020-FMS	OKMN-GW-PW23-FMS-161104	>ULOQ (6)	NA	>ULOQ (6)	NA	504	96.7 (3)
Average Concentration (ng/mL) ± %RPD		**0.338 ng/mL ± 0.59%**		**1.04 ng/mL ± 2.9%**		**18.8 ng/mL ± 5.3%**	

NA = Not Applicable
NC = Not Calculated; Spike level was less than 0.5 times the endogenous sample concentration.
ULOQ = Upper Limit of Quantitation
(1) Samples were analyzed by internal standard calibration except where otherwise noted.
(2) Sample were analyzed by external standard calibration.
(3) FMS spike level was greater than 10 times the endogenous sample concentration.
(4) FMS exceeded meet criteria of 100±30%.
(5) The data uncertainty has been expanded to ±44% for PFHpA.
(6) Sample was spiked at an inappropriate level, more than 100x the endogenous sample concentration.

Table 17. OKMN GW W33 161102 (1)

		PFBA		PFPeA		PFHxA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-027	OKMN-GW-W33-0-161102	121	NA	38.3	NA	93.2	NA
ISO11-01-01-20-027-DUP	OKMN-GW-W33-DB-161102	118	NA	35.6	NA	91.0	NA
ISO11-01-01-20-027-FMS	OKMN-GW-W33-FMS-161102	129	NC	52.9	79.8	108	NC
Average Concentration (ng/mL) ± %RPD		**120 ng/mL ± 2.5%**		**37.0 ng/mL ± 7.3%**		**92.1 ng/mL ± 2.4%**	

		PFHpA		PFOA (2)		PFNA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-027	OKMN-GW-W33-0-161102	99.6	NA	537	NA	18.0	NA
ISO11-01-01-20-027-DUP	OKMN-GW-W33-DB-161102	97.5	NA	515	NA	17.4	NA
ISO11-01-01-20-027-FMS	OKMN-GW-W33-FMS-161102	106	NC	534	NC	34.4	83.5
Average Concentration (ng/mL) ± %RPD		**98.6 ng/mL ± 2.1%**		**526 ng/mL ± 4.2%**		**17.7 ng/mL ± 3.4%**	

		PFDA		PFUnA		PFDoA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-027	OKMN-GW-W33-0-161102	15.7	NA	1.62	NA	<0.0250	NA
ISO11-01-01-20-027-DUP	OKMN-GW-W33-DB-161102	14.6	NA	1.60	NA	<0.0250	NA
ISO11-01-01-20-027-FMS	OKMN-GW-W33-FMS-161102	32.6	87.3	19.7	90.5 (3)	18.9	94.5 (3)
Average Concentration (ng/mL) ± %RPD		**15.2 ng/mL ± 7.3%**		**1.61 ng/mL ± 1.2%**		**<0.0250 ng/mL**	

NA = Not Applicable
NC = Not Calculated; Spike level was less than 0.5 times the endogenous sample concentration.
(1) Samples were analyzed by internal standard calibration except where otherwise noted.
(2) Sample were analyzed by external standard calibration.
(3) FMS spike level was greater than 10 times the endogenous sample concentration.

Table 17 continued. OKMN GW W33 161102 (1)

		PFBS		PFHS		PFOS (2)	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-027	OKMN-GW-W33-0-161102	8.30	NA	18.0	NA	5090	NA
ISO11-01-01-20-027-DUP	OKMN-GW-W33-DB-161102	7.78	NA	16.4	NA	5070	NA
ISO11-01-01-20-027-FMS	OKMN-GW-W33-FMS-161102	26.9	94.3	32.0	74.0	5030	NC
Average Concentration (ng/mL) ± %RPD		**8.04 ng/mL ± 6.5%**		**17.2 ng/mL ± 9.3%**		**5080 ng/mL ± 0.39%**	

NA = Not Applicable
NC = Not Calculated; Sp ke level was less than 0.5 times the endogenous sample concentration.
(1) Samples were analyzed by internal standard cal bration except where otherwise noted.
(2) Sample were analyzed by external standard calibration.
(3) FMS spike level was greater than 10 times the endogenous sample concentration.

Table 18. OKMN GW W205 161031 (1)

		PFBA		PFPeA		PFHxA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-028	OKMN-GW-W205-0-161031	5.00	NA	0.465	NA	0.995	NA
ISO11-01-01-20-028-DUP	OKMN-GW-W205-DB-161031	4.46	NA	0.412	NA	0.932	NA
ISO11-01-01-20-028-FMS	OKMN-GW-W205-FMS-161031	15.9	109	0.712	109	1.32	NC
Average Concentration (ng/mL) ± %RPD		**4.73 ng/mL ± 11%**		**0.439 ng/mL ± 12%**		**0.964 ng/mL ± 6.5%**	

		PFHpA		PFOA		PFNA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-028	OKMN-GW-W205-0-161031	1.34	NA	16.9	NA	0.152	NA
ISO11-01-01-20-028-DUP	OKMN-GW-W205-DB-161031	1.22	NA	15.4	NA	0.135	NA
ISO11-01-01-20-028-FMS	OKMN-GW-W205-FMS-161031	1.66	NC	27.5	111	0.383	95.8
Average Concentration (ng/mL) ± %RPD		**1.28 ng/mL ± 9.4%**		**16.2 ng/mL ± 9.3%**		**0.144 ng/mL ± 12%**	

		PFDA		PFUnA		PFDoA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-028	OKMN-GW-W205-0-161031	0.0875	NA	<0.0250	NA	<0.0250	NA
ISO11-01-01-20-028-DUP	OKMN-GW-W205-DB-161031	0.0763	NA	<0.0250	NA	<0.0250	NA
ISO11-01-01-20-028-FMS	OKMN-GW-W205-FMS-161031	0.320	95.2	0.223	89.2 (2)	0.257	103 (2)
Average Concentration (ng/mL) ± %RPD		**0.0819 ng/mL ± 14%**		**<0.0250 ng/mL**		**<0.0250 ng/mL**	

NA = Not Applicable
NC = Not Calculated; Spike level was less than 0.5 times the endogenous sample concentration.
(1) Samples were analyzed by internal standard calibration.
(2) FMS spike level was greater than 10 times the endogenous sample concentration.

Table 18 continued. OKMN GW W205 161031 (1)

		PFBS		PFHS		PFOS	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-028	OKMN-GW-W205-0-161031	0.305	NA	1.15	NA	57.1	NA
ISO11-01-01-20-028-DUP	OKMN-GW-W205-DB-161031	0.277	NA	0.983	NA	55.4	NA
ISO11-01-01-20-028-FMS	OKMN-GW-W205-FMS-161031	10.3	97.6 (2)	12.0	107 (2)	65.3	NC
Average Concentration (ng/mL) ± %RPD		**0.291 ng/mL ± 9.6%**		**1.07 ng/mL ± 16%**		**56.3 ng/mL ± 3.0%**	

NA = Not Applicable
NC = Not Calculated; Spike level was less than 0.5 times the endogenous sample concentration.
(1) Samples were analyzed by internal standard calibration.
(2) FMS spike level was greater than 10 times the endogenous sample concentration.

Table 19. OKMN GW RW37 161101 (1)

		PFBA		PFPeA		PFHxA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-029	OKMN-GW-RW37-0-161101	0.0674	NA	<0.0250	NA	<0.0250	NA
ISO11-01-01-20-029-DUP	OKMN-GW-RW37-DB-161101	0.0699	NA	<0.0250	NA	<0.0250	NA
ISO11-01-01-20-029-FMS	OKMN-GW-RW37-FMS-161101	0.325	103	0.239	95.6 (2)	0.258	103 (2)
Average Concentration (ng/mL) ± %RPD		**0.0687 ng/mL ± 3.6%**		**<0.0250 ng/mL**		**<0.0250 ng/mL**	

		PFHpA		PFOA		PFNA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-029	OKMN-GW-RW37-0-161101	<0.0250	NA	0.105	NA	<0.0250	NA
ISO11-01-01-20-029-DUP	OKMN-GW-RW37-DB-161101	<0.0250	NA	0.109	NA	<0.0250	NA
ISO11-01-01-20-029-FMS	OKMN-GW-RW37-FMS-161101	0.259	104 (2)	0.344	99.0	0.260	104 (2)
Average Concentration (ng/mL) ± %RPD		**<0.0250 ng/mL**		**0.107 ng/mL ± 3.7%**		**<0.0250 ng/mL**	

		PFDA		PFUnA		PFDoA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-029	OKMN-GW-RW37-0-161101	<0.0250	NA	<0.0250	NA	<0.0250	NA
ISO11-01-01-20-029-DUP	OKMN-GW-RW37-DB-161101	<0.0250	NA	<0.0250	NA	<0.0250	NA
ISO11-01-01-20-029-FMS	OKMN-GW-RW37-FMS-161101	0.260	104 (2)	0.236	94.4 (2)	0.266	106 (2)
Average Concentration (ng/mL) ± %RPD		**<0.0250 ng/mL**		**<0.0250 ng/mL**		**<0.0250 ng/mL**	

NA = Not Applicable
NC = Not Calculated; Sp ke level was less than 0.5 times the endogenous sample concentration.
(1) Samples were analyzed by internal standard cal bration.
(2) FMS spike level was greater than 10 times the endogenous sample concentration.

Table 19 continued. OKMN GW RW37 161101 (1)

		PFBS		PFHS		PFOS	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-029	OKMN-GW-RW37-0-161101	<0.0250	NA	<0.0250	NA	3.59	NA
ISO11-01-01-20-029-DUP	OKMN-GW-RW37-DB-161101	<0.0250	NA	<0.0250	NA	3.56	NA
ISO11-01-01-20-029-FMS	OKMN-GW-RW37-FMS-161101	0.261	104 (2)	0.279	112 (2)	3.70	NC
Average Concentration (ng/mL) ± %RPD		**<0.0250 ng/mL**		**<0.0250 ng/mL**		**3.58 ng/mL ± 0.84%**	

NA = Not Applicable
NC = Not Calculated; Spike level was less than 0.5 times the endogenous sample concentration.
(1) Samples were analyzed by internal standard calibration.
(2) FMS spike level was greater than 10 times the endogenous sample concentration.

Table 20. OKMN SW SW16 161103 (1)

		PFBA		PFPeA		PFHxA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-036	OKMN-SW-SW16-0-161103	0.0773	NA	<0.0250	NA	<0.0250	NA
ISO11-01-01-20-036-DUP	OKMN-SW-SW16-DB-161103	0.0740	NA	<0.0250	NA	<0.0250	NA
ISO11-01-01-20-036-FMS	OKMN-SW-SW16-FMS-161103	0.597	104	0.453	90.6 (2)	0.461	92.2 (2)
Average Concentration (ng/mL) ± %RPD		**0.0757 ng/mL ± 4.4%**		**<0.0250 ng/mL**		**<0.0250 ng/mL**	

		PFHpA		PFOA		PFNA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-036	OKMN-SW-SW16-0-161103	<0.0250	NA	<0.0240	NA	<0.0250	NA
ISO11-01-01-20-036-DUP	OKMN-SW-SW16-DB-161103	<0.0250	NA	<0.0240	NA	<0.0250	NA
ISO11-01-01-20-036-FMS	OKMN-SW-SW16-FMS-161103	0.492	98.4 (2)	0.450	93.9 (2)	0.515	103 (2)
Average Concentration (ng/mL) ± %RPD		**<0.0250 ng/mL**		**<0.0240 ng/mL**		**<0.0250 ng/mL**	

		PFDA		PFUnA		PFDoA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-036	OKMN-SW-SW16-0-161103	<0.0250	NA	<0.0250	NA	<0.0250	NA
ISO11-01-01-20-036-DUP	OKMN-SW-SW16-DB-161103	<0.0250	NA	<0.0250	NA	<0.0250	NA
ISO11-01-01-20-036-FMS	OKMN-SW-SW16-FMS-161103	0.501	100 (2)	0.436	87.2 (2)	0.485	97.0 (2)
Average Concentration (ng/mL) ± %RPD		**<0.0250 ng/mL**		**<0.0250 ng/mL**		**<0.0250 ng/mL**	

NA = Not Applicable
NC = Not Calculated; Sp ke level was less than 0.5 times the endogenous sample concentration.
(1) Samples were analyzed by internal standard cal bration.
(2) FMS spike level was greater than 10 times the endogenous sample concentration.

Table 20 continued. OKMN SW SW16 161103 (1)

		PFBS		PFHS		PFOS	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-036	OKMN-SW-SW16-0-161103	<0.0250	NA	<0.0250	NA	<0.0232	NA
ISO11-01-01-20-036-DUP	OKMN-SW-SW16-DB-161103	<0.0250	NA	<0.0250	NA	<0.0232	NA
ISO11-01-01-20-036-FMS	OKMN-SW-SW16-FMS-161103	0.478	95.6 (2)	0.494	98.8 (2)	0.474	102 (2)
Average Concentration (ng/mL) ± %RPD		**<0.0250 ng/mL**		**<0.0250 ng/mL**		**<0.0232 ng/mL**	

NA = Not Applicable
NC = Not Calculated; Spike level was less than 0.5 times the endogenous sample concentration.
(1) Samples were analyzed by internal standard calibration.
(2) FMS spike level was greater than 10 times the endogenous sample concentration.

Table 21. OKMN GW Trip Blank 161031 (1)

		PFBA		PFPeA		PFHxA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-037	OKMN-GW-TRIP-0-161031	<0.0250	NA	<0.0250	NA	<0.0250	NA
ISO11-01-01-20-037-FMS	OKMN-GW-TRIP-FMS-161031	10.5	102	0.242	96.8	0.215	86.0

		PFHpA		PFOA		PFNA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-037	OKMN-GW-TRIP-0-161031	<0.0250	NA	<0.0240	NA	<0.0250	NA
ISO11-01-01-20-037-FMS	OKMN-GW-TRIP-FMS-161031	0.265	106	10.2	99.6	0.255	102

		PFDA		PFUnA		PFDoA	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-037	OKMN-GW-TRIP-0-161031	<0.0250	NA	<0.0250	NA	<0.0250	NA
ISO11-01-01-20-037-FMS	OKMN-GW-TRIP-FMS-161031	0.232	92.8	0.229	91.6	0.241	96.4

		PFBS		PFHS		PFOS	
3M LIMS ID	**Description**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**	**Concentration (ng/mL)**	**%Recovery**
ISO11-01-01-20-037	OKMN-GW-TRIP-0-161031	<0.0250	NA	<0.0250	NA	<0.0232	NA
ISO11-01-01-20-037-FMS	OKMN-GW-TRIP-FMS-161031	10.0	97.6	10.5	102	9.68	94.6

NA = Not Applicable
(1) Samples were analyzed by internal standard cal bration.

Table 22. Surrogate Recovery (1)

		Analysis 11/15/16			
3M LIMS ID	**Description**	**[$^{13}C_3$]-PFBA %Recovery**	**[$^{13}C_4$]-PFOA %Recovery**	**[$^{13}C_2$]-PFUnA %Recovery**	**[$^{13}C_4$]-PFOS %Recovery**
ISO11-01-01-20-001	OKMN-GW-W2007-0-161103	NA	93.6	NA	80.5
ISO11-01-01-20-001-DUP	OKMN-GW-W2007-DB-161103	NA	87.6	NA	90.7
ISO11-01-01-20-001-FMS	OKMN-GW-W2007-FMS-161103	NA	93.7	NA	86.4
ISO11-01-01-20-002	OKMN-GW-W26R-0-161102	87.1	89.3	NA	85.8
ISO11-01-01-20-002-DUP	OKMN-GW-W26R-DB-161102	88.7	95.0	NA	83.4
ISO11-01-01-20-003	OKMN-GW-PW01-0-161103	85.1	99.8	89.9	93.3
ISO11-01-01-20-003-DUP	OKMN-GW-PW01-DB-161103	85.5	97.1	87.5	101
ISO11-01-01-20-004	OKMN-GW-PW02-0-161103	88.1	92.6	94.3	87.4
ISO11-01-01-20-004-DUP	OKMN-GW-PW02-DB-161103	91.9	84.1	94.9	88.7
ISO11-01-01-20-004-FMS	OKMN-GW-PW02-FMS-161103	94.6	83.8	90.0	97.0
ISO11-01-01-20-005	OKMN-GW-PW03-0-161103	88.8	92.3	88.7	84.6
ISO11-01-01-20-005-DUP	OKMN-GW-PW03-DB-161103	84.4	90.7	95.5	76.0
ISO11-01-01-20-006	OKMN-GW-PW04-0-161103	87.4	88.0	88.1	87.4
ISO11-01-01-20-006-DUP	OKMN-GW-PW04-DB-161103	88.7	78.5	90.6	84.0
ISO11-01-01-20-006-FMS	OKMN-GW-PW04-FMS-161103	87.4	89.7	93.5	99.6
ISO11-01-01-20-007	OKMN-GW-PW06-0-161103	90.5	83.7	96.7	76.8
ISO11-01-01-20-007-DUP	OKMN-GW-PW06-DB-161103	94.4	85.1	90.3	90.7
ISO11-01-01-20-008	OKMN-GW-PW07-0-161103	91.0	91.8	93.4	91.9
ISO11-01-01-20-008-DUP	OKMN-GW-PW07-DB-161103	92.2	102	95.2	80.5
ISO11-01-01-20-009	OKMN-GW-PW10-0-161103	78.0	NA	95.3	76.3
ISO11-01-01-20-009-DUP	OKMN-GW-PW10-DB-161103	80.3	NA	91.4	89.7
ISO11-01-01-20-010	OKMN-GW-PW11-0-161103	89.4	94.5	84.9	82.5
ISO11-01-01-20-010-DUP	OKMN-GW-PW11-DB-161103	81.8	87.0	91.1	72.8
ISO11-01-01-20-010-FMS	OKMN-GW-PW11-FMS-161103	82.8	97.4	90.4	92.8
ISO11-01-01-20-011	OKMN-GW-PW14-0-161103	88.8	88.8	87.4	89.4
ISO11-01-01-20-011-DUP	OKMN-GW-PW14-DB-161103	86.9	89.5	95.4	89.2
ISO11-01-01-20-012	OKMN-GW-PW15-0-161103	88.3	92.2	90.1	90.4
ISO11-01-01-20-012-DUP	OKMN-GW-PW15-DB-161103	88.1	89.3	85.2	107
ISO11-01-01-20-013	OKMN-GW-PW16-0-161103	91.2	90.6	85.0	115
ISO11-01-01-20-013-DUP	OKMN-GW-PW16-DB-161103	94.3	87.8	92.1	85.3
ISO11-01-01-20-014	OKMN-GW-PW17-0-161103	87.0	89.1	88.9	77.8
ISO11-01-01-20-014-DUP	OKMN-GW-PW17-DB-161103	90.8	85.1	93.1	73.3
ISO11-01-01-20-015	OKMN-GW-PW18-0-161103	90.4	85.6	97.1	101
ISO11-01-01-20-015-DUP	OKMN-GW-PW18-DB-161103	86.4	87.4	88.5	88.5
ISO11-01-01-20-015-FMS	OKMN-GW-PW18-FMS-161103	88.8	97.1	88.2	72.3
ISO11-01-01-20-016	OKMN-GW-PW19-0-161103	88.4	92.7	91.4	86.9
ISO11-01-01-20-016-DUP	OKMN-GW-PW19-DB-161103	95.4	94.7	99.3	80.8

NA = Not Applicable
(1) Samples were analyzed by internal standard cal bration except where otherwise noted.
(2) Samples were analyzed by external standard cal bration.
(3) Due to the high levels of endogenous analytes in the samples and the need for sample dilution, the surrogate recovery is a laboratory matrix spike at 1 ng/mL added during sample preparation, prior to analysis and quantitated by external standard cal bration.

Table 22 continued. Surrogate Recovery (1)

		Analysis 11/15/16			
3M LIMS ID	**Description**	**[$^{13}C_3$]-PFBA %Recovery**	**[$^{13}C_4$]-PFOA %Recovery**	**[$^{13}C_2$]-PFUnA %Recovery**	**[$^{13}C_4$]-PFOS %Recovery**
ISO11-01-01-20-017	OKMN-GW-PW20-0-161103	83.4	94.4	93.3	85.1
ISO11-01-01-20-017-DUP	OKMN-GW-PW20-DB-161103	87.2	84.1	93.1	87.3
ISO11-01-01-20-018	OKMN-GW-PW21-0-161103	94.7	92.7	94.8	73.8
ISO11-01-01-20-018-DUP	OKMN-GW-PW21-DB-161103	91.3	95.5	88.8	86.6
ISO11-01-01-20-019	OKMN-GW-PW22-0-161103	90.6	83.1	95.3	102
ISO11-01-01-20-019-DUP	OKMN-GW-PW22-DB-161103	89.4	85.1	87.9	76.2
ISO11-01-01-20-020	OKMN-GW-PW23-0-161104	88.9	93.3	92.3	97.9
ISO11-01-01-20-020-DUP	OKMN-GW-PW23-DB-161104	89.7	88.8	88.2	102
ISO11-01-01-20-020-FMS	OKMN-GW-PW23-FMS-161104	79.1	99.0	90.8	76.9
ISO11-01-01-20-021	OKMN-GW-PW24-0-161103	89.4	91.7	88.6	96.6
ISO11-01-01-20-021-DUP	OKMN-GW-PW24-DB-161103	88.2	87.0	93.3	83.1
ISO11-01-01-20-022	OKMN-GW-PW25-0-161103	88.0	95.5	88.2	93.9
ISO11-01-01-20-022-DUP	OKMN-GW-PW25-DB-161103	88.8	81.3	89.8	77.5
ISO11-01-01-20-023	OKMN-GW-PW26-0-161103	89.3	90.2	89.1	97.5
ISO11-01-01-20-023-DUP	OKMN-GW-PW26-DB-161103	91.8	94.3	89.7	96.5
ISO11-01-01-20-024	OKMN-GW-W08-0-161031	88.5	90.5	95.5	98.4
ISO11-01-01-20-024-DUP	OKMN-GW-W08-DB-161031	89.2	89.4	92.0	78.0
ISO11-01-01-20-025	OKMN-GW-PL41-0-161031	91.0	88.9	90.0	88.8
ISO11-01-01-20-025-DUP	OKMN-GW-PL41-DB-161031	84.2	92.1	90.0	102
ISO11-01-01-20-026	OKMN-GW-SP42-0-161101	89.9	92.3	89.2	97.1
ISO11-01-01-20-026-DUP	OKMN-GW-SP42-DB-161101	93.3	91.3	90.8	104
ISO11-01-01-20-027	OKMN-GW-W33-0-161102	88.6	NA	94.6	NA
ISO11-01-01-20-027-DUP	OKMN-GW-W33-DB-161102	86.7	NA	89.1	NA
ISO11-01-01-20-027-FMS	OKMN-GW-W33-FMS-161102	91.7	NA	110	NA
ISO11-01-01-20-028	OKMN-GW-W205-0-161031	89.5	87.8	86.5	102
ISO11-01-01-20-028-DUP	OKMN-GW-W205-DB-161031	92.4	86.1	94.1	82.8
ISO11-01-01-20-028-FMS	OKMN-GW-W205-FMS-161031	89.2	91.6	92.8	84.8
ISO11-01-01-20-029	OKMN-GW-RW37-0-161101	84.9	90.0	91.3	93.6
ISO11-01-01-20-029-DUP	OKMN-GW-RW37-DB-161101	83.7	90.7	91.3	90.8
ISO11-01-01-20-029-FMS	OKMN-GW-RW37-FMS-161101	84.9	97.9	88.7	80.9
ISO11-01-01-20-030	OKMN-GW-RW38-0-161101	92.3	83.7	91.0	84.5
ISO11-01-01-20-030-DUP	OKMN-GW-RW38-DB-161101	86.6	82.5	86.8	88.4
ISO11-01-01-20-031	OKMN-SW-SW01-0-161103	88.5	85.8	88.8	86.1
ISO11-01-01-20-031-DUP	OKMN-SW-SW01-DB-161103	90.2	85.4	84.0	74.0
ISO11-01-01-20-032	OKMN-SW-SW12-0-161103	91.2	86.4	89.4	100
ISO11-01-01-20-032-DUP	OKMN-SW-SW12-DB-161103	88.5	91.2	90.1	94.2

NA = Not Applicable
(1) Samples were analyzed by internal standard cal bration except where otherwise noted.
(2) Samples were analyzed by external standard cal bration.
(3) Due to the high levels of endogenous analytes in the samples and the need for sample dilution, the surrogate recovery is a laboratory matrix spike at 1 ng/mL added during sample preparation, prior to analysis and quantitated by external standard cal bration.

Table 22 continued. Surrogate Recovery (1)

		Analysis 11/15/16			
3M LIMS ID	**Description**	**[$^{13}C_3$]-PFBA %Recovery**	**[$^{13}C_4$]-PFOA %Recovery**	**[$^{13}C_2$]-PFUnA %Recovery**	**[$^{13}C_4$]-PFOS %Recovery**
ISO11-01-01-20-033	OKMN-SW-SW13-0-161103	84.8	83.3	81.2	82.9
ISO11-01-01-20-033-DUP	OKMN-SW-SW13-DB-161103	85.1	94.9	86.9	92.7
ISO11-01-01-20-036	OKMN-SW-SW16-0-161103	86.6	84.3	90.5	84.8
ISO11-01-01-20-036-DUP	OKMN-SW-SW16-DB-161103	84.6	83.4	86.4	93.2
ISO11-01-01-20-036-FMS	OKMN-SW-SW16-FMS-161103	97.9	88.6	86.6	99.5
ISO11-01-01-20-038	OKMN-GW-PW08-RB01-0-161101	93.0	88.1	95.0	90.4
ISO11-01-01-20-039	OKMN-GW-W2007-RB02-0-161102	89.8	83.0	NA	78.2
ISO11-01-01-20-040	OKMN-GW-PW02-RB03-0-161103	85.5	94.0	90.3	78.2
ISO11-01-01-20-037	OKMN-GW-TRIP-0-161031	88.3	89.5	89.5	86.6
ISO11-01-01-20-037-FMS	OKMN-GW-TRIP-FMS-161031	88.4	87.7	93.1	84.1

		Analysis 11/22/16		
3M LIMS ID	**Description**	**[$^{13}C_4$]-PFOA %Recovery**	**[$^{13}C_2$]-PFUnA %Recovery**	**[$^{13}C_4$]-PFOS %Recovery**
ISO11-01-01-20-013	OKMN-GW-PW16-0-161103	97.6	NA	NA
ISO11-01-01-20-013-DUP	OKMN-GW-PW16-DB-161103	91.1	NA	NA
ISO11-01-01-20-023	OKMN-GW-PW26-0-161103	NA	89.5	NA
ISO11-01-01-20-023-DUP	OKMN-GW-PW26-DB-161103	NA	95.7	NA
ISO11-01-01-20-024	OKMN-GW-W08-0-161031	92.1	NA	81.3
ISO11-01-01-20-024-DUP	OKMN-GW-W08-DB-161031	93.3	NA	76.2
ISO11-01-01-20-028	OKMN-GW-W205-0-161031	NA	88.8	NA
ISO11-01-01-20-028-DUP	OKMN-GW-W205-DB-161031	NA	94.5	NA
ISO11-01-01-20-028-FMS	OKMN-GW-W205-FMS-161031	NA	90.5	NA
ISO11-01-01-20-033	OKMN-SW-SW13-0-161103	91.1	NA	NA
ISO11-01-01-20-033-DUP	OKMN-SW-SW13-DB-161103	82.7	NA	NA
ISO11-01-01-20-039	OKMN-GW-W2007-RB02-0-161102	NA	88.5	NA

NA = Not Applicable
(1) Samples were analyzed by internal standard cal bration except where otherwise noted.
(2) Samples were analyzed by external standard cal bration.
(3) Due to the high levels of endogenous analytes in the samples and the need for sample dilution, the surrogate recovery is a laboratory matrix spike at 1 ng/mL added during sample preparation, prior to analysis and quantitated by external standard cal bration.

Table 22 continued. Surrogate Recovery (1)

		Analysis 11/28/16 (2, 3)		
3M LIMS ID	Description	$[^{13}C_3]$-PFBA %Recovery	$[^{13}C_4]$-PFOA %Recovery	$[^{13}C_4]$-PFOS %Recovery
ISO11-01-01-20-001	OKMN-GW-W2007-0-161103	105	NA	NA
ISO11-01-01-20-001-DUP	OKMN-GW-W2007-DB-161103	102	NA	NA
ISO11-01-01-20-001-FMS	OKMN-GW-W2007-FMS-161103	100	NA	NA
ISO11-01-01-20-002	OKMN-GW-W26R-0-161102	NA	NA	105
ISO11-01-01-20-002-DUP	OKMN-GW-W26R-DB-161102	NA	NA	98.1
ISO11-01-01-20-009	OKMN-GW-PW10-0-161103	100	98.1	99.1
ISO11-01-01-20-009-DUP	OKMN-GW-PW10-DB-161103	100	99.8	100
ISO11-01-01-20-010	OKMN-GW-PW11-0-161103	NA	100	103
ISO11-01-01-20-010-DUP	OKMN-GW-PW11-DB-161103	NA	104	103
ISO11-01-01-20-010-FMS	OKMN-GW-PW11-FMS-161103	NA	99.5	101
ISO11-01-01-20-020	OKMN-GW-PW23-0-161104	105	103	102
ISO11-01-01-20-020-DUP	OKMN-GW-PW23-DB-161104	105	103	104
ISO11-01-01-20-020-FMS	OKMN-GW-PW23-FMS-161104	106	100	104
ISO11-01-01-20-027	OKMN-GW-W33-0-161102	106	99.6	101
ISO11-01-01-20-027-DUP	OKMN-GW-W33-DB-161102	106	99.3	101
ISO11-01-01-20-027-FMS	OKMN-GW-W33-FMS-161102	105	100	101

NA = Not Applicable
(1) Samples were analyzed by internal standard cal bration except where otherwise noted.
(2) Samples were analyzed by external standard cal bration.
(3) Due to the high levels of endogenous analytes in the samples and the need for sample dilution, the surrogate recovery is a laboratory matrix spike at 1 ng/mL added during sample preparation, prior to analysis and quantitated by external standard cal bration.

5 Conclusion

Laboratory control spikes were used to determine the analytical method accuracy and precision for all analytes. The accuracy and precision were then used to estimate the method uncertainty for the results. Field matrix spike recoveries demonstrated that the analytical method was appropriate for the given sample matrix. Analysis was completed using 3M Environmental Laboratory method ETS-8-044.3 “Method of Analysis for the Determination of Perfluorinated Compounds in Water by LC/MS/MS; Direct Injection Analysis”. Analytical results are reported in Table 1 and 11-22 of this report.

6 Data / Sample Retention

All remaining sample and associated project data (hardcopy and electronic) will be archived according to 3M Environmental Laboratory standard operating procedures.

7 Attachments

Attachment A: Trend Data for PFBA, PFOA, PFBS, PFHS, and PFOS at Select Sampling Locations

8 Signatures

Scott Porcher, Report Author

Susan T. Wolf, 3M Principal Analytical Investigator

William K. Reagen, Ph.D., 3M Environmental Laboratory Technical Director

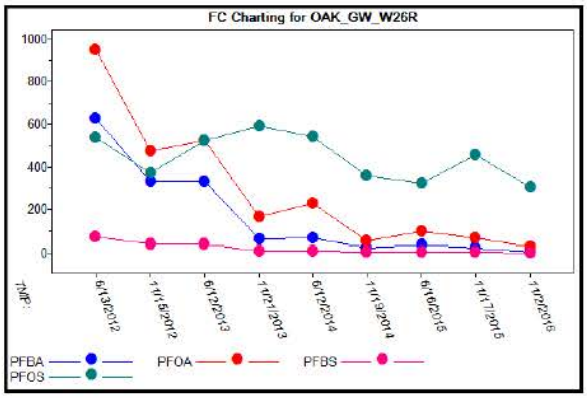
The 3M Environmental Laboratory's Quality Assurance Unit has audited the data and report for this project.

Quality Assurance Representative

This test report shall not be reproduced except in full, without written approval of the 3M Environmental Laboratory.

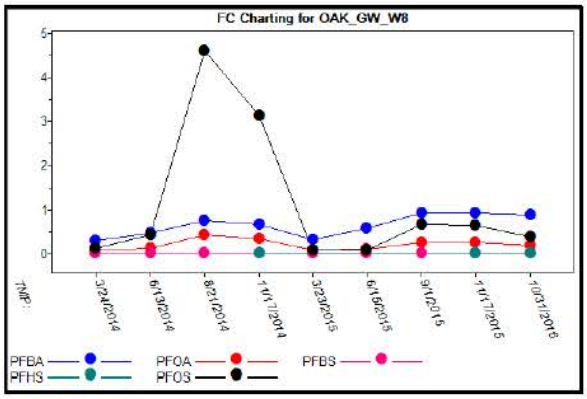
Attachment A: Trend Data for Select Analytes at Select Sampling Locations. Samples reported in ng/mL.

W26R



W26R	6/13/12	11/15/12	6/12/13	11/21/13	6/12/14	11/19/14	6/16/15	11/17/15	11/2/16
PFBA	627	331	329	61.3	65.7	20.3	36.1	23.2	5.21
PFOA	948	475	525	167	229	53.5	98.5	68.5	27.6
PFBS	73.7	42.3	40.2	8.42	10.9	3.01	5.58	2.21	0.692
PFOS	536	371	525	589	543	356	320	457	305

W8

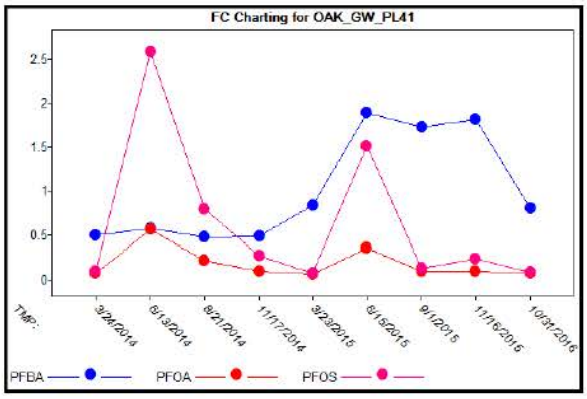


W8	3/24/14	6/13/14	8/21/14	11/17/14	3/23/15	6/15/15	9/1/15	11/17/15	10/31/16
PFBA	0.303	0.479	0.762	0.669	0.332	0.587	0.921	0.937	0.877
PFOA	0.0958	0.136	0.441	0.339	0.0829	0.103	0.263	0.249	0.195
PFBS	0.0290	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250
PFHS	NA	NA	NA	<0.0250	NA	NA	NA	0.0254	0.0272
PFOS	0.127	0.441	4.60	3.13	0.0962	0.0852	0.678	0.640	0.380

NA = Not Applicable; analyte not requested for sampling event.

Attachment A: Trend Data for Select Analytes at Select Sampling Locations. Samples reported in ng/mL.

PL41

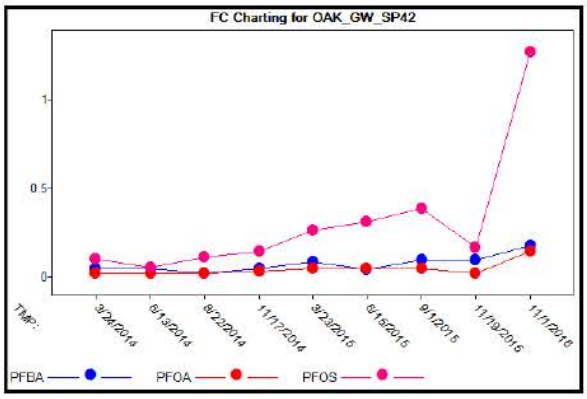


PL41	3/24/14	6/13/14	8/21/14	11/17/14	3/23/15	6/15/15	9/1/15	11/16/15	10/31/16
PFBA	0.496	0.576	0.482	0.492	0.839	1.89	1.72	1.81	0.802
PFOA	0.0811	0.570	0.219	0.101	0.0679	0.361	0.0987	0.0960	0.0776
PFOS	0.0992	2.58	0.791	0.268	0.073	1.51	0.133	0.238	0.0843

PFBS as not detected above the LOQ for these sampling events.

PFHS was either not requested or not detected above the LOQ for these sampling events.

SP42



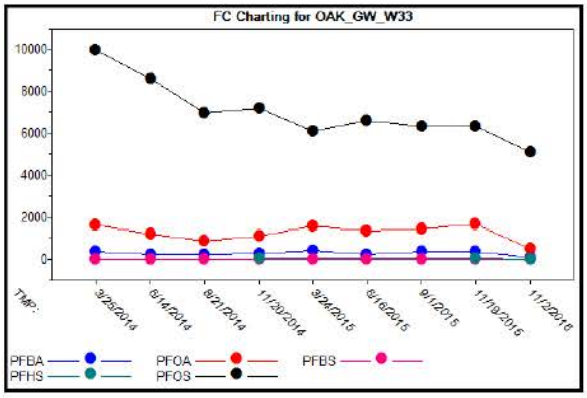
SP42	3/24/14	6/13/14	8/22/14	11/17/14	3/23/15	6/15/15	9/1/15	11/19/15	11/1/16
PFBA	<0.0500	<0.0500	<0.0250	<0.0500	0.0867	0.0438	<0.100	<0.100	0.178
PFOA	<0.0240	<0.0240	<0.0240	0.0319	0.0486	<0.0480	0.0493	<0.0240	0.145
PFOS	0.102	0.0553	0.113	0.146	0.265	0.316	0.387	0.167	1.27

PFBS as not detected above the LOQ for these sampling events.

PFHS was either not requested or not detected above the LOQ for these sampling events.

Attachment A: Trend Data for Select Analytes at Select Sampling Locations. Samples reported in ng/mL.

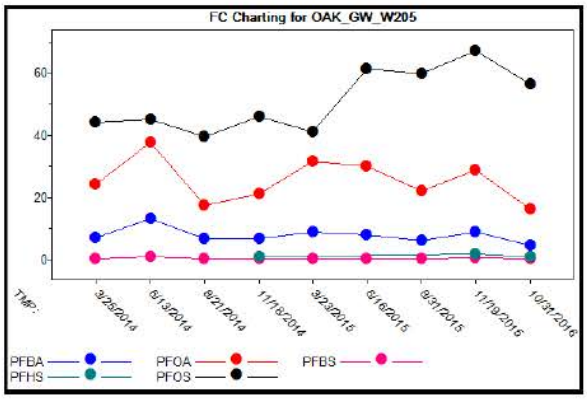
W33



W33	3/25/14	6/14/14	8/21/14	11/20/14	3/24/15	6/16/15	9/1/15	11/19/15	11/2/16
PFBA	366	253	224	287	419	242	383	370	120
PFOA	1600	1190	879	1120	1560	1350	1410	1660	526
PFBS	30.0	19.7	17.1	21.4	22.3	19.5	22.3	18.6	8.04
PFHS	NA	NA	NA	61.6	NA	NA	NA	64.8	17.2
PFOS	9980	8610	6970	7190	6070	6610	6340	6340	5080

NA = Not Applicable; analyte not requested for sampling event.

W205

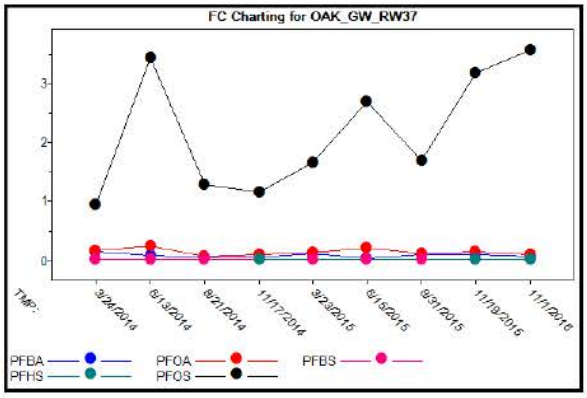


W205	3/25/14	6/13/14	8/21/14	11/18/14	3/23/15	6/16/15	8/31/15	11/19/15	10/31/16
PFBA	7.19	13.1	6.93	6.73	8.82	7.99	6.03	8.84	4.73
PFOA	24.1	37.7	17.6	21.1	31.7	30.2	22.2	28.9	16.2
PFBS	0.299	0.892	0.388	0.328	0.429	0.417	0.377	0.545	0.291
PFHS	NA	NA	NA	0.984	NA	NA	NA	1.84	1.07
PFOS	44.1	45.2	39.7	45.9	41.2	61.4	59.9	67.2	56.3

NA = Not Applicable; analyte not requested for sampling event.

Attachment A: Trend Data for Select Analytes at Select Sampling Locations. Samples reported in ng/mL.

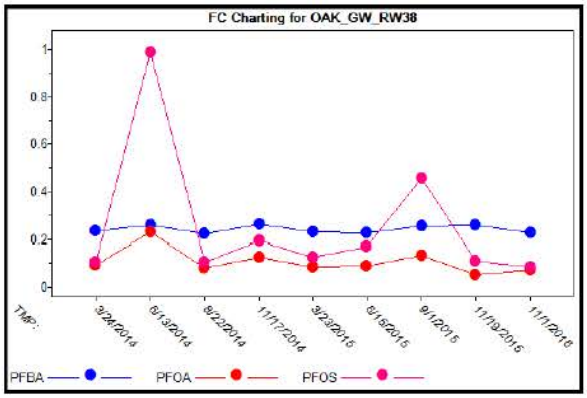
RW37



RW37	3/24/14	6/13/14	8/21/14	11/17/14	3/23/15	6/15/15	8/31/15	11/19/15	11/1/16
PFBA	0.152	0.0881	0.0612	0.0570	0.118	0.0473	<0.100	<0.100	0.0687
PFOA	0.168	0.252	0.0752	0.0999	0.145	0.214	0.123	0.157	0.107
PFBS	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250
PFHS	NA	NA	NA	<0.0250	NA	NA	NA	<0.0236	<0.0250
PFOS	0.934	3.44	1.28	1.15	1.65	2.70	1.68	3.19	3.58

NA = Not Applicable; analyte not requested for sampling event.

RW38



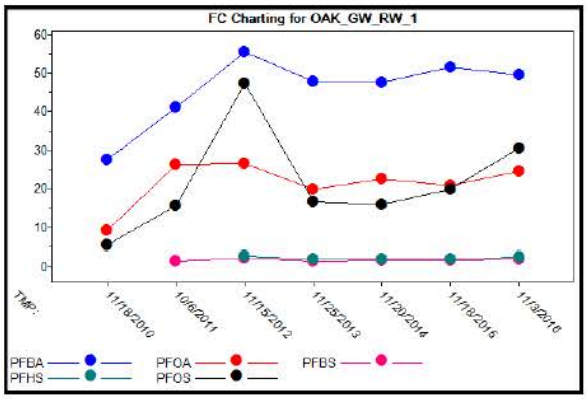
RW38	3/24/14	6/13/14	8/22/14	11/17/14	3/23/15	6/15/15	9/1/15	11/19/15	11/1/16
PFBA	0.236	0.260	0.221	0.262	0.232	0.227	0.256	0.258	0.225
PFOA	0.0934	0.232	0.0804	0.126	0.0865	0.0890	0.133	0.0540	0.0727
PFOS	0.105	0.988	0.104	0.193	0.125	0.170	0.455	0.110	0.0846

PFBS as not detected above the LOQ for these sampling events.

PFHS was either not requested or not detected above the LOQ for these sampling events.

Attachment A: Trend Data for Select Analytes at Select Sampling Locations. Samples reported in ng/mL.

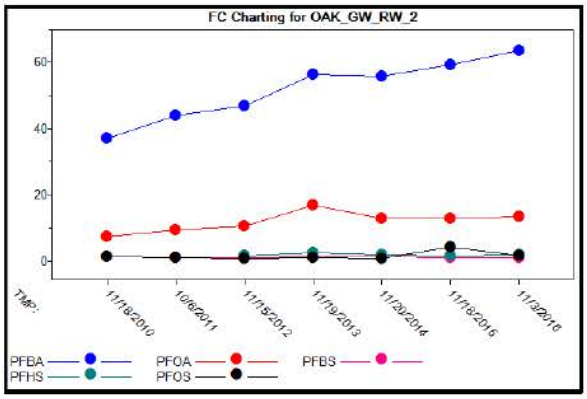
PW01



PW01	11/18/2010	10/6/2011	11/15/2012	11/25/2013	11/20/2014	11/18/2015	11/3/2016
PFBA	27.5	41.1	55.5	47.8	47.6	51.6	49.4
PFOA	9.17	26.3	26.5	19.8	22.6	20.9	24.5
PFBS	NA	1.44	2.11	1.44	1.79	1.81	1.86
PFHS	NA	NA	2.62	1.88	1.95	2.10	2.56
PFOS	5.36	15.7	47.4	16.7	15.8	19.9	30.4

NA = Not Applicable; analyte not requested for sampling event.

PW02

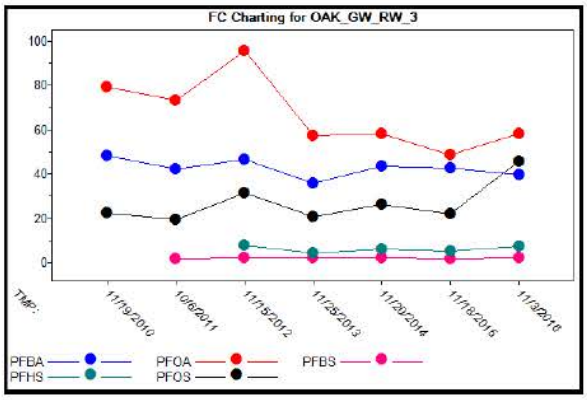


PW02	11/18/2010	10/6/2011	11/15/2012	11/19/2013	11/20/2014	11/18/2015	11/3/2016
PFBA	37.1	44.0	46.9	56.4	55.9	59.2	63.6
PFOA	7.33	9.51	10.5	16.9	12.9	12.9	13.4
PFBS	NA	1.13	1.05	1.33	1.35	0.961	1.11
PFHS	NA	NA	1.47	2.36	1.82	1.57	1.86
PFOS	1.23	1.15	0.685	1.10	0.791	4.20	1.50

NA = Not Applicable; analyte not requested for sampling event.

Attachment A: Trend Data for Select Analytes at Select Sampling Locations. Samples reported in ng/mL.

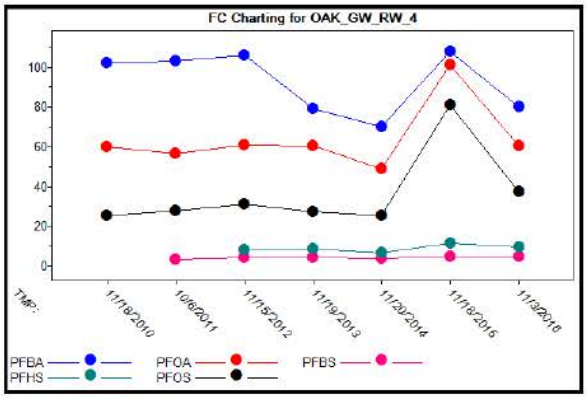
PW03



PW03	11/19/2010	10/6/2011	11/15/2012	11/25/2013	11/20/2014	11/18/2015	11/3/2016
PFBA	48.5	42.3	46.5	35.9	43.5	42.5	39.6
PFOA	79.4	73.2	95.7	57.2	58.2	48.7	58.4
PFBS	NA	1.74	2.45	2.31	2.33	1.95	2.24
PFHS	NA	NA	7.74	4.29	6.06	5.29	7.45
PFOS	22.4	19.3	31.4	20.9	26.2	21.9	45.9

NA = Not Applicable; analyte not requested for sampling event.

PW04

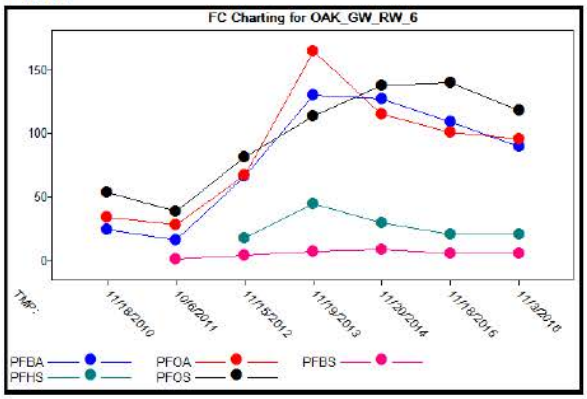


PW04	11/18/2010	10/6/2011	11/15/2012	11/19/2013	11/20/2014	11/18/2015	11/3/2016
PFBA	102	103	106	78.9	69.9	108	80.2
PFOA	59.9	56.6	61.0	60.6	48.7	101	60.6
PFBS	NA	3.24	4.26	4.13	3.80	4.85	4.87
PFHS	NA	NA	7.97	8.43	6.78	11.6	9.76
PFOS	25.5	27.8	31.0	27.2	25.2	81.0	37.5

NA = Not Applicable; analyte not requested for sampling event.

Attachment A: Trend Data for Select Analytes at Select Sampling Locations. Samples reported in ng/mL.

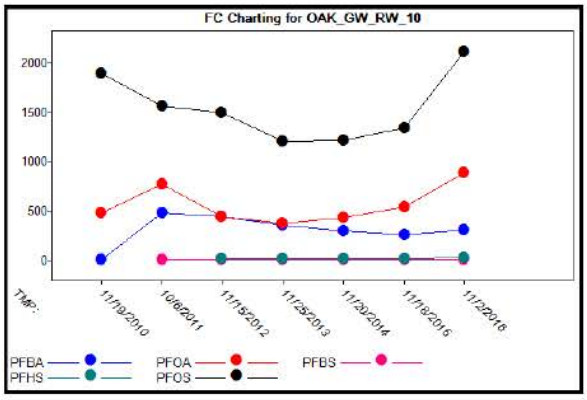
PW06



PW06	11/18/2010	10/6/2011	11/15/2012	11/19/2013	11/20/2014	11/18/2015	11/3/2016
PFBA	24.3	16.6	66.4	130	127	109	89.6
PFOA	34.0	28.3	67.4	165	115	101	96.1
PFBS	NA	1.23	4.39	7.69	8.65	6.08	5.97
PFHS	NA	NA	17.6	44.9	29.8	20.8	20.6
PFOS	53.5	39.2	81.6	114	138	140	118

NA = Not Applicable; analyte not requested for sampling event.

PW10

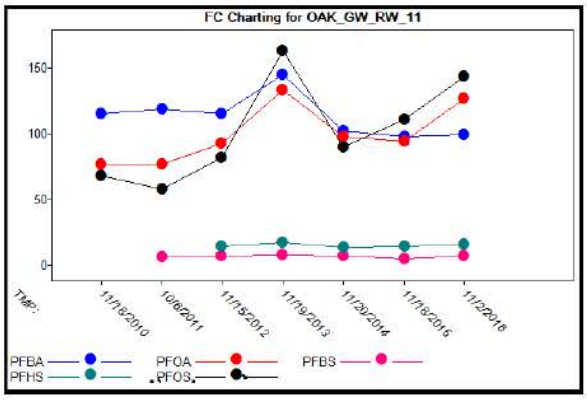


PW10	11/19/2010	10/6/2011	11/15/2012	11/25/2013	11/20/2014	11/18/2015	11/2/2016
PFBA	<5.00	480	440	357	295	254	310
PFOA	477	776	443	375	433	541	890
PFBS	NA	5.12	5.14	4.33	5.22	7.19	8.23
PFHS	NA	NA	15.8	15.2	13.8	16.9	23.6
PFOS	1900	1570	1500	1210	1220	1340	2120

NA = Not Applicable; analyte not requested for sampling event.

Attachment A: Trend Data for Select Analytes at Select Sampling Locations. Samples reported in ng/mL.

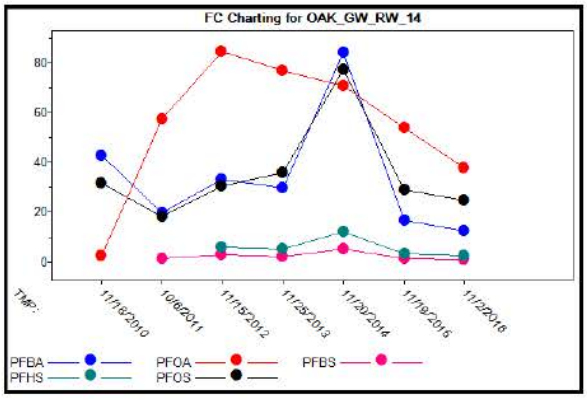
PW11



PW11	11/18/2010	10/6/2011	11/15/2012	11/19/2013	11/20/2014	11/18/2015	11/2/2016
PFBA	115	119	115	145	102	97.5	98.8
PFOA	76.5	77.0	92.7	133	97.7	94.1	127
PFBS	NA	6.24	7.38	7.73	7.41	4.77	7.22
PFHS	NA	NA	14.0	17.0	13.7	14.6	15.4
PFOS	68.2	57.5	82.0	163	89.8	111	143

NA = Not Applicable; analyte not requested for sampling event.

PW14

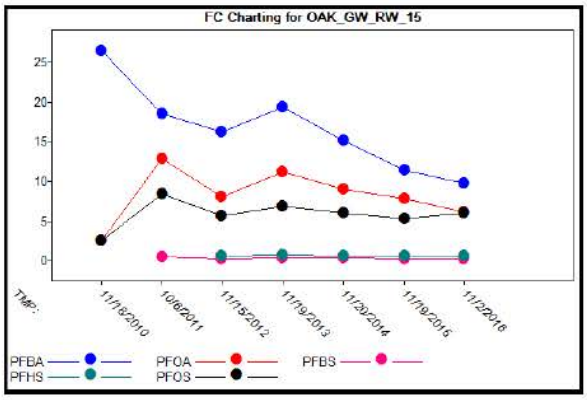


PW14	11/18/2010	10/6/2011	11/15/2012	11/25/2013	11/20/2014	11/19/2015	11/2/2016
PFBA	43.0	19.9	33.3	29.9	84.4	16.8	12.4
PFOA	<2.50	57.5	84.7	77.0	71.0	53.9	37.7
PFBS	NA	1.39	2.74	2.05	5.22	1.26	0.944
PFHS	NA	NA	5.84	5.28	12.2	3.20	2.51
PFOS	31.6	18.4	30.6	35.9	77.5	29.1	24.8

NA = Not Applicable; analyte not requested for sampling event.

Attachment A: Trend Data for Select Analytes at Select Sampling Locations. Samples reported in ng/mL.

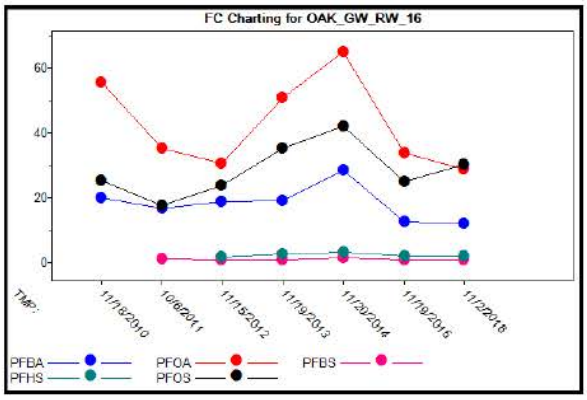
PW15



PW15	11/18/2010	10/6/2011	11/15/2012	11/19/2013	11/20/2014	11/19/2015	11/2/2016
PFBA	26.5	18.6	16.3	19.4	15.2	11.4	9.79
PFOA	<2.50	12.9	8.11	11.2	9.07	7.80	6.20
PFBS	NA	0.461	0.314	0.359	0.345	0.268	0.235
PFHS	NA	NA	0.596	0.756	0.662	0.573	0.576
PFOS	<2.50	8.40	5.66	6.89	6.05	5.26	6.02

NA = Not Applicable; analyte not requested for sampling event.

PW16

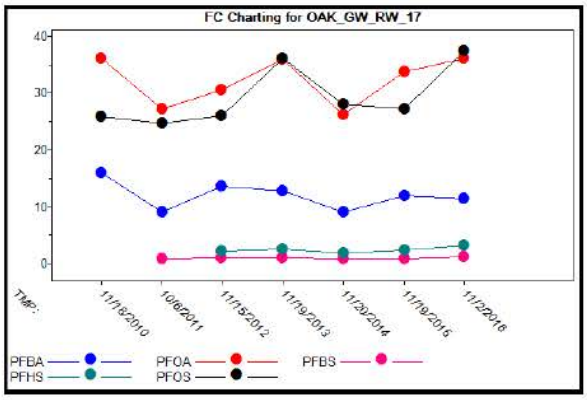


PW16	11/18/2010	10/6/2011	11/15/2012	11/19/2013	11/20/2014	11/19/2015	11/2/2016
PFBA	20.1	16.6	18.8	19.2	28.6	12.7	12.0
PFOA	55.6	35.2	30.6	50.9	65.2	33.8	28.7
PFBS	NA	0.948	0.810	0.940	1.53	0.773	0.744
PFHS	NA	NA	1.76	2.46	3.06	1.88	2.04
PFOS	25.3	17.7	23.8	35.3	42.1	25.1	30.3

NA = Not Applicable; analyte not requested for sampling event.

Attachment A: Trend Data for Select Analytes at Select Sampling Locations. Samples reported in ng/mL.

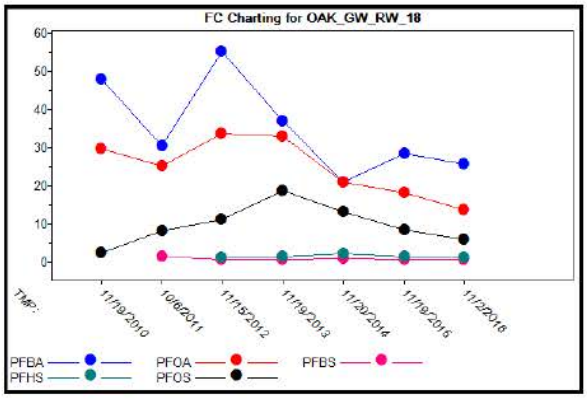
PW17



PW17	11/18/2010	10/6/2011	11/15/2012	11/19/2013	11/20/2014	11/19/2015	11/2/2016
PFBA	15.9	9.09	13.6	12.8	9.12	12.0	11.5
PFOA	36.1	27.2	30.6	35.9	26.3	33.7	36.1
PFBS	NA	0.928	0.958	0.939	0.823	0.934	1.13
PFHS	NA	NA	2.26	2.57	1.89	2.41	3.19
PFOS	25.9	24.7	26.1	36.1	28.1	27.3	37.5

NA = Not Applicable; analyte not requested for sampling event.

PW18

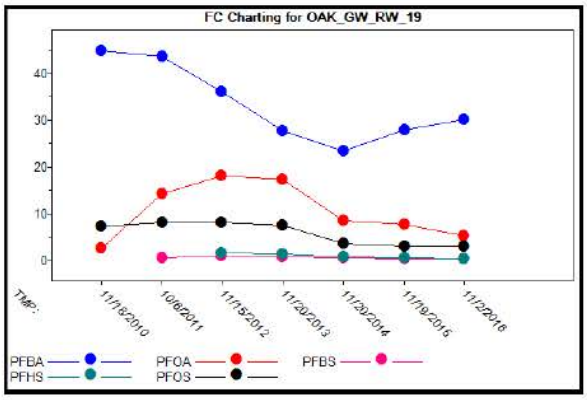


PW18	11/19/2010	10/6/2011	11/15/2012	11/19/2013	11/20/2014	11/19/2015	11/2/2016
PFBA	48.0	30.5	55.3	37.0	21.0	28.5	25.7
PFOA	29.7	25.2	33.7	33.0	21.1	18.3	13.8
PFBS	NA	1.55	0.828	0.746	1.05	0.810	0.673
PFHS	NA	NA	1.20	1.56	2.11	1.42	1.12
PFOS	<2.50	8.19	11.1	18.7	13.3	8.49	5.97

NA = Not Applicable; analyte not requested for sampling event.

Attachment A: Trend Data for Select Analytes at Select Sampling Locations. Samples reported in ng/mL.

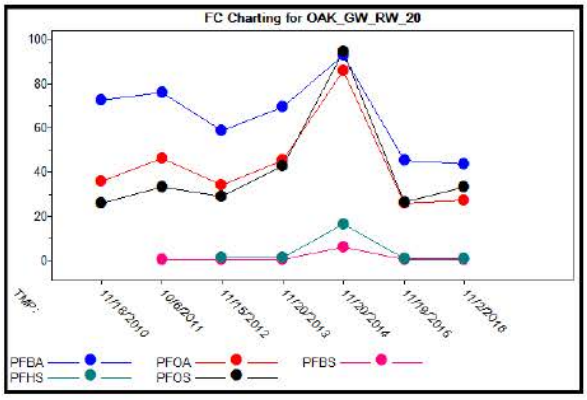
PW19



PW19	11/18/2010	10/6/2011	11/15/2012	11/20/2013	11/20/2014	11/19/2015	11/2/2016
PFBA	44.9	43.6	36.0	27.7	23.5	27.9	30.1
PFOA	<2.50	14.2	18.1	17.3	8.39	7.68	5.31
PFBS	NA	0.546	0.905	0.738	0.504	0.406	0.360
PFHS	NA	NA	1.54	1.41	0.672	0.440	0.273
PFOS	7.35	8.16	7.98	7.43	3.53	2.87	3.00

NA = Not Applicable; analyte not requested for sampling event.

PW20

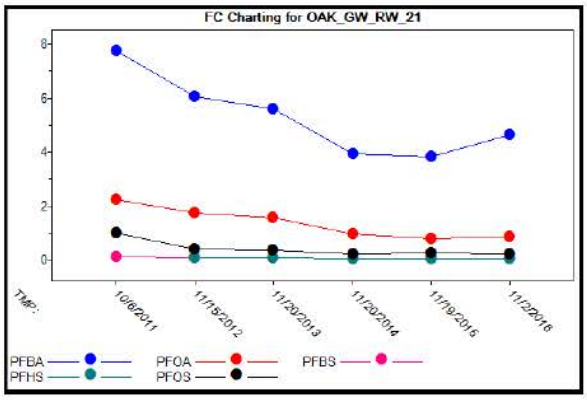


PW20	11/18/2010	10/6/2011	11/15/2012	11/20/2013	11/20/2014	11/19/2015	11/2/2016
PFBA	72.6	76.2	58.7	69.4	92.9	45.2	43.5
PFOA	36.0	46.3	34.0	45.3	85.8	26.1	27.2
PFBS	NA	0.752	0.613	0.652	6.20	0.467	0.491
PFHS	NA	NA	1.24	1.52	16.3	0.969	1.04
PFOS	25.8	33.5	28.9	42.7	94.6	26.6	33.5

NA = Not Applicable; analyte not requested for sampling event.

Attachment A: Trend Data for Select Analytes at Select Sampling Locations. Samples reported in ng/mL.

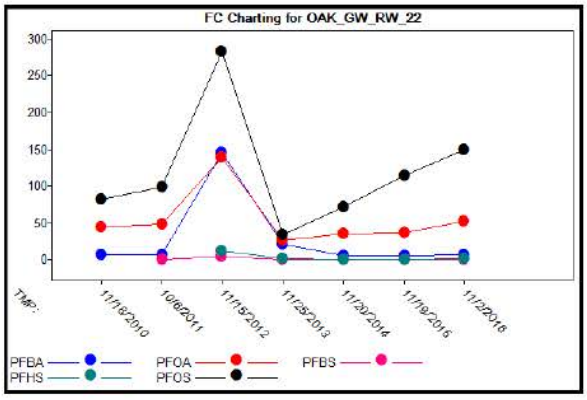
PW21



PW21	10/6/2011	11/15/2012	11/20/2013	11/20/2014	11/19/2015	11/2/2016
PFBA	7.76	6.04	5.60	3.94	3.82	4.63
PFOA	2.22	1.72	1.57	0.950	0.769	0.839
PFBS	0.0951	0.0660	0.0635	0.0471	0.0384	0.0464
PFHS	NA	0.0641	0.0623	0.0372	0.0316	0.031
PFOS	0.981	0.385	0.368	0.218	0.238	0.216

NA = Not Applicable; analyte not requested for sampling event.

PW22

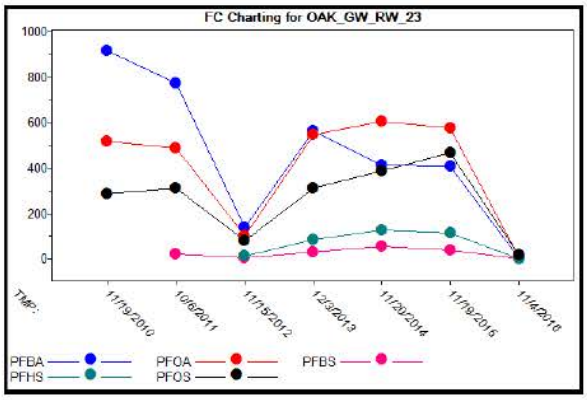


PW22	11/18/2010	10/6/2011	11/15/2012	11/25/2013	11/20/2014	11/19/2015	11/2/2016
PFBA	7.46	6.84	146	20.6	5.74	6.02	6.43
PFOA	44.8	48.2	139	26.8	35.7	37.3	52.4
PFBS	NA	0.380	4.40	0.576	0.335	0.293	0.337
PFHS	NA	NA	11.9	1.43	1.10	1.11	1.33
PFOS	82.3	98.9	283	34.1	71.6	115	150

NA = Not Applicable; analyte not requested for sampling event.

Attachment A: Trend Data for Select Analytes at Select Sampling Locations. Samples reported in ng/mL.

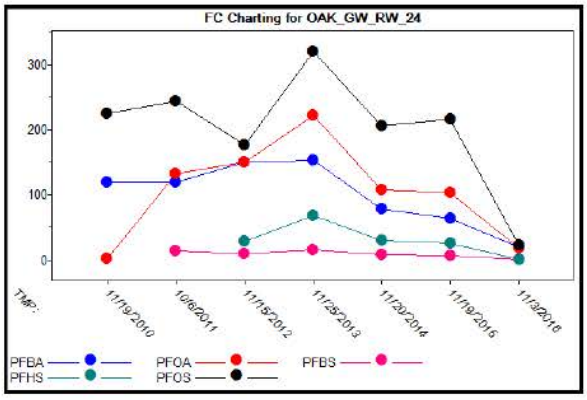
PW23



PW23	11/19/2010	10/6/2011	11/15/2012	12/3/2013	11/20/2014	11/19/2015	11/4/2016
PFBA	918	776	139	565	414	408	5.10
PFOA	517	490	103	549	607	575	8.90
PFBS	NA	22.8	5.67	30.1	54.4	37.3	0.338
PFHS	NA	NA	13.2	83.2	129	116	1.04
PFOS	287	310	80.1	313	387	466	18.8

NA = Not Applicable; analyte not requested for sampling event.

PW24

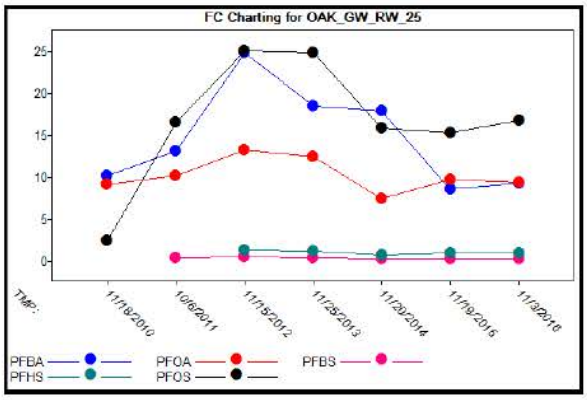


PW24	11/19/2010	10/6/2011	11/15/2012	11/25/2013	11/20/2014	11/19/2015	11/3/2016
PFBA	119	120	151	154	78.6	64.0	20.3
PFOA	<2.50	133	151	223	108	104	18.7
PFBS	NA	14.5	10.2	14.9	8.54	7.10	0.583
PFHS	NA	NA	28.4	68.3	30.3	25.9	1.25
PFOS	225	244	177	321	206	217	23.2

NA = Not Applicable; analyte not requested for sampling event.

Attachment A: Trend Data for Select Analytes at Select Sampling Locations. Samples reported in ng/mL.

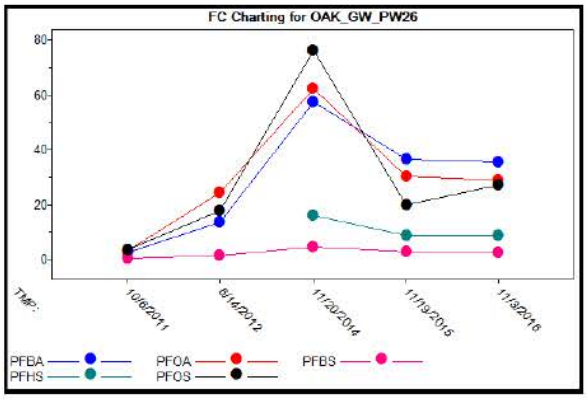
PW25



PW25	11/18/2010	10/6/2011	11/15/2012	11/25/2013	11/20/2014	11/19/2015	11/3/2016
PFBA	10.2	13.2	24.8	18.5	17.9	8.65	9.34
PFOA	9.19	10.2	13.3	12.5	7.56	9.77	9.44
PFBS	NA	0.441	0.568	0.443	0.370	0.372	0.364
PFHS	NA	NA	1.39	1.30	0.868	1.10	1.04
PFOS	<2.50	16.6	25.1	24.8	15.9	15.3	16.8

NA = Not Applicable; analyte not requested for sampling event.

PW26

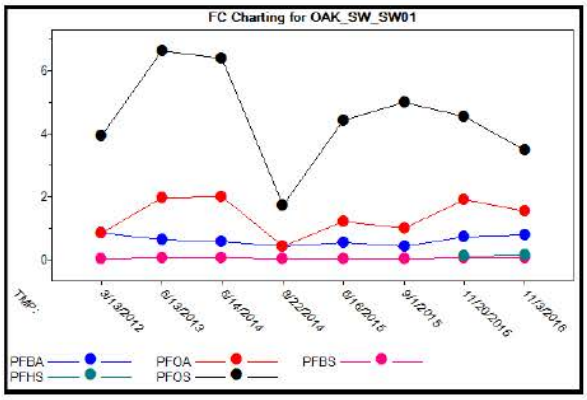


PW26	10/6/2011	6/14/2012	11/20/2014	11/19/2015	11/3/2016
PFBA	2.27	13.7	57.5	36.7	35.5
PFOA	3.13	24.3	62.2	30.3	28.8
PFBS	0.281	1.30	4.44	2.61	2.57
PFHS	NA	NA	16.0	8.78	8.72
PFOS	3.49	17.9	76.3	19.8	27.1

NA = Not Applicable; analyte not requested for sampling event.

Attachment A: Trend Data for Select Analytes at Select Sampling Locations. Samples reported in ng/mL.

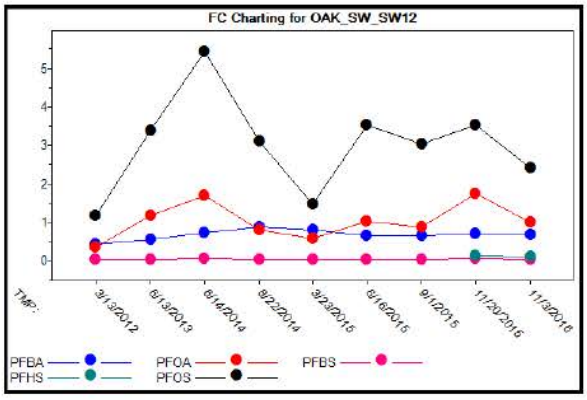
SW01



SW01	3/13/12	6/13/13	6/14/14	8/22/14	6/16/15	9/1/15	11/20/15	11/3/16
PFBA	0.860	0.630	0.586	0.437	0.549	0.414	0.727	0.798
PFOA	0.847	1.97	2.00	0.425	1.21	1.01	1.90	1.55
PFBS	0.0286	0.0558	0.0484	0.0266	0.0311	<0.0250	0.0476	0.0630
PFHS	NA	NA	NA	NA	NA	NA	0.129	0.151
PFOS	3.92	6.63	6.39	1.71	4.43	4.99	4.54	3.47

NA = Not Applicable; analyte not requested for sampling event.

SW12

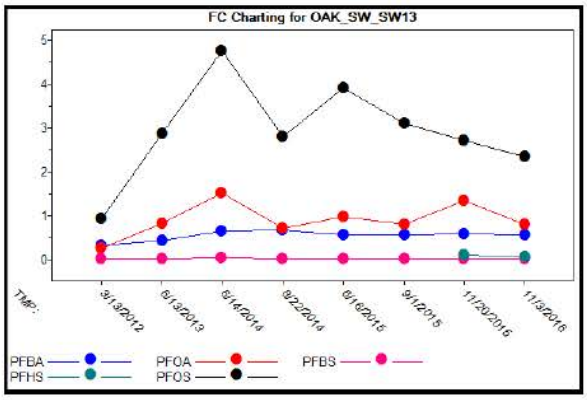


SW12	3/13/12	6/13/13	6/14/14	8/22/14	3/23/15	6/16/15	9/1/15	11/20/15	11/3/16
PFBA	0.435	0.545	0.726	0.868	0.806	0.650	0.658	0.709	0.684
PFOA	0.361	1.16	1.69	0.791	0.572	1.02	0.866	1.75	0.992
PFBS	<0.0250	0.0359	0.0468	0.0327	<0.0250	<0.0250	<0.0250	0.0461	0.0368
PFHS	NA	NA	NA	NA	NA	NA	NA	0.121	0.0945
PFOS	1.17	3.38	5.44	3.10	1.47	3.52	3.02	3.52	2.40

NA = Not Applicable; analyte not requested for sampling event.

Attachment A: Trend Data for Select Analytes at Select Sampling Locations. Samples reported in ng/mL.

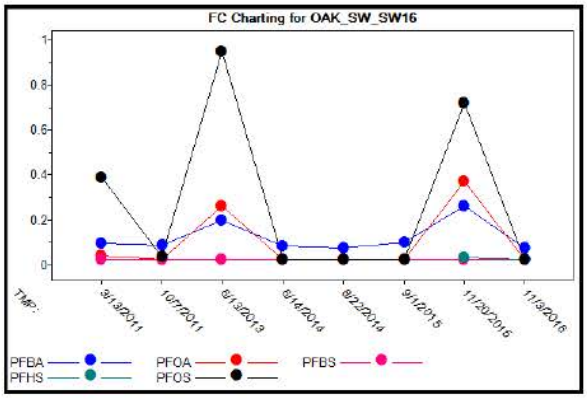
SW13



SW13	3/13/12	6/13/13	6/14/14	8/22/14	6/16/15	9/1/15	11/20/15	11/3/16
PFBA	0.323	0.434	0.666	0.684	0.562	0.580	0.597	0.569
PFOA	0.257	0.821	1.53	0.728	0.974	0.817	1.36	0.820
PFBS	<0.0250	0.0268	0.0413	0.0304	<0.0250	<0.0250	0.0368	0.033
PFHS	NA	NA	NA	NA	NA	NA	0.106	0.0811
PFOS	0.933	2.88	4.76	2.81	3.92	3.11	2.72	2.35

NA = Not Applicable; analyte not requested for sampling event.

SW16



SW16	3/13/11	10/7/11	6/13/13	6/14/14	8/22/14	9/1/15	11/20/15	11/3/16
PFBA	0.0976	0.0883	0.197	0.0852	0.0758	<0.100	0.261	0.0757
PFOA	0.0412	<0.0240	0.261	<0.0240	<0.0240	<0.0240	0.370	<0.0240
PFBS	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250
PFHS	NA	NA	NA	NA	NA	NA	0.0340	<0.0250
PFOS	0.388	<0.0371	0.950	<0.0232	<0.0232	<0.0232	0.722	<0.0232

NA = Not Applicable; analyte not requested for sampling event.

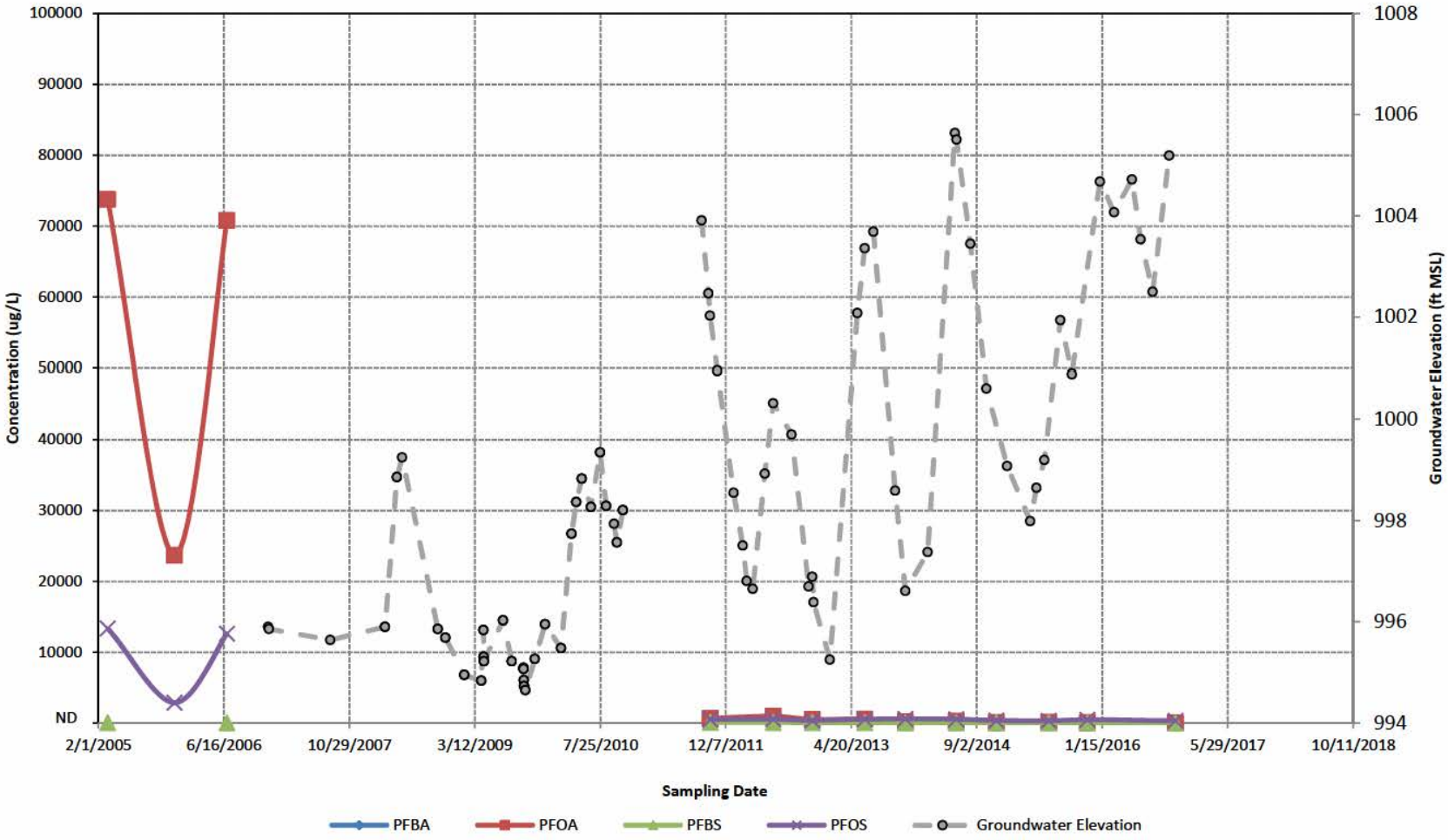
APPENDIX D
PFBA, PFOA, PFBS AND PFOS TREND GRAPHS

- **Upper Alluvium Monitoring Well W26/W26R**

(North of Highway 14)

Monitoring Well W26/W26R

PFC Groundwater Analytical Data
Oakdale Site, Oakdale, MN.



Note: Replacement monitoring well W26R was installed in September 2011.

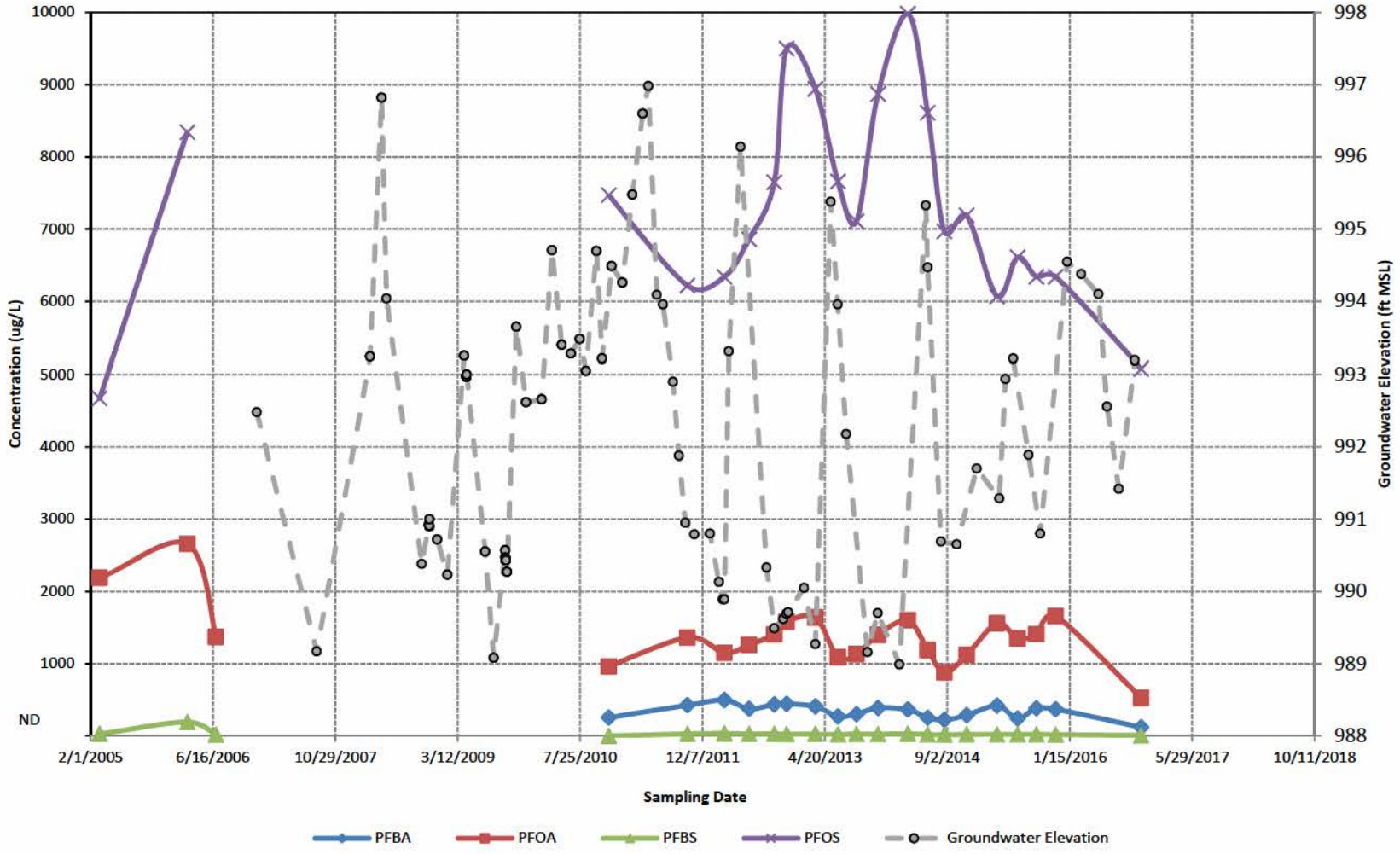
2016-11-OKMN-GW-FC+VOC-TrendGraphs-Linear_Scale(ISO-20); Chart-W26-W26R

- **Upper Alluvium Monitoring Well W33**

(Isthmus Area)

Monitoring Well W33

PFC Groundwater Analytical Data
Oakdale Site, Oakdale, MN.



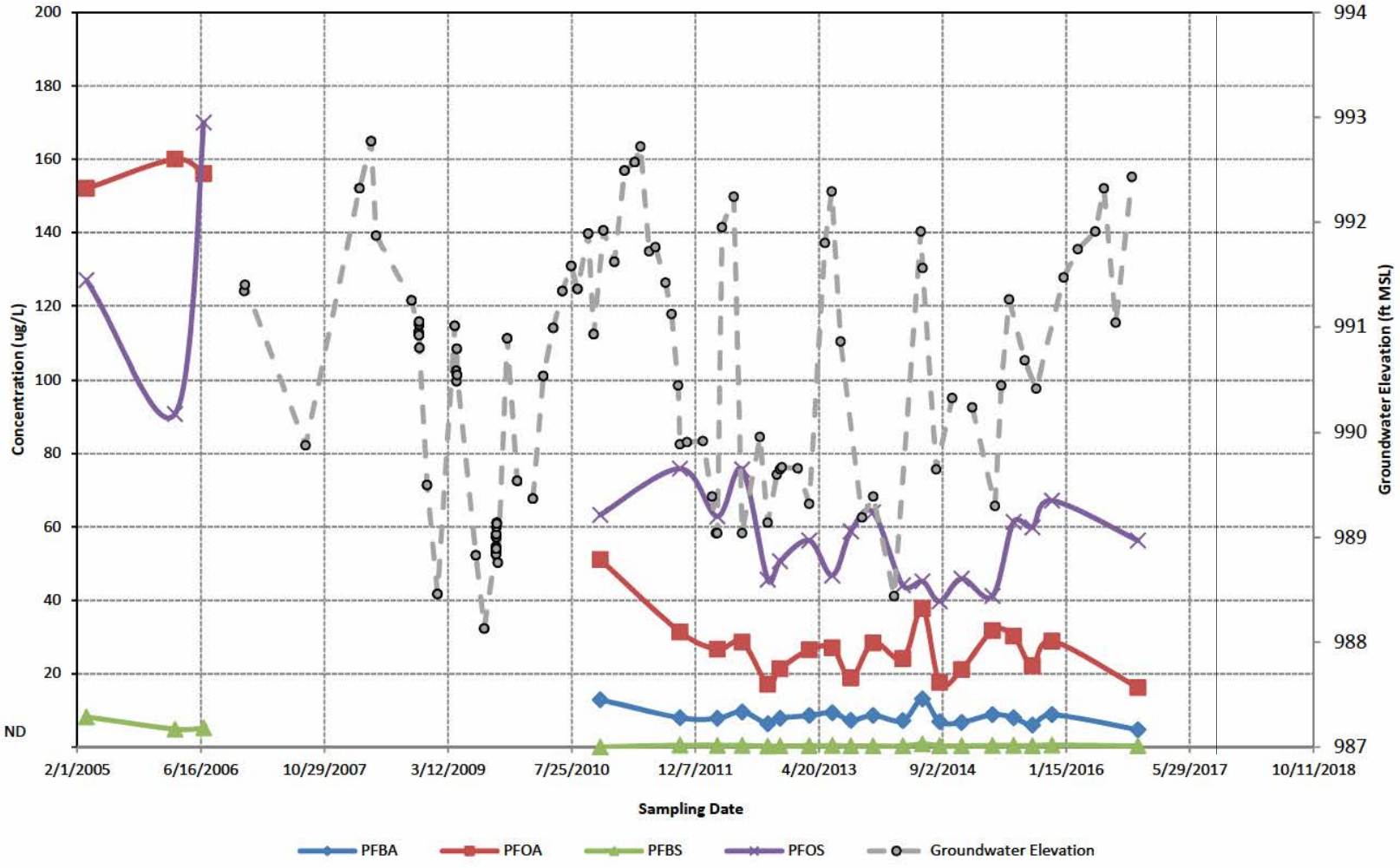
2016-11-OKMN-GW-FC+VOC-TrendGraphs-Linear_Scale(ISO-20); Chart-W33

- **Upper Alluvium Monitoring Well W205**

(Southeast Site Area)

Monitoring Well W205

PFC Groundwater Analytical Data
Oakdale Site, Oakdale, MN.

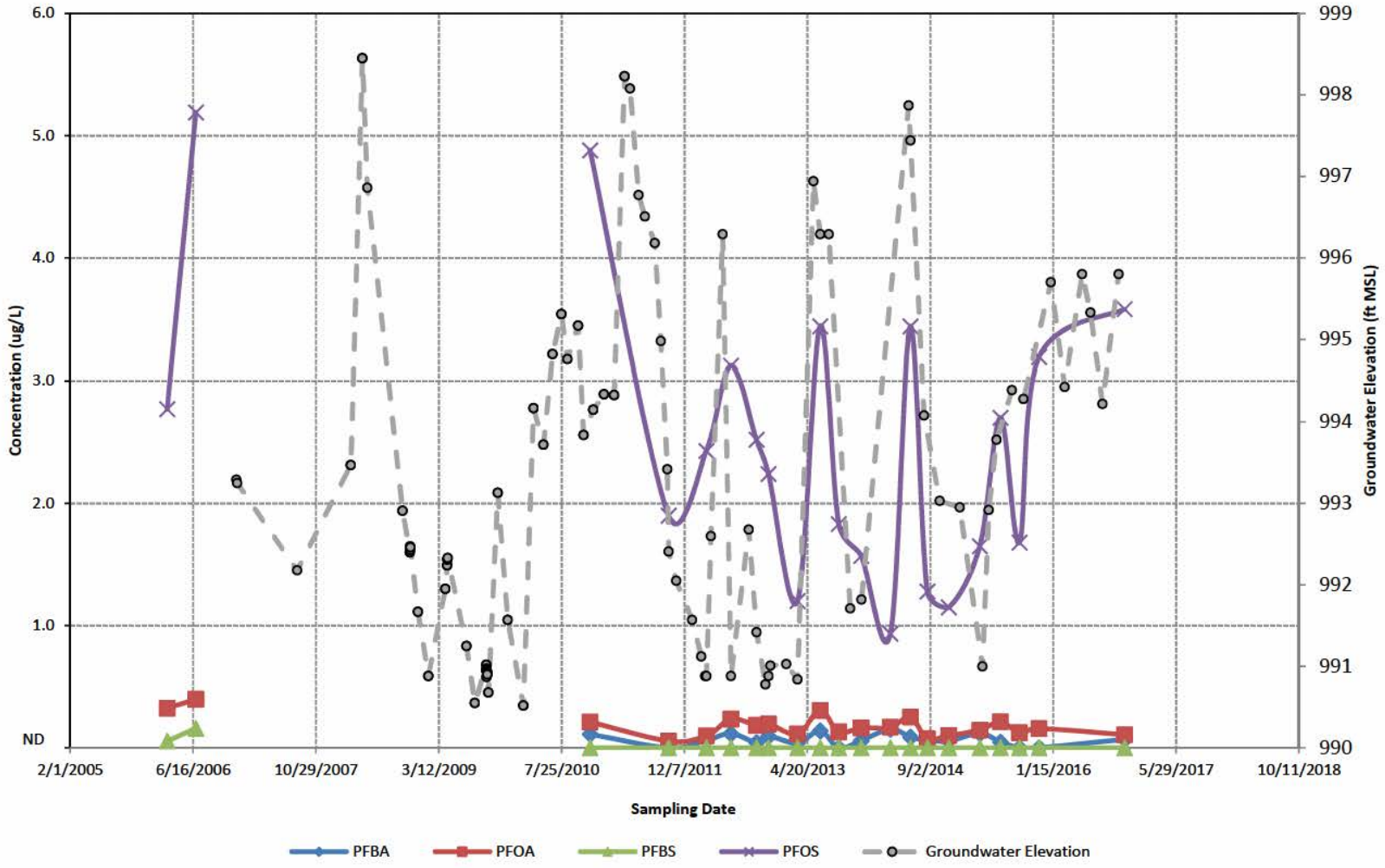


2016-11-OKMN-GW-FC+VOC-TrendGraphs-Linear_Scale(ISO-20); Chart-W205

- **Monitoring Well Cluster in Southeast Site Area**
  - Upper Alluvium Monitoring Well RW37
  - Lower Alluvium Monitoring Well RW38
  - Platteville Limestone Monitoring Well PL41
  - St. Peter Sandstone Monitoring Well SP42

Monitoring Well RW37

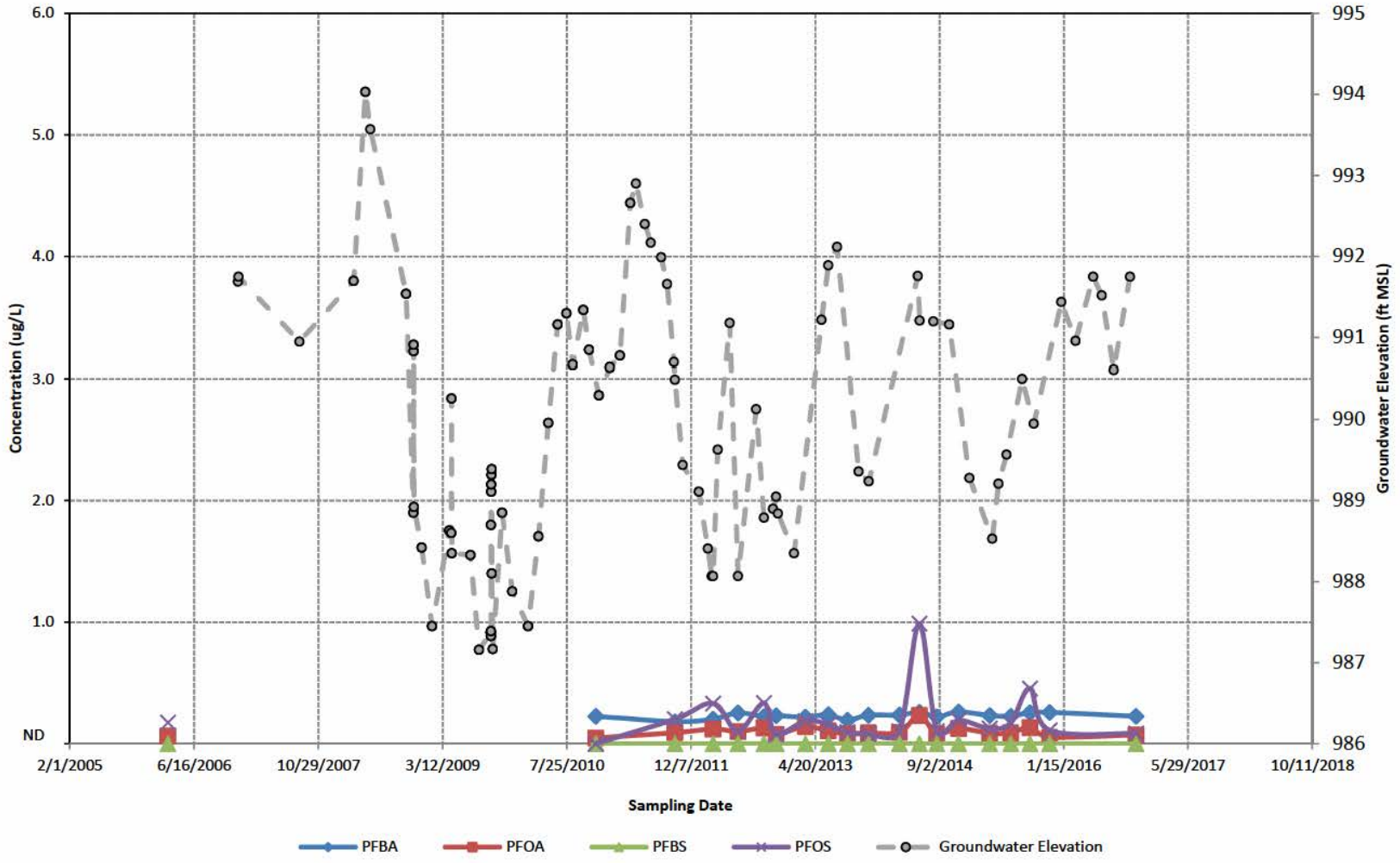
PFC Groundwater Analytical Data
Oakdale Site, Oakdale, MN.



2016-11-OKMN-GW-FC+VOC-TrendGraphs-Linear_Scale(ISO-20); Chart-RW37

Monitoring Well RW38

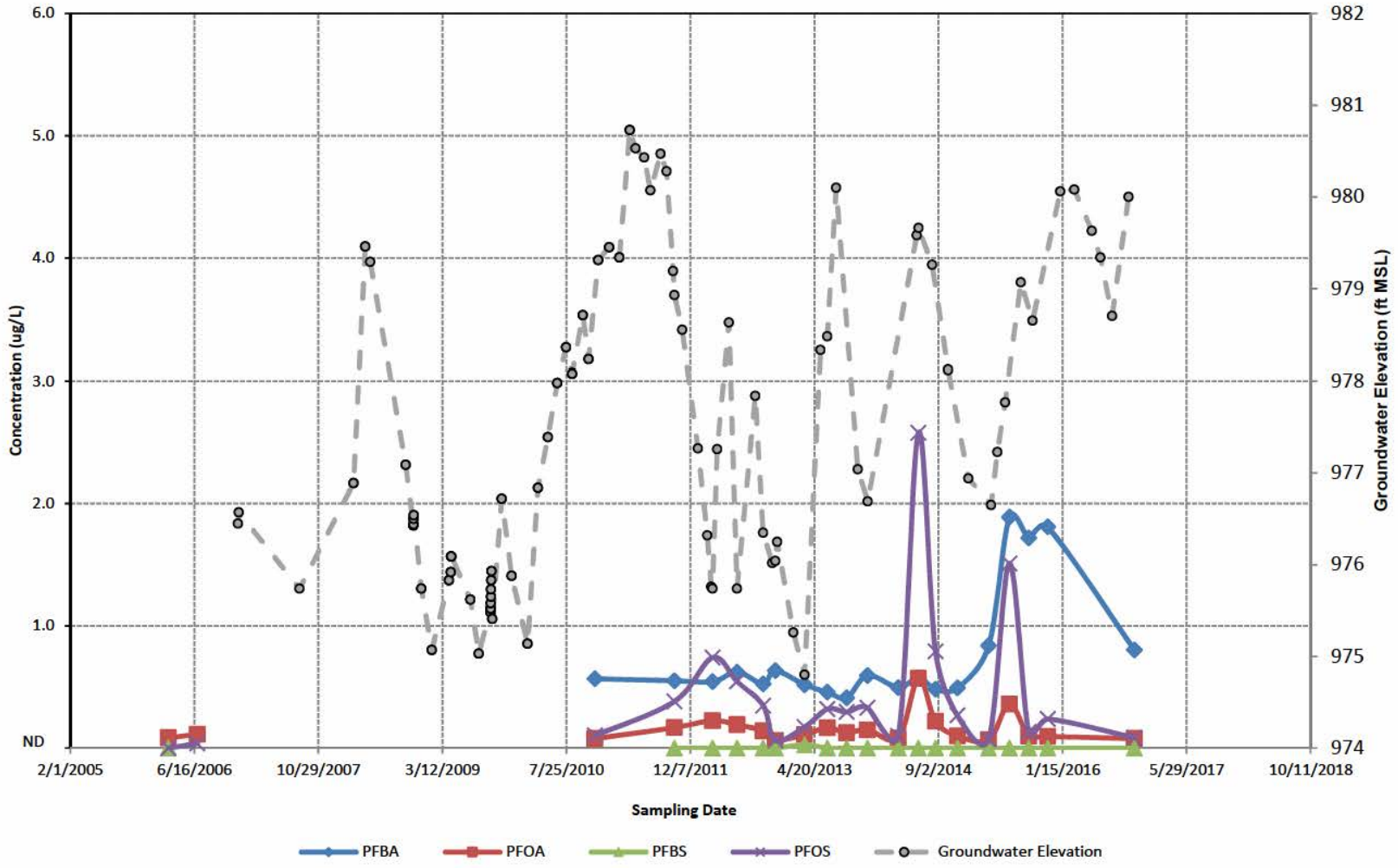
PFC Groundwater Analytical Data
Oakdale Site, Oakdale, MN.



2016-11-OKMN-GW-FC+VOC-TrendGraphs-Linear_Scale(ISO-20); Chart-RW38

Monitoring Well PL41

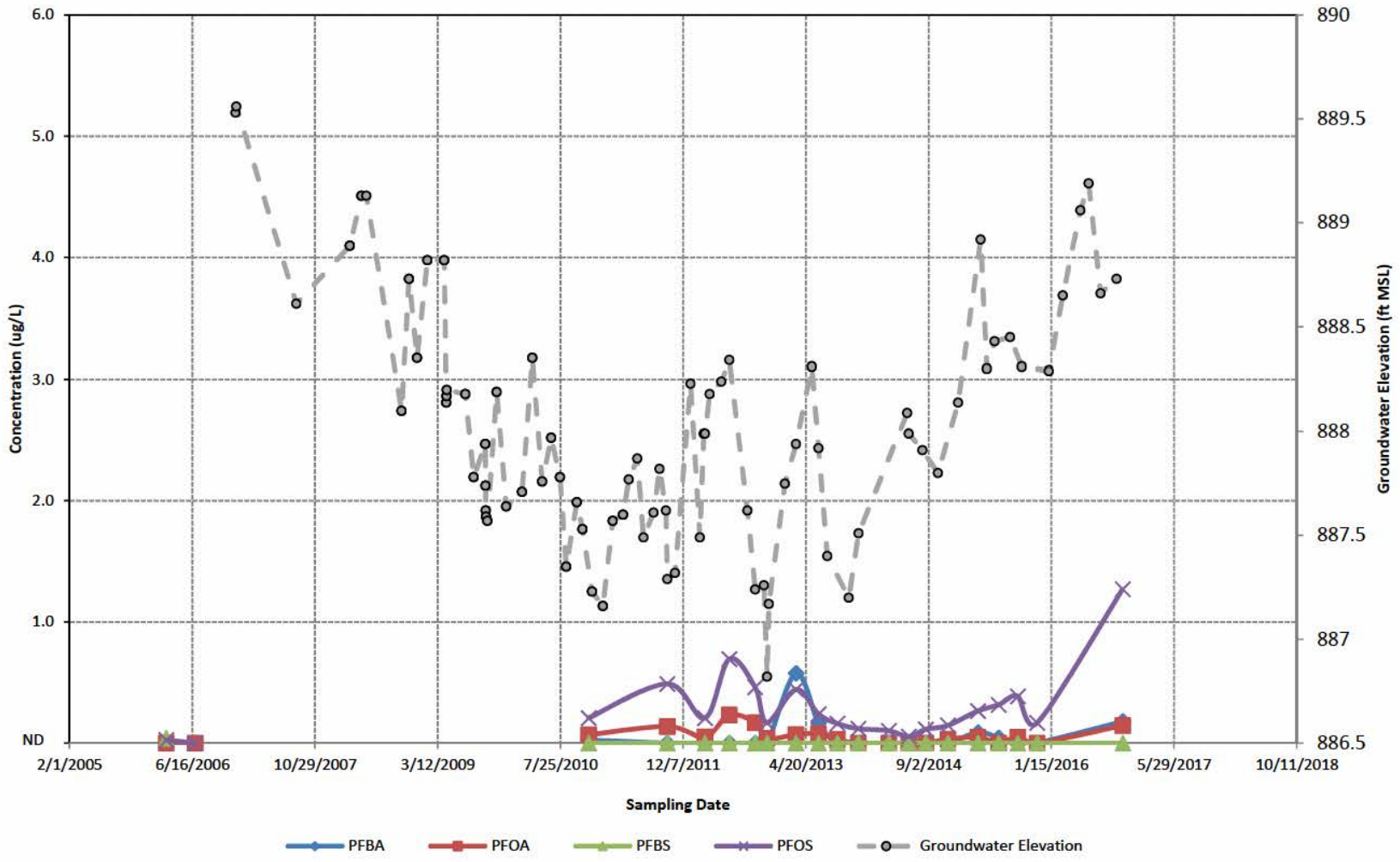
PFC Groundwater Analytical Data
Oakdale Site, Oakdale, MN.



2016-11-OKMN-GW-FC+VOC-TrendGraphs-Linear_Scale(ISO-20); Chart-PL41

Monitoring Well SP42

PFC Groundwater Analytical Data
Oakdale Site, Oakdale, MN.

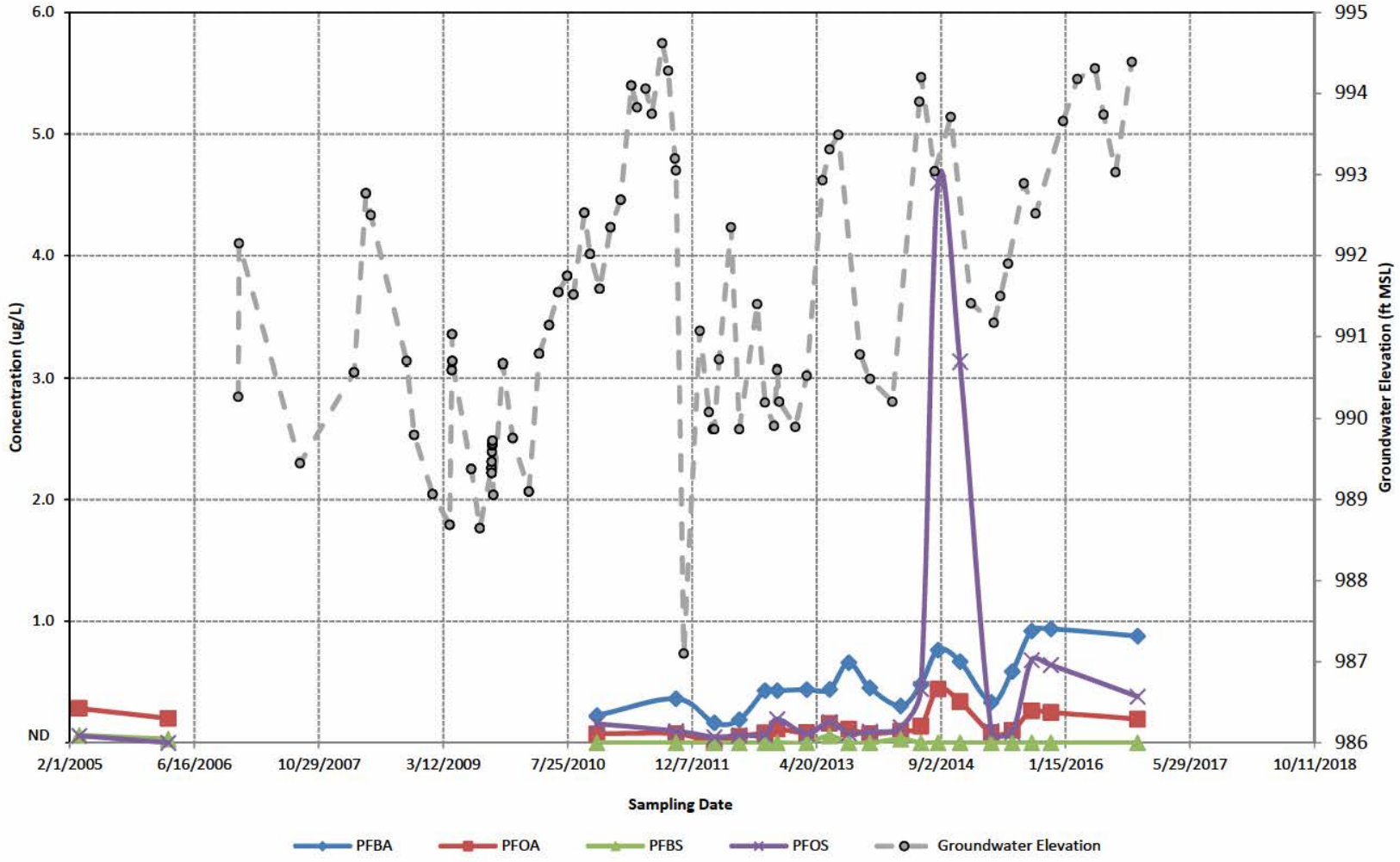


2016-11-OKMN-GW-FC+VOC-TrendGraphs-Linear_Scale(ISO-20); Chart-SP42

- **Platteville Limestone Monitoring Well W8**

Monitoring Well W8

PFC Groundwater Analytical Data
Oakdale Site, Oakdale, MN.



2016-11-OKMN-GW-FC+VOC-TrendGraphs-Linear_Scale(ISO-20); Chart-W08

APPENDIX E
PFC GROUNDWATER ANALYTICAL DATA FOR MANN-KENDALL TREND TEST

Groundwater PFC Analytical Data
Mann-Kendall Dataset (March 2005 - November 2016)
Oakdale Site, Oakdale, MN

Location	Date Sampled	Matrix	Units	PFBA	PFBS	PFHS	PFOA	PFOS
PL41	3/3/2006	GW	ng/mL	---	<0.0250	<0.0250	0.085	<0.0250
PL41	6/28/2006	GW	ng/mL	---	NR	<0.0250	0.112	0.038
PL41	11/17/2010	GW	ng/mL	0.567	---	---	0.078	0.104
PL41	10/3/2011	GW	ng/mL	0.551	<0.0250	---	0.168	0.381
PL41	3/5/2012	GW	ng/mL	0.544	<0.0250	---	0.224	0.740
PL41	6/12/2012	GW	ng/mL	0.622	<0.0250	---	0.191	0.546
PL41	9/25/2012	GW	ng/mL	0.526	<0.0250	---	0.140	0.348
PL41	11/13/2012	GW	ng/mL	0.634	<0.0250	<0.0250	0.063	0.065
PL41	3/11/2013	GW	ng/mL	0.519	0.027	---	0.111	0.172
PL41	6/11/2013	GW	ng/mL	0.458	<0.0250	---	0.167	0.319
PL41	8/27/2013	GW	ng/mL	0.412	<0.0250	---	0.126	0.296
PL41	11/20/2013	GW	ng/mL	0.594	<0.0250	<0.0250	0.150	0.331
PL41	3/24/2014	GW	ng/mL	0.496	<0.0250	---	0.081	0.099
PL41	6/13/2014	GW	ng/mL	0.576	<0.0250	---	0.570	2.58
PL41	8/21/2014	GW	ng/mL	0.482	<0.0250	---	0.219	0.791
PL41	11/17/2014	GW	ng/mL	0.492	<0.0250	<0.0250	0.101	0.268
PL41	3/23/2015	GW	ng/mL	0.839	<0.0250	---	0.068	0.073
PL41	6/15/2015	GW	ng/mL	1.89	<0.0250	---	0.361	1.51
PL41	9/1/2015	GW	ng/mL	1.72	<0.0250	---	0.099	0.133
PL41	11/16/2015	GW	ng/mL	1.81	<0.0250	<0.0236	0.096	0.238
PL41	10/31/2016	GW	ng/mL	0.802	<0.0250	<0.0250	0.078	0.084
PW01	3/10/2005	GW	ng/mL	---	5.62	4.16	38.6	69.8
PW01	11/18/2010	GW	ng/mL	27.5	---	---	9.17	5.36
PW01	10/6/2011	GW	ng/mL	41.1	1.44	---	26.3	15.7
PW01	11/15/2012	GW	ng/mL	55.5	2.11	2.62	26.5	47.4
PW01	11/25/2013	GW	ng/mL	47.8	1.44	1.88	19.8	16.7
PW01	11/20/2014	GW	ng/mL	47.6	1.79	1.95	22.6	15.8
PW01	11/18/2015	GW	ng/mL	51.6	1.81	2.10	20.9	19.9
PW01	11/3/2016	GW	ng/mL	49.4	1.86	2.56	24.5	30.4
PW02	3/10/2005	GW	ng/mL	---	0.720	0.564	4.23	0.346
PW02	11/18/2010	GW	ng/mL	37.1	---	---	7.33	1.23
PW02	10/6/2011	GW	ng/mL	44.0	1.13	---	9.51	1.15
PW02	11/15/2012	GW	ng/mL	46.9	1.05	1.47	10.5	0.685
PW02	11/19/2013	GW	ng/mL	56.4	1.33	2.36	16.9	1.10
PW02	11/20/2014	GW	ng/mL	55.9	1.35	1.82	12.9	0.791
PW02	11/18/2015	GW	ng/mL	59.2	0.961	1.57	12.9	4.20
PW02	11/3/2016	GW	ng/mL	63.6	1.11	1.86	13.4	1.50
PW03	3/10/2005	GW	ng/mL	---	6.76	9.91	171	30.2
PW03	11/19/2010	GW	ng/mL	48.5	---	---	79.4	21.1
PW03	10/6/2011	GW	ng/mL	42.3	1.74	---	73.2	19.3
PW03	11/15/2012	GW	ng/mL	46.5	2.45	7.74	95.7	31.4
PW03	11/25/2013	GW	ng/mL	35.9	2.31	4.29	57.2	20.9
PW03	11/20/2014	GW	ng/mL	43.5	2.33	6.06	58.2	26.2
PW03	11/18/2015	GW	ng/mL	42.5	1.95	5.29	48.7	21.9
PW03	11/3/2016	GW	ng/mL	39.6	2.24	7.45	58.4	45.9

Groundwater PFC Analytical Data (cont'd)
Mann-Kendall Dataset (March 2005 - November 2016)
Oakdale Site, Oakdale, MN

Location	Date Sampled	Matrix	Units	PFBA	PFBS	PFHS	PFOA	PFOS
PW04	3/10/2005	GW	ng/mL	---	7.88	7.64	68.6	30.6
PW04	11/18/2010	GW	ng/mL	102	---	---	59.9	25.5
PW04	10/6/2011	GW	ng/mL	103	3.24	---	56.6	27.8
PW04	11/15/2012	GW	ng/mL	106	4.26	7.97	61.0	31.0
PW04	11/19/2013	GW	ng/mL	78.9	4.13	8.43	60.6	27.2
PW04	11/20/2014	GW	ng/mL	69.9	3.80	6.78	48.7	25.2
PW04	11/18/2015	GW	ng/mL	108	4.85	11.6	101	81.0
PW04	11/3/2016	GW	ng/mL	80.2	4.87	9.76	60.6	37.5
PW06	3/10/2005	GW	ng/mL	---	8.02	14.6	78.5	87.1
PW06	11/18/2010	GW	ng/mL	24.3	---	---	34.0	53.5
PW06	10/6/2011	GW	ng/mL	16.6	1.23	---	28.3	39.2
PW06	11/15/2012	GW	ng/mL	66.4	4.39	17.6	67.4	81.6
PW06	11/19/2013	GW	ng/mL	130	7.69	44.9	165	114
PW06	11/20/2014	GW	ng/mL	127	8.65	29.8	115	138
PW06	11/18/2015	GW	ng/mL	109	6.08	20.8	101	140
PW06	11/3/2016	GW	ng/mL	89.6	5.97	20.6	96.1	118
PW07	3/10/2005	GW	ng/mL	---	4.48	4.99	38.1	70.5
PW07	11/19/2010	GW	ng/mL	52.3	---	---	59.5	51.0
PW07	10/6/2011	GW	ng/mL	26.2	1.44	---	44.1	43.4
PW07	11/14/2012	GW	ng/mL	26.2	1.89	10.2	62.1	84.2
PW07	11/21/2013	GW	ng/mL	29.6	2.15	13.7	79.6	124
PW07	11/18/2014	GW	ng/mL	25.8	1.91	14.0	95.3	86.5
PW07	11/18/2015	GW	ng/mL	4.41	1.30	8.31	85.5	171
PW07	11/3/2016	GW	ng/mL	6.62	0.746	12.3	101	156
PW10	3/10/2005	GW	ng/mL	---	12.6	27.8	771	1640
PW10	11/19/2010	GW	ng/mL	413	---	---	477	1900
PW10	10/6/2011	GW	ng/mL	480	5.12	---	776	1570
PW10	11/15/2012	GW	ng/mL	440	5.14	15.8	443	1500
PW10	11/25/2013	GW	ng/mL	357	4.69	15.2	375	1210
PW10	11/20/2014	GW	ng/mL	295	5.22	13.8	433	1220
PW10	11/18/2015	GW	ng/mL	254	7.19	16.9	541	1340
PW10	11/3/2016	GW	ng/mL	310	8.23	23.6	890	2120
PW11	3/10/2005	GW	ng/mL	---	7.39	9.29	64.2	45.0
PW11	11/18/2010	GW	ng/mL	115	---	---	76.5	68.2
PW11	10/6/2011	GW	ng/mL	119	6.24	---	77.0	57.5
PW11	11/15/2012	GW	ng/mL	115	7.38	14.0	92.7	82.0
PW11	11/19/2013	GW	ng/mL	145	7.73	17.0	133	163
PW11	11/20/2014	GW	ng/mL	102	7.41	13.7	97.7	89.8
PW11	11/18/2015	GW	ng/mL	97.5	4.77	14.6	94.1	111
PW11	11/3/2016	GW	ng/mL	98.8	7.22	15.4	127	143
PW14	11/18/2010	GW	ng/mL	43.0	---	---	102	31.6
PW14	10/6/2011	GW	ng/mL	19.9	1.39	---	57.5	18.4
PW14	11/15/2012	GW	ng/mL	33.3	2.74	5.84	84.7	30.6
PW14	11/25/2013	GW	ng/mL	29.9	2.05	5.28	77.0	35.9
PW14	11/20/2014	GW	ng/mL	84.4	5.22	12.2	71.0	77.5
PW14	11/19/2015	GW	ng/mL	16.8	1.26	3.20	53.9	29.1
PW14	11/3/2016	GW	ng/mL	12.4	0.944	2.51	37.7	24.8

Groundwater PFC Analytical Data (cont'd)
Mann-Kendall Dataset (March 2005 - November 2016)
Oakdale Site, Oakdale, MN

Location	Date Sampled	Matrix	Units	PFBA	PFBS	PFHS	PFOA	PFOS
PW15	11/18/2010	GW	ng/mL	26.5	---	---	16.9	11.5
PW15	10/6/2011	GW	ng/mL	18.6	0.461	---	12.9	8.40
PW15	11/15/2012	GW	ng/mL	16.3	0.314	0.596	8.11	5.66
PW15	11/19/2013	GW	ng/mL	19.4	0.359	0.756	11.2	6.89
PW15	11/20/2014	GW	ng/mL	15.2	0.345	0.662	9.07	6.05
PW15	11/19/2015	GW	ng/mL	11.4	0.268	0.573	7.80	5.26
PW15	11/3/2016	GW	ng/mL	9.79	0.235	0.576	6.20	6.02
PW16	11/18/2010	GW	ng/mL	20.1	---	---	55.6	25.3
PW16	10/6/2011	GW	ng/mL	16.6	0.948	---	35.2	17.7
PW16	11/15/2012	GW	ng/mL	18.8	0.810	1.76	30.6	23.8
PW16	11/19/2013	GW	ng/mL	19.2	0.940	2.46	50.9	35.3
PW16	11/20/2014	GW	ng/mL	28.6	1.53	3.06	65.2	42.1
PW16	11/19/2015	GW	ng/mL	12.7	0.773	1.88	33.8	25.1
PW16	11/3/2016	GW	ng/mL	12.0	0.744	2.04	28.7	30.3
PW17	11/18/2010	GW	ng/mL	15.9	---	---	36.1	25.9
PW17	10/6/2011	GW	ng/mL	9.09	0.928	---	27.2	24.7
PW17	11/15/2012	GW	ng/mL	13.6	0.958	2.26	30.6	26.1
PW17	11/19/2013	GW	ng/mL	12.8	0.939	2.57	35.9	36.1
PW17	11/20/2014	GW	ng/mL	9.12	0.823	1.89	26.3	28.1
PW17	11/19/2015	GW	ng/mL	12.0	0.934	2.41	33.7	27.3
PW17	11/3/2016	GW	ng/mL	11.5	1.13	3.19	36.1	37.5
PW18	11/19/2010	GW	ng/mL	48.0	---	---	29.7	10.9
PW18	10/6/2011	GW	ng/mL	30.5	1.55	---	25.2	8.19
PW18	11/15/2012	GW	ng/mL	55.3	0.828	1.20	33.7	11.1
PW18	11/19/2013	GW	ng/mL	37.0	0.746	1.56	33.0	18.7
PW18	11/20/2014	GW	ng/mL	21.0	1.05	2.11	21.1	13.3
PW18	11/19/2015	GW	ng/mL	28.5	0.810	1.42	18.3	8.49
PW18	11/3/2016	GW	ng/mL	25.7	0.673	1.12	13.8	5.97
PW19	11/18/2010	GW	ng/mL	44.9	---	---	17.4	7.35
PW19	10/6/2011	GW	ng/mL	43.6	0.546	---	14.2	8.16
PW19	11/15/2012	GW	ng/mL	36.0	0.905	1.54	18.1	7.98
PW19	11/20/2013	GW	ng/mL	27.7	0.738	1.41	17.3	7.43
PW19	11/20/2014	GW	ng/mL	23.5	0.504	0.672	8.39	3.53
PW19	11/19/2015	GW	ng/mL	27.9	0.406	0.440	7.68	2.87
PW19	11/3/2016	GW	ng/mL	30.1	0.360	0.273	5.31	3.00
PW20	11/18/2010	GW	ng/mL	72.6	---	---	36.0	25.8
PW20	10/6/2011	GW	ng/mL	76.2	0.752	---	46.3	33.5
PW20	11/15/2012	GW	ng/mL	58.7	0.613	1.24	34.0	28.9
PW20	11/20/2013	GW	ng/mL	69.4	0.652	1.52	45.3	42.7
PW20	11/20/2014	GW	ng/mL	92.9	6.20	16.3	85.8	94.6
PW20	11/19/2015	GW	ng/mL	45.2	0.467	0.969	26.1	26.6
PW20	11/3/2016	GW	ng/mL	43.5	0.491	1.04	27.2	33.5
PW21	11/18/2010	GW	ng/mL	8.65	---	---	2.38	1.05
PW21	10/6/2011	GW	ng/mL	7.76	0.095	---	2.22	0.981
PW21	11/15/2012	GW	ng/mL	6.04	0.066	0.064	1.72	0.385
PW21	11/20/2013	GW	ng/mL	5.60	0.064	0.062	1.57	0.368
PW21	11/20/2014	GW	ng/mL	3.94	0.047	0.037	0.950	0.218
PW21	11/19/2015	GW	ng/mL	3.82	0.038	0.032	0.769	0.238
PW21	11/3/2016	GW	ng/mL	4.63	0.046	0.031	0.839	0.216

Groundwater PFC Analytical Data (cont'd)
Mann-Kendall Dataset (March 2005 - November 2016)
Oakdale Site, Oakdale, MN

Location	Date Sampled	Matrix	Units	PFBA	PFBS	PFHS	PFOA	PFOS
PW22	11/18/2010	GW	ng/mL	7.46	---	---	44.8	82.3
PW22	10/6/2011	GW	ng/mL	6.84	0.380	---	48.2	98.9
PW22	11/15/2012	GW	ng/mL	146	4.40	11.9	139	283
PW22	11/20/2013	GW	ng/mL	20.6	0.576	1.43	26.8	34.1
PW22	11/20/2014	GW	ng/mL	5.74	0.335	1.10	35.7	71.6
PW22	11/19/2015	GW	ng/mL	6.02	0.293	1.11	37.3	115
PW22	11/3/2016	GW	ng/mL	6.43	0.337	1.33	52.4	150
PW23	11/19/2010	GW	ng/mL	959	---	---	517	287
PW23	10/6/2011	GW	ng/mL	776	22.8	---	490	310
PW23	11/15/2012	GW	ng/mL	139	5.67	13.2	103	80.1
PW23	12/3/2013	GW	ng/mL	565	30.1	83.2	549	313
PW23	11/20/2014	GW	ng/mL	414	54.4	129	607	387
PW23	11/19/2015	GW	ng/mL	408	37.3	116	575	466
PW23	11/4/2016	GW	ng/mL	5.10	0.338	1.04	8.90	18.8
PW24	11/19/2010	GW	ng/mL	119	---	---	165	225
PW24	10/6/2011	GW	ng/mL	120	14.5	---	133	244
PW24	11/15/2012	GW	ng/mL	151	10.2	28.4	151	177
PW24	11/25/2013	GW	ng/mL	154	14.9	68.3	223	321
PW24	11/20/2014	GW	ng/mL	78.6	8.54	30.3	108	206
PW24	11/19/2015	GW	ng/mL	64.0	7.10	25.9	104	217
PW24	11/3/2016	GW	ng/mL	20.8	0.593	1.25	18.6	22.9
PW25	11/18/2010	GW	ng/mL	10.2	---	---	9.19	16.8
PW25	10/6/2011	GW	ng/mL	13.2	0.441	---	10.2	16.6
PW25	11/15/2012	GW	ng/mL	24.8	0.568	1.39	13.3	25.1
PW25	11/25/2013	GW	ng/mL	18.5	0.443	1.30	12.5	24.8
PW25	11/20/2014	GW	ng/mL	17.9	0.370	0.868	7.56	15.9
PW25	11/19/2015	GW	ng/mL	8.65	0.372	1.10	9.77	15.3
PW25	11/3/2016	GW	ng/mL	9.34	0.364	1.04	9.44	16.8
PW26	10/6/2011	GW	ng/mL	2.27	0.281	---	3.13	3.49
PW26	6/14/2012	GW	ng/mL	13.7	1.30	---	24.3	17.9
PW26	11/15/2012	GW	ng/mL	16.2	1.72	7.01	30.1	23.7
PW26	11/25/2013	GW	ng/mL	34.5	3.58	14.4	69.6	62.8
PW26	11/20/2014	GW	ng/mL	57.5	4.44	16.0	62.2	76.3
PW26	11/19/2015	GW	ng/mL	36.7	2.61	8.78	30.3	19.8
PW26	11/3/2016	GW	ng/mL	35.5	2.57	8.72	28.8	27.1

Groundwater PFC Analytical Data (cont'd)
Mann-Kendall Dataset (March 2005 - November 2016)
Oakdale Site, Oakdale, MN

Location	Date Sampled	Matrix	Units	PFBA	PFBS	PFHS	PFOA	PFOS
RW37	3/3/2006	GW	ng/mL	---	0.055	0.026	0.322	2.77
RW37	6/28/2006	GW	ng/mL	---	NR	0.030	0.398	NR
RW37	11/18/2010	GW	ng/mL	0.110	---	---	0.212	4.88
RW37	10/3/2011	GW	ng/mL	<0.0250	<0.0250	---	0.055	1.90
RW37	3/5/2012	GW	ng/mL	0.061	<0.0250	---	0.098	2.43
RW37	6/13/2012	GW	ng/mL	0.116	<0.0250	---	0.234	3.12
RW37	9/25/2012	GW	ng/mL	0.043	<0.0250	---	0.184	2.52
RW37	11/13/2012	GW	ng/mL	0.094	<0.0250	<0.0250	0.195	2.24
RW37	3/11/2013	GW	ng/mL	0.040	<0.0250	---	0.113	1.20
RW37	6/11/2013	GW	ng/mL	0.139	<0.0250	---	0.306	3.44
RW37	8/26/2013	GW	ng/mL	<0.100	<0.0250	---	0.130	1.83
RW37	11/25/2013	GW	ng/mL	0.059	<0.0250	<0.0250	0.162	1.57
RW37	3/24/2014	GW	ng/mL	0.152	<0.0250	---	0.168	0.934
RW37	6/13/2014	GW	ng/mL	0.088	<0.0250	---	0.252	3.44
RW37	8/21/2014	GW	ng/mL	0.061	<0.0250	---	0.075	1.28
RW37	11/17/2014	GW	ng/mL	0.057	<0.0250	<0.0250	0.100	1.15
RW37	3/23/2015	GW	ng/mL	0.118	<0.0250	---	0.145	1.65
RW37	6/15/2015	GW	ng/mL	0.047	<0.0250	---	0.214	2.70
RW37	8/31/2015	GW	ng/mL	<0.100	<0.0250	---	0.123	1.68
RW37	11/19/2015	GW	ng/mL	<0.100	<0.0250	<0.0236	0.157	3.19
RW37	11/1/2016	GW	ng/mL	0.069	<0.0250	<0.0250	0.107	3.58
RW38	3/3/2006	GW	ng/mL	---	<0.0250	<0.0250	0.064	0.175
RW38	11/18/2010	GW	ng/mL	0.225	---	---	0.047	<0.100
RW38	10/3/2011	GW	ng/mL	0.182	<0.0250	---	0.090	0.202
RW38	3/5/2012	GW	ng/mL	0.203	<0.0250	---	0.120	0.331
RW38	6/13/2012	GW	ng/mL	0.253	<0.0250	---	0.100	0.105
RW38	9/25/2012	GW	ng/mL	0.224	<0.0250	---	0.129	0.334
RW38	11/13/2012	GW	ng/mL	0.230	<0.0250	<0.0250	0.078	0.076
RW38	3/11/2013	GW	ng/mL	0.219	<0.0250	---	0.140	0.187
RW38	6/11/2013	GW	ng/mL	0.238	<0.0250	---	0.106	0.158
RW38	8/27/2013	GW	ng/mL	0.194	<0.0250	---	0.080	0.096
RW38	11/20/2013	GW	ng/mL	0.234	<0.0250	<0.0250	0.090	0.081
RW38	3/24/2014	GW	ng/mL	0.236	<0.0250	---	0.093	0.105
RW38	6/13/2014	GW	ng/mL	0.260	<0.0250	---	0.232	0.988
RW38	8/22/2014	GW	ng/mL	0.221	<0.0250	---	0.080	0.104
RW38	11/17/2014	GW	ng/mL	0.262	<0.0250	<0.0250	0.126	0.193
RW38	3/23/2015	GW	ng/mL	0.232	<0.0500	---	0.087	0.125
RW38	6/15/2015	GW	ng/mL	0.227	<0.0250	---	0.089	0.170
RW38	9/1/2015	GW	ng/mL	0.256	<0.0250	---	0.133	0.455
RW38	11/19/2015	GW	ng/mL	0.258	<0.0250	<0.0236	0.054	0.110
RW38	11/1/2016	GW	ng/mL	0.225	<0.0250	<0.0250	0.073	0.085

Groundwater PFC Analytical Data (cont'd)
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Location	Date Sampled	Matrix	Units	PFBA	PFBS	PFHS	PFOA	PFOS
SP42	3/2/2006	GW	ng/mL	---	0.040	<0.0250	<0.0250	0.025
SP42	6/28/2006	GW	ng/mL	---	NR	<0.0250	<0.0250	<0.0250
SP42	11/17/2010	GW	ng/mL	0.025	---	---	0.068	0.207
SP42	10/3/2011	GW	ng/mL	<0.0250	<0.0250	---	0.137	0.489
SP42	3/5/2012	GW	ng/mL	<0.0250	<0.0250	---	0.051	0.206
SP42	6/12/2012	GW	ng/mL	<0.0500	<0.0250	---	0.232	0.693
SP42	9/25/2012	GW	ng/mL	<0.0250	<0.0250	---	0.169	0.462
SP42	11/13/2012	GW	ng/mL	<0.0500	<0.0250	<0.0250	0.039	0.169
SP42	3/11/2013	GW	ng/mL	0.576	<0.0250	---	0.070	0.442
SP42	6/11/2013	GW	ng/mL	0.167	<0.0250	---	0.079	0.239
SP42	8/27/2013	GW	ng/mL	<0.100	<0.0250	---	0.030	0.161
SP42	11/20/2013	GW	ng/mL	<0.0500	<0.0250	<0.0250	<0.0240	0.119
SP42	3/24/2014	GW	ng/mL	<0.0500	<0.0250	---	<0.0240	0.102
SP42	6/13/2014	GW	ng/mL	<0.0500	<0.0250	---	<0.0240	0.055
SP42	8/22/2014	GW	ng/mL	<0.0250	<0.0250	---	<0.0240	0.113
SP42	11/20/2014	GW	ng/mL	<0.0500	<0.0250	<0.0250	0.032	0.146
SP42	3/23/2015	GW	ng/mL	0.087	<0.0250	---	0.049	0.265
SP42	6/15/2015	GW	ng/mL	0.044	<0.0250	---	<0.0480	0.316
SP42	9/1/2015	GW	ng/mL	<0.0100	<0.0250	---	0.049	0.387
SP42	11/19/2015	GW	ng/mL	<0.100	<0.0250	<0.0236	<0.0240	0.167
SP42	11/1/2016	GW	ng/mL	0.178	<0.0250	<0.0250	0.145	1.27
SW01	2/1/2006	SW	ng/mL	---	0.180	0.396	9.52	7.47
SW01	11/17/2010	SW	ng/mL	0.782	---	---	1.43	4.00
SW01	3/13/2012	SW	ng/mL	0.860	0.029	---	0.847	3.92
SW01	6/13/2013	SW	ng/mL	0.630	0.056	---	1.97	6.63
SW01	6/14/2014	SW	ng/mL	0.586	0.048	---	2.00	6.39
SW01	8/22/2014	SW	ng/mL	0.437	0.027	---	0.425	1.71
SW01	6/16/2015	SW	ng/mL	0.549	0.031	---	1.21	4.43
SW01	9/1/2015	SW	ng/mL	0.414	<0.0250	---	1.01	4.99
SW01	11/20/2015	SW	ng/mL	0.727	0.048	0.129	1.90	4.54
SW01	11/3/2016	SW	ng/mL	0.798	0.063	0.151	1.55	3.47
SW12	11/17/2010	SW	ng/mL	0.805	---	---	1.17	2.35
SW12	3/13/2012	SW	ng/mL	0.435	<0.0250	---	0.361	1.17
SW12	6/13/2013	SW	ng/mL	0.545	0.036	---	1.16	3.38
SW12	6/14/2014	SW	ng/mL	0.726	0.047	---	1.69	5.44
SW12	8/22/2014	SW	ng/mL	0.868	0.033	---	0.791	3.10
SW12	3/23/2015	SW	ng/mL	0.806	<0.0250	---	0.572	1.47
SW12	6/16/2015	SW	ng/mL	0.650	<0.0250	---	1.02	3.52
SW12	9/1/2015	SW	ng/mL	0.658	<0.0250	---	0.866	3.02
SW12	11/20/2015	SW	ng/mL	0.709	0.046	0.121	1.75	3.52
SW12	11/3/2016	SW	ng/mL	0.684	0.037	0.095	0.992	2.40

Groundwater PFC Analytical Data (cont'd)
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Location	Date Sampled	Matrix	Units	PFBA	PFBS	PFHS	PFOA	PFOS
SW13	11/17/2010	SW	ng/mL	0.761	---	---	1.00	2.00
SW13	3/13/2012	SW	ng/mL	0.323	<0.0250	---	0.257	0.933
SW13	6/13/2013	SW	ng/mL	0.434	<0.0250	---	0.821	2.88
SW13	6/14/2014	SW	ng/mL	0.666	0.041	---	1.53	4.76
SW13	8/22/2014	SW	ng/mL	0.684	0.030	---	0.728	2.81
SW13	6/16/2015	SW	ng/mL	0.562	<0.0250	---	0.974	3.92
SW13	9/1/2015	SW	ng/mL	0.580	<0.0250	---	0.817	3.11
SW13	11/20/2015	SW	ng/mL	0.597	0.037	0.106	1.36	2.72
SW13	11/3/2016	SW	ng/mL	0.569	0.033	0.081	0.820	2.35
SW14	11/17/2010	SW	ng/mL	0.644	---	---	0.779	1.54
SW14	3/13/2012	SW	ng/mL	0.166	<0.0250	---	0.124	0.965
SW14	6/13/2013	SW	ng/mL	0.294	<0.0250	---	0.341	1.16
SW14	6/14/2014	SW	ng/mL	0.54	0.037	---	1.17	3.91
SW14	11/20/2015	SW	ng/mL	0.569	0.038	0.102	1.31	2.56
SW16	11/17/2010	SW	ng/mL	0.533	---	---	0.626	1.22
SW16	10/7/2011	SW	ng/mL	0.088	<0.0250	---	<0.0240	<0.0371
SW16	3/13/2012	SW	ng/mL	0.098	<0.0250	---	0.041	0.388
SW16	6/13/2013	SW	ng/mL	0.197	<0.0250	---	0.261	0.950
SW16	6/14/2014	SW	ng/mL	0.085	<0.0250	---	<0.0240	<0.0232
SW16	8/22/2014	SW	ng/mL	0.076	<0.0250	---	<0.0240	<0.0232
SW16	9/1/2015	SW	ng/mL	<0.100	<0.0250	---	<0.0240	<0.0232
SW16	11/20/2015	SW	ng/mL	0.261	<0.0250	0.034	0.370	0.722
SW16	11/3/2016	SW	ng/mL	0.076	<0.0250	<0.0250	<0.0240	<0.0232
W08	3/10/2005	GW	ng/mL	---	0.060	<0.0250	0.283	0.057
W08	3/3/2006	GW	ng/mL	---	0.030	<0.0250	0.200	<0.0250
W08	11/19/2010	GW	ng/mL	0.223	---	---	0.073	0.156
W08	10/3/2011	GW	ng/mL	0.362	<0.0250	---	0.074	0.096
W08	3/5/2012	GW	ng/mL	0.164	<0.0250	---	<0.0240	0.047
W08	6/13/2012	GW	ng/mL	0.190	<0.0250	---	0.052	0.061
W08	9/25/2012	GW	ng/mL	0.428	<0.0250	---	0.080	0.067
W08	11/13/2012	GW	ng/mL	0.428	<0.0250	<0.0250	0.113	0.194
W08	3/11/2013	GW	ng/mL	0.438	<0.0250	---	0.084	0.072
W08	6/11/2013	GW	ng/mL	0.439	0.056	---	0.159	0.171
W08	8/27/2013	GW	ng/mL	0.659	<0.0250	---	0.113	0.077
W08	11/20/2013	GW	ng/mL	0.452	<0.0250	<0.0250	0.075	0.091
W08	3/24/2014	GW	ng/mL	0.303	0.029	---	0.096	0.127
W08	6/13/2014	GW	ng/mL	0.479	<0.0250	---	0.136	0.441
W08	8/21/2014	GW	ng/mL	0.762	<0.0250	---	0.441	4.60
W08	11/17/2014	GW	ng/mL	0.669	<0.0250	<0.0250	0.339	3.13
W08	3/23/2015	GW	ng/mL	0.332	<0.0250	---	0.083	0.096
W08	6/15/2015	GW	ng/mL	0.587	<0.0250	---	0.103	0.085
W08	9/1/2015	GW	ng/mL	0.921	<0.0250	---	0.263	0.678
W08	11/17/2015	GW	ng/mL	0.937	<0.0250	0.025	0.249	0.640
W08	10/31/2016	GW	ng/mL	0.877	<0.0250	0.027	0.195	0.380

Groundwater PFC Analytical Data (cont'd)
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Oakdale Site, Oakdale, MN

Location	Date Sampled	Matrix	Units	PFBA	PFBS	PFHS	PFOA	PFOS
W2007	10/3/2011	GW	ng/mL	1040	7.22	---	16.4	32.0
W2007	11/15/2012	GW	ng/mL	948	6.61	---	12.3	33.7
W2007	11/26/2013	GW	ng/mL	1020	6.91	---	8.42	29.6
W2007	11/19/2014	GW	ng/mL	996	7.12	---	9.18	31.2
W2007	11/19/2015	GW	ng/mL	1340	9.03	---	13.2	29.4
W2007	11/3/2016	GW	ng/mL	1460	9.38	---	12.5	31.8
W205	3/10/2005	GW	ng/mL	---	8.24	6.81	152	127
W205	3/3/2006	GW	ng/mL	---	4.88	7.04	160	90.8
W205	6/28/2006	GW	ng/mL	---	NR	7.05	156	170
W205	11/18/2010	GW	ng/mL	12.9	---	---	51.1	63.3
W205	10/6/2011	GW	ng/mL	7.98	0.509	---	31.4	75.9
W205	3/5/2012	GW	ng/mL	7.85	0.436	---	26.7	62.9
W205	6/13/2012	GW	ng/mL	9.59	0.440	---	28.6	75.7
W205	9/25/2012	GW	ng/mL	6.37	0.241	---	17.1	45.6
W205	11/14/2012	GW	ng/mL	7.85	0.285	1.04	21.3	50.7
W205	3/12/2013	GW	ng/mL	8.60	0.354	---	26.5	56.3
W205	6/13/2013	GW	ng/mL	9.34	0.434	---	27.0	46.8
W205	8/27/2013	GW	ng/mL	7.29	0.324	---	18.8	58.8
W205	11/25/2013	GW	ng/mL	8.61	0.324	1.22	28.4	64.0
W205	3/25/2014	GW	ng/mL	7.19	0.299	---	24.1	44.1
W205	6/13/2014	GW	ng/mL	13.1	0.892	---	37.7	45.2
W205	8/21/2014	GW	ng/mL	6.93	0.388	---	17.6	39.7
W205	11/18/2014	GW	ng/mL	6.73	0.328	0.984	21.1	45.9
W205	3/23/2015	GW	ng/mL	8.82	0.429	---	31.7	41.2
W205	6/16/2015	GW	ng/mL	7.99	0.417	---	30.2	61.4
W205	8/31/2015	GW	ng/mL	6.03	0.377	---	22.2	59.9
W205	11/19/2015	GW	ng/mL	8.84	0.545	1.84	28.9	67.2
W205	10/31/2016	GW	ng/mL	4.73	0.291	1.07	16.2	56.3
W26	3/10/2005	GW	ng/mL	---	73.5	227	73767	13367
W26	12/1/2005	GW	ng/mL	---	23.0	58.5	23700	3057
W26	6/28/2006	GW	ng/mL	---	NR	NR	NR	NR
W26R	10/6/2011	GW	ng/mL	562	79.6	---	639	503
W26R	6/13/2012	GW	ng/mL	627	73.7	---	948	536
W26R	11/15/2012	GW	ng/mL	331	42.3	---	499	371
W26R	6/12/2013	GW	ng/mL	329	40.2	---	525	525
W26R	11/21/2013	GW	ng/mL	61.3	8.42	---	167	589
W26R	6/12/2014	GW	ng/mL	65.7	10.9	---	229	543
W26R	11/19/2014	GW	ng/mL	20.3	3.01	---	53.5	356
W26R	6/16/2015	GW	ng/mL	36.1	5.58	---	98.5	320
W26R	11/17/2015	GW	ng/mL	23.2	2.21	---	68.5	457
W26R	11/2/2016	GW	ng/mL	5.21	0.692	---	27.6	305

Groundwater PFC Analytical Data (cont'd)
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Oakdale Site, Oakdale, MN

Location	Date Sampled	Matrix	Units	PFBA	PFBS	PFHS	PFOA	PFOS
W33	3/10/2005	GW	ng/mL	---	28.0	86.2	2187	4673
W33	3/3/2006	GW	ng/mL	---	192	NR	2660	8343
W33	6/28/2006	GW	ng/mL	---	NR	48.7	NR	NR
W33	11/19/2010	GW	ng/mL	254	---	---	960	7470
W33	10/6/2011	GW	ng/mL	425	29.0	---	1360	6220
W33	3/5/2012	GW	ng/mL	496	34.1	---	1150	6340
W33	6/14/2012	GW	ng/mL	377	27.9	---	1260	6860
W33	9/25/2012	GW	ng/mL	436	27.9	---	1405	7650
W33	11/15/2012	GW	ng/mL	443	25.5	81.3	1580	9500
W33	3/12/2013	GW	ng/mL	409	26.2	---	1640	8940
W33	6/12/2013	GW	ng/mL	269	19.9	---	1090	7660
W33	8/27/2013	GW	ng/mL	303	23.0	---	1130	7110
W33	11/23/2013	GW	ng/mL	386	24.0	71.5	1400	8870
W33	3/25/2014	GW	ng/mL	366	30.0	---	1600	9980
W33	6/14/2014	GW	ng/mL	253	19.7	---	1190	8610
W33	8/21/2014	GW	ng/mL	224	17.1	---	879	6970
W33	11/20/2014	GW	ng/mL	287	21.4	61.6	1120	7190
W33	3/24/2015	GW	ng/mL	419	22.3	---	1560	6070
W33	6/16/2015	GW	ng/mL	242	19.5	---	1350	6610
W33	9/1/2015	GW	ng/mL	383	22.3	---	1410	6340
W33	11/19/2015	GW	ng/mL	370	18.6	64.8	1660	6340
W33	11/2/2016	GW	ng/mL	120	8.04	17.2	526	5080

Notes:
NR - Not reportable.
--- - Not Analyzed.