INVESTIGATION OF PERFLUORINATED AND POLYFLUORINATED COMPOUND CONTAMINATION IN THE LAKE HURON-AU SABLE RIVER PLUME IOSCO COUNTY

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Background

Perfluorinated compounds are a group of organic chemicals in which all the carbon atoms in the molecular backbone are fluorinated, and they are a subset of a large class of chemicals known as polyfluoroalkyl and perfluoroalkyl substances (PFAS). These are anthropogenic compounds and have been synthesized for over 50 years. Many PFAS are persistent, some of the compounds bioaccumulate in the environment, and several have proven to be toxic to birds and mammals in laboratory testing. In addition, epidemiological studies indicate links between exposure to perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS) and several human diseases.

PFAS are used in a wide variety of consumer products and several of the compounds are key ingredients in fire-fighting foams. Historically PFAS containing fire-fighting foams were used extensively in regular training exercises as well as in crash site fire suppression at the former Wurtsmith Air Force Base (AFB) in Oscoda, Michigan. Subsequent groundwater contamination has impacted nearby surface waters including the Au Sable River. Extremely high levels of PFAS have been measured in Clark's Marsh, a series of ponds nearest the Wurtsmith AFB fire suppression training area.

The Michigan Department of Environment, Great Lakes, and Energy (EGLE) has generated Rule 57 surface water quality values for the protection of human health and aquatic life for PFOS and PFOA. The Rule 57 Human Non-Cancer Value (HNV) for PFOS is 12 nanograms per liter (ng/L; parts per trillion) in surface waters not used as a source of drinking water, and 11 ng/L for those surface waters used as a drinking water source. The HNVs for PFOA are 420 ng/L and 12,000 ng/L for drinking and non-drinking water sources, respectively. The Aquatic Maximum Value (AMV) is the highest concentration of a substance to which an aquatic community can be exposed briefly without resulting in adverse effects, whereas, the Final Chronic Value (FCV) is the highest concentration of a substance to which an aquatic community can be exposed for a long period of time without experiencing adverse effects. The Rule 57 AMV and FCV for PFOS is 880,000 and 7,700 ng/L, respectively. The Rule 57 AMV and FCV for PFOA is 780,000 and 140,000 ng/L, respectively.

Surface water samples collected in 2014 from the Au Sable River near and downstream of Clark's Marsh had total PFAS concentrations ranging from 9 to 150 nanograms per liter (ng/L; parts per trillion) with a geometric mean of 22 ng/L. PFOS concentrations ranged from 1 to 16 ng/L (geometric mean = 4 ng/L); PFOA concentrations ranged from 1 to 7 ng/L (geometric mean = 2 ng/L).

Several species of fish have been collected from the Au Sable River and analyzed for PFAS. Based on the concentrations of PFOS in smallmouth bass, rock bass, and bluegill the Department of Health and Human Services issued a "Do Not Eat" advisory for non-migratory, "resident" species of fish such as those listed above. The elevated levels in fish provides good evidence that contamination from the Wurtsmith AFB is a chronic condition.

Contaminated Au Sable River water has the potential to impact drinking water intakes in Lake Huron. The Au Sable River empties into Lake Huron at Oscoda, roughly 6 miles downstream of groundwater and surface water inputs from Clark's Marsh. Currents in Lake Huron generally rotate in a counter-clockwise direction (https://www.glerl.noaa.gov/res/glcfs/currents/), consistently carrying the Au Sable discharge in a southerly direction along the shoreline toward Tawas City (the Au Sable River plume is often visible in satellite images). In addition, the current

generally continues to follow the shoreline southwesterly to the vicinity of the city of Au Gres before heading east across Saginaw Bay (**Figure 1**).

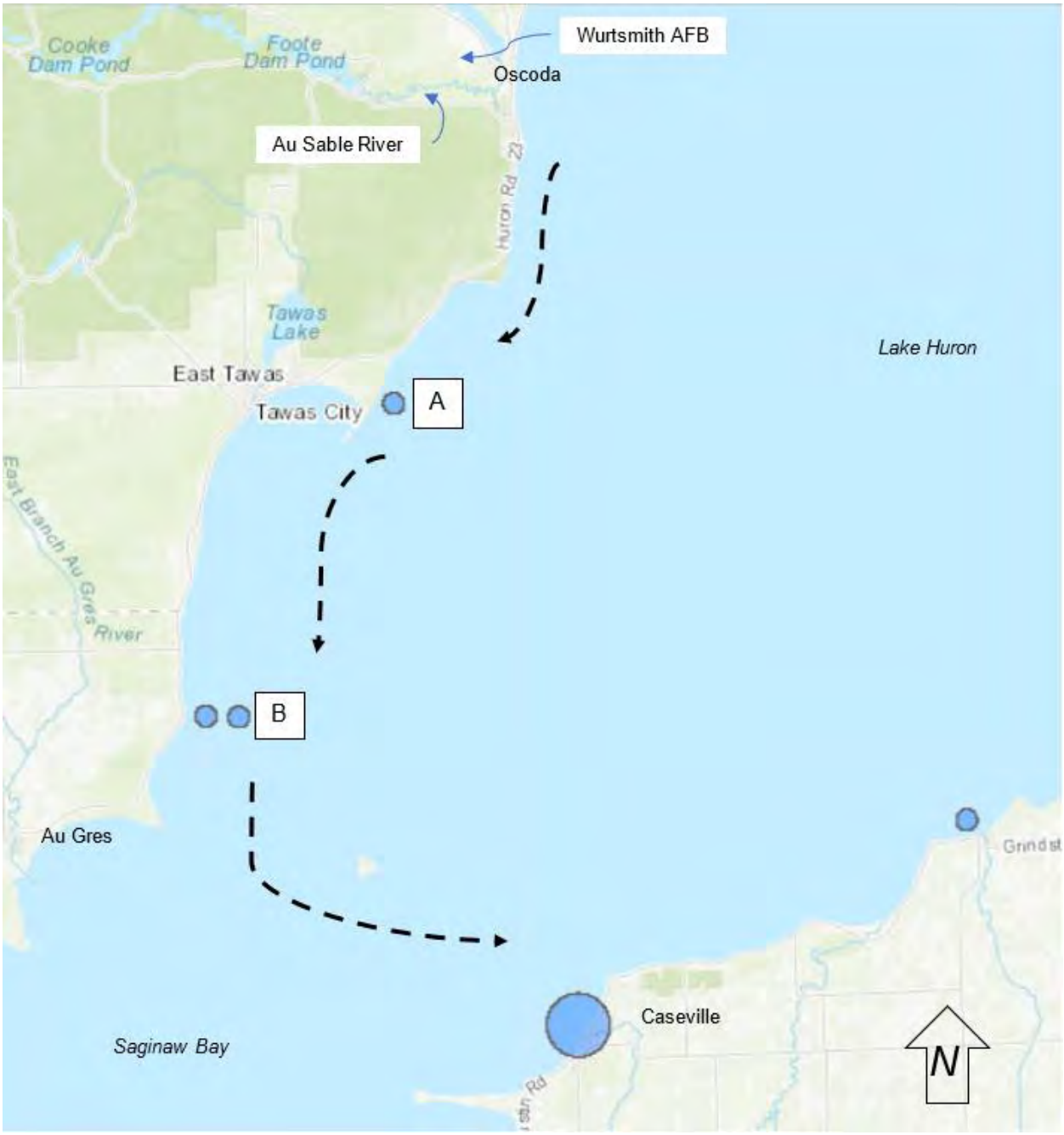

Figure 1. Lake Huron in the vicinity of Oscoda and Tawas City showing approximate locations of the HSRUA and SWUA drinking water intakes (A & B, respectively). Prevailing lake currents are indicated by black arrows.

The Huron Shore Regional Utility Authority (HSRUA) operates a water treatment facility with a Lake Huron intake approximately 11 miles south of the Au Sable River mouth (**Figure 1**), providing drinking water to a population of over 14,000 people in the cities of East Tawas, Tawas City, and in Baldwin, Au Sable, and Oscoda Townships. The intake is approximately 1.4 km (4,600 ft) offshore at a depth of 6 m (20 ft). The Michigan Department of Environment, Great Lakes, and Energy (EGLE), formerly Michigan Department of Environmental Quality (MDEQ), began sampling the HSRUA raw water in December 2015 and has sampled monthly since June 2016. This sampling found detectable levels of PFAS in the raw Lake Huron surface water; however, none of the raw surface water samples have exceeded the HNVs.

The Sims-Whitney Utilities Authority (SWUA) operates a drinking water intake roughly 23 miles south of the Au Sable River mouth and serves a population of over 5,700 in Arenac County. The intake is approximately 2.7 km (9,000 ft) offshore at a depth of 11 m (36 ft). Raw water from the intake was sampled in November 2018. Detectable levels of PFAS were found, but none exceeded the HNVs.

OBJECTIVE

The objective of the project was to determine the extent of measurable PFAS contamination in nearshore Lake Huron south of the Au Sable River mouth.

SUMMARY

1. PFOS was detected in 246 of the 260 samples collected in the Au Sable River and Lake Huron during four sampling events with concentrations ranging from non-detect to 6.7 ng/L; a value of 760 ng/L was considered an outlier as the sample had data quality concerns. The number of estimated values above the method detection limit but below the reporting limit was 209 of the 246 samples with detected concentrations. Eleven of the 37 detectable PFOS concentrations were from the Au Sable River. Excluding the outlier value of 760 ng/L for PFOS, no surface water samples exceeded the HNV or AMV for PFOS.
2. PFOA was detected in 244 of the 260 samples collected with concentrations ranging from non-detect to 3.9 ng/L. The number of estimated values above the method detection limit but below the reporting limit was 241 of the 244 samples with detected concentrations. No samples exceeded the HNV or AMV for PFOA.
3. For both PFOS and PFOA, results of a 2-way ANOVA indicated statistically significant differences in concentrations at different transects in Lake Huron, but no significant differences in concentrations at different depths.
4. Results of the PFOS Tukey test indicated that concentrations at transect TN2 were statistically significantly lower than at transects ON1, OS1, and OS2. Results of the PFOA Tukey test indicated that concentrations at transect ON2 were statistically significantly lower than at transects ON1, OS1, TN1 and TN2. These finding are not toxicologically significant, however, because the overall ranges of mean PFOS and PFOA concentrations across the six transects were similar, below the human health water quality values, and nearly all intra-transect mean PFOS and PFOA concentrations were <2 ng/L (below background).
5. Total PFAS concentrations were remarkably similar in Lake Huron and generally between 6 and 9 ng/L. Water samples collected from the Au Sable River had slightly higher concentrations of total PFAS overall for roughly the same number of PFAS quantified compared to the Lake Huron transects.

6. The influence of Au Sable River discharge to nearshore Lake Huron adjacent to the outlet appears minimal based on measurements of conductivity and turbidity. There is only a slight difference in conductivity among transects on Lake Huron and a minimal difference in turbidity.
7. Based on the results from this study, no significant plume of PFAS appears to be entering Lake Huron from the Au Sable River that might impact Tawas City drinking water.

METHODS

Ambient Surface Water Sampling

Sampling sites were selected to assess PFAS concentrations in the Au Sable River, in Lake Huron directly north and south of the river mouth, and in Lake Huron in the vicinity of East Tawas, both north and south of the HSRUA intake.

Surface water samples were collected from the Au Sable River near the river mouth in Oscoda and from nearshore Lake Huron. Samples were collected in accordance with the MDEQ General and Surface Water PFAS Sampling Guidance documents (MDEQ, 2018a and 2018b, respectively). To account for variability in concentrations due to weather related conditions four sampling events were conducted in July, September, and November 2019, and again in April 2021. The delay in sampling between November 2019 and April 2021 was due to the COVID-19 pandemic.

One sample was collected at each of two sites on the Au Sable River (**Table 1**; **Figure 2**) to characterize PFAS concentrations in the river for comparisons with Lake Huron samples. Depth-composite sub-surface samples were collected in the main flow of the river using a depth-integrating water sampler.

Lake Huron samples were collected at each end and the mid-point of each of six transects (**Table 1**; **Figures 2** and **3**) with the intention of monitoring the river plume south along the shoreline to near Tawas City. Each transect began approximately 300 m (980 ft) from the shore and extend approximately 1.2 km (3,900 ft) perpendicular to shore. Four transects were near Oscoda: two transects to the north of the Au Sable River mouth (ON2 and ON1) and two transects south of the river mouth (OS1 and OS2). Two transects were near Tawas City, one north (TN2) and one south (TN1) of the HSRUA (Tawas) drinking water intake.

Individual Lake Huron samples were collected at the selected sites at approximately 1-meter below the surface, mid-depth, and 1-meter off lake bottom using a Van Dorn or Kemmerer sampler. Nine samples were collected along each transect for a total of 54 Lake Huron samples during each sampling event.

Each sample was dispensed from the water sampler into two 250 ml high-density polyethylene bottles (certified PFAS-free bottles provided by TestAmerica), alternating between both bottles. All personnel handling sample bottles wore nitrile gloves.

Ancillary data (water temperature, water depth, depth at sample, pH, turbidity, and conductivity) was collected at each PFAS sample site each event using a YSI ProDSS multiparameter meter (see **Appendix A**). Conductivity and turbidity were of particular importance because data collected by EGLE, and the United States Environmental Protection Agency (EPA) indicated a potential significant difference in those parameters between the Au Sable River and open waters of Lake Huron. By comparing these key parameters between sampling sites EGLE is hoping to be able to determine the zone of influence of the Au Sable River plume on Lake Huron.

All samples for each event were collected in one day and shipped directly to a Eurofins-TestAmerica (West Sacramento, CA laboratory) via overnight delivery. Samples were analyzed for selected PFAS, as described in the Quality Assurance Project Plan (QAPP; MDEQ 2018c) and listed in **Table 2**.

The TestAmerica method detection limit for the surface water samples varied by compound, with a reporting limit of 2 ng/L for all PFAS analyzed. TestAmerica flagged results below the reporting limit but above the method detection limit as estimated values (J). The estimated values were used for data compilation and summary as reported. Total PFAS values were calculated as the sum of detected values for each individual compound. Values qualified as estimated by TestAmerica were treated as the reported value during total PFAS summation. Non-detect values were assigned a value of zero for the purpose of calculating total PFAS and arithmetic means.

Statistical Analysis

Potential differences in Lake Huron PFOS and PFOA concentrations at different depths (surface, mid-depth, bottom) and transect locations south of the mouth of the Au Sable River were investigated using two-way ANOVA. PFOS and PFOA concentrations were natural log transformed to satisfy model assumptions of homogeneity of variances and normality. For all analysis, an alpha (α) of 0.05 was used to indicate statistical significance.

Quality Assurance/Quality Control (QA/QC)

QA/QC procedures followed those provided in the Michigan Surface Water PFAS Investigation 2018 QAPP (MDEQ 2018c). All quality control objectives and criteria for the PFAS analyses are provided in **Table 3**. Field sampling and analytical quality were assessed using replicate, duplicate, and blank (field, equipment, and laboratory method) samples. A total of 56 ambient, two equipment blanks, one field blank, three duplicate, and three replicate samples were collected during each sampling event. Replicate samples were taken by collecting two sets of samples in succession at the same sample location. Duplicate samples were taken by collecting a one-liter composite sample dispensed into two sets of two 250 mL HDPE bottles. The field blank was collected by filling a clean set of sample bottles with PFAS free deionized water in the field. Finally, the equipment blanks were collected by filling the equipment with deionized water and pouring the water into the sample containers. Precision of replicate and duplicate results is calculated by the relative percent deviation (RPD) as defined by 100 times the difference (range) of each sample, X1 and X2, divided by the arithmetic mean of the set and calculated using the following equation:

$$RPD = 100 * \left(\frac{X1 - X2}{\frac{(X1 - X2)}{2}}\right)$$

Table 1. Au Sable River and Lake Huron surface water sample collection locations, July 30, September 24, and November 20, 2019, and April 7, 2021.

Site Code	Description	Latitude	Longitude
Au Sable River			
AS001	at US-23	44.40731	-83.32459
AS002	at Mill St.	44.4154	-83.3308
Lake Huron			
ON1a-S,M,B	Oscoda North 1, Site a; Surface, Mid-depth, Bottom	44.40866	-83.31673
ON1b-S,M,B	Oscoda North 1, Site b; Surface, Mid-depth, Bottom	44.40946	-83.30894
ON1c-S,M,B	Oscoda North 1, Site c; Surface, Mid-depth, Bottom	44.41034	-83.30124
ON2a-S,M,B	Oscoda North 2, Site a; Surface, Mid-depth, Bottom	44.42114	-83.32191
ON2b-S,M,B	Oscoda North 2, Site b; Surface, Mid-depth, Bottom	44.42113	-83.31461
ON2c-S,M,B	Oscoda North 2, Site c; Surface, Mid-depth, Bottom	44.42115	-83.3065
OS1a-S,M,B	Oscoda South 1, Site a; Surface, Mid-depth, Bottom	44.40425	-83.31707
OS1b-S,M,B	Oscoda South 1, Site b; Surface, Mid-depth, Bottom	44.403	-83.31016
OS1c-S,M,B	Oscoda South 1, Site c; Surface, Mid-depth, Bottom	44.40162	-83.3023
OS2a-S,M,B	Oscoda South 2, Site a; Surface, Mid-depth, Bottom	44.39185	-83.32234
OS2b-S,M,B	Oscoda South 2, Site b; Surface, Mid-depth, Bottom	44.39001	-83.31543
OS2c-S,M,B	Oscoda South 2, Site c; Surface, Mid-depth, Bottom	44.38799	-83.30795
TN1a-S,M,B	Tawas North 1, Site a; Surface, Mid-depth, Bottom	44.25608	-83.43578
TN1b-S,M,B	Tawas North 1, Site b; Surface, Mid-depth, Bottom	44.25262	-83.43004
TN1c-S,M,B	Tawas North 1, Site c; Surface, Mid-depth, Bottom	44.24902	-83.42414
TN2a-S,M,B	Tawas North 2, Site a; Surface, Mid-depth, Bottom	44.28076	-83.41761
TN2b-S,M,B	Tawas North 2, Site b; Surface, Mid-depth, Bottom	44.27896	-83.41095
TN2c-S,M,B	Tawas North 2, Site c; Surface, Mid-depth, Bottom	44.27698	-83.40355

Figure 2. Au Sable River and Oscoda area Lake Huron sampling sites.

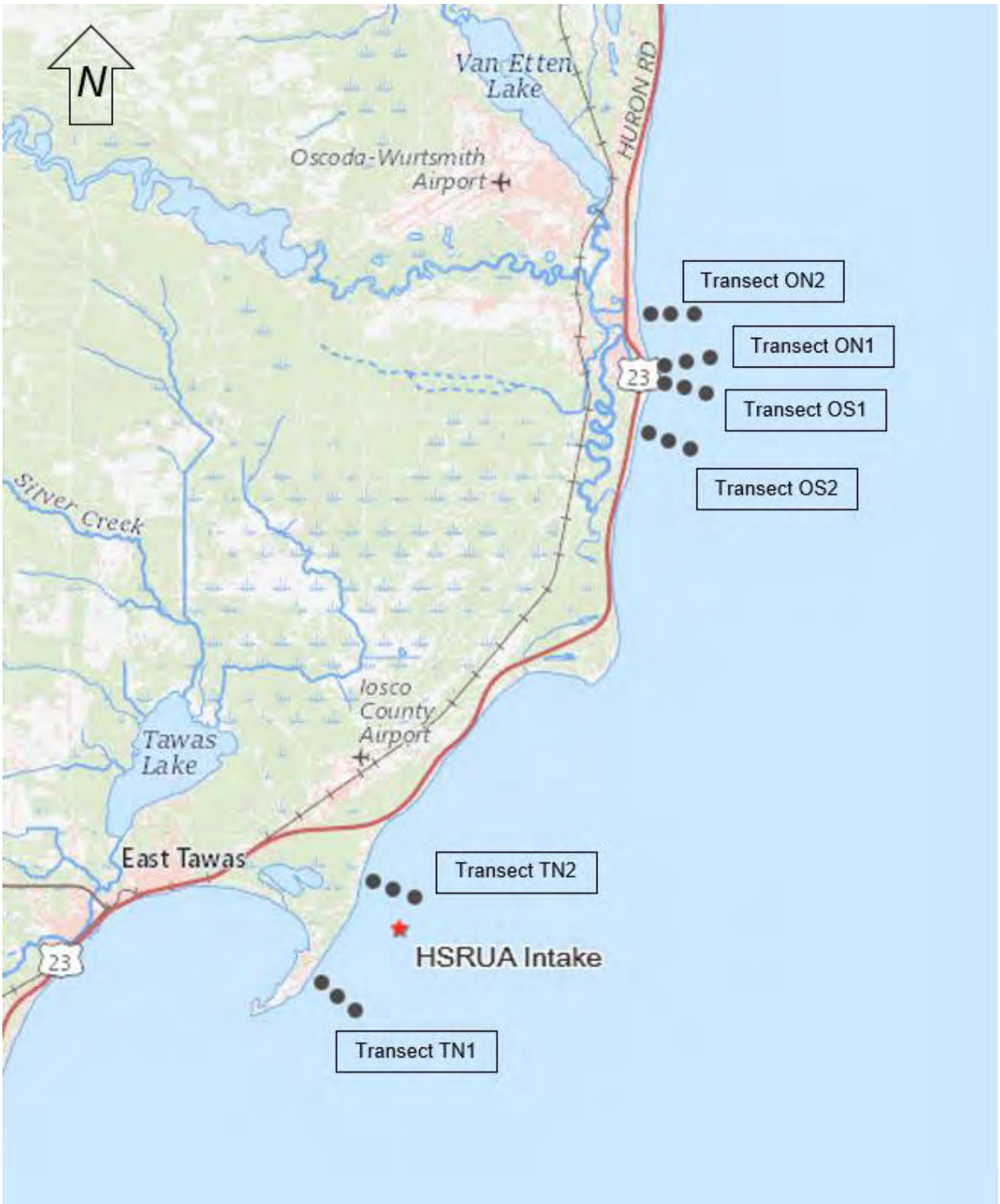

Figure 3. Approximate location of Lake Huron surface water sampling transects.

Table 2. Perfluoroalkyl and polyfluoroalkyl substances analyzed in Au Sable and Lake Huron surface water samples, July 30, September 24, and November 20, 2019, and April 7, 2021.

Compound	Abbreviation	CAS Number
Perfluorobutanoic acid	PFBA	375-22-4
Perfluorooctanoic acid	PFOA	335-67-1
Perfluorooctane sulfonic acid	PFOS	1763-23-1
Perfluoropentanoic acid	PFPeA	2706-90-3
Perfluorohexanoic acid	PFHxA	307-24-4
Perfluoroheptanoic acid	PFHpA	375-85-9
Perfluorononanoic acid	PFNA	375-95-1
Perfluorodecanoic acid	PFDA	335-76-2
Perfluoroundecanoic acid	PFUnA	2058-94-8
Perfluorododecanoic acid	PFDoA	307-55-1
Perfluorotridecanoic acid	PFTriA	72629-94-8
Perfluorotetradecanoic acid	PFTeA	376-06-7
Perfluorobutanesulfonic acid	PFBS	375-73-5
Perfluorohexanesulfonic acid	PFHxS	355-46-4
Perfluoroheptanesulfonic acid	PFHpS	375-92-8
Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorooctanesulfonamide	FOSA	754-91-6
Perfluoropentanesulfonic acid	PFPeS	2706-91-4
Perfluorononanesulfonic acid	PFNS	68259-12-1
N-methyl perfluorooctane sulfonamidoacetic acid	NMeFOSAA	2355-31-9
N-ethyl perfluorooctane sulfonamidoacetic acid	NEtFOSAA	2991-50-6
Fluorotelomer sulphonic acid 4:2	4:2 FTS	757124-72-4
Fluorotelomer sulphonic acid 6:2	6:2 FTS	27619-97-2
Fluorotelomer sulphonic acid 8:2	8:2 FTS	39108-34-4

Table 3. Quality objectives and criteria for water measurement data.

Data Quality Indicator	Measurement	Data Quality Objective	Results
Precision	1 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) per preparation batch	%RPD < 30%	RPD < 30 % in all MS/MSD samples except for PFTriA in September 2019 (33 %)
Precision	Field Sample Replication/Duplication	%RPD < 30%	RPD < 30 % in all field replicate and duplicate samples
Accuracy/Bias	1 Lab Control Sample (LCS) and 1 LCS/LCSD per preparation batch	% recovery varies with each analyte	Analyte recovery within percent recovery limits in all LCS/LCSD samples except for LCS sample in preparation batch 479444 - PFTeA (135%; Recovery limits 70-130%) and PFPeS (134%; Recover Limits 66-126%) ; LCS sample in preparation batch 479603 - PFPeS (130%; Recovery Limits 66-126%); LCS sample in preparation batch 479955 - PFPeS (129%; Recovery Limits 66-126%); LCSD sample in preparation batch 479955 - PFPeS (134%; Recovery Limits 66-126%); LCS sample in preparation batch 481251 - PFPeS (134%; Recovery Limits 66-126%); and LCSD sample in preparation batch 481251 - PFPeS (145%; Recovery Limits 66-126%) in April 2021.
Accuracy/Bias	1 method blank per preparation batch	No target analytes greater than or equal to the laboratory reporting limit	Analyte detection in all method blanks below reporting limits

Table 3. Quality objectives and criteria for water measurement data.

Data Quality Indicator	Measurement	Data Quality Objective	Results
Comparability	LC/MS Analytical work was conducted by the Eurofins TestAmerica LCMS West Sacramento Laboratory	The laboratory will provide verification that methods were properly implemented, and results meet QA/QC standards	All samples analyzed were conducted by Eurofins TestAmerica LCMS West Sacramento Laboratory and met QA/QC standards
Sensitivity	LC/MS/MS is tested daily or as needed following WS-LC-0025 SOP	Each analyte will pass continuing calibration verification (CCV) criteria of 40 or 50 % difference (analyte specific)	Not requested from or provided by Eurofins TestAmerica
Accuracy/Bias	Every sample (spiked, standard or method blank) received an internal standard	25 to 150 % recovery	Analyte recovery < 150 % in every sample
Completeness	[Total number of samples analyzed found to meet or exceed quality control criteria / total number of samples analyzed] * 100	90% samples should pass quality control criteria	224/224 $*$ 100 = 100 % for all analytes; 224/224 $*$ 100 = 100 % for PFOS/PFOA

RESULTS AND DISCUSSION

Ambient Water Sampling QA/QC

Neither PFOS nor PFOA were measured above their respective detection limit in the equipment or field blanks. All other analytes in the blanks were below laboratory detection limits with a few exceptions: PFHxS was measured below the laboratory reporting limit at between 0.25 to 0.31 ng/L in the two equipment blanks and field blank in July, September, and November 2019. Similarly, PFHxS was detected in several laboratory method blanks below the laboratory reporting limit in July, September, and November 2019 at between 0.294 to 0.383 ng/L. These findings suggest the source of PFHxS was most likely within the analytical process. In addition to PFHxS, PFBA was measured below the laboratory reporting limit in the two equipment blanks in November 2019 at 0.60 and 0.67 ng/L. Finally, PFBS and FOSA were detected below laboratory reporting limits in one laboratory method blank at 0.202 and 0.861 ng/L in July 2019, and PFOS, PFTeA, and PFBS were detected below laboratory reporting limits in one laboratory method blank at 0.559, 0.404, and 0.387 ng/L in September 2019.

Twelve replicate and duplicate samples (24 samples total) were collected over all four sampling events. The data quality objective of an RPD<30% was achieved for all replicate and duplicate samples for PFOS and PFOA. RPDs ranged from 0.0 to 22.2 for PFOS and 0.0 to 26.1 for PFOA. This data quality objective was also achieved for all replicate and duplicate samples for total PFAS with the exception of a field replicate in April 2021 taken at OS2a - Surface depth. The RPD for this sample and its replicate was 34.9% and explained by the difference in #PFAS detected between replicate samples of 4 and 8 individual PFAS compounds, respectively. In this instance, the four additional PFAS compounds detected in the replicate caused the discrepancy in total PFAS between the two samples.

PFTriA exceeded the RPD limit for the laboratory control sample duplicate (LCSD) 320-327726/3-A in September 2019. The laboratory control sample (LCS) for preparation batch 320-479444 and analytical batch 320-481209 recovered outside control limits for PFTeA and PFPeS in April 2021. These analytes were biased high in the LCS and were not detected in the associated samples; therefore, the data were reported. Finally, elevated reporting limits were provided for the following samples in November 2019 due to insufficient sample provided for preparation: TN1b - Surface (320-56525-4), TN1b - Middle (320-56525-5), TN1b - Bottom (320-56525-6), TN1c - Surface (320-56525-7), and TN2b - Bottom (320-56525-15).

All other data quality control objectives and criteria were met (**Table 3**).

Water Quality Conditions

Four ambient surface water sampling events were conducted for this study on July 30th, September 24th and November 20th in 2019, and April 7th in 2021. Sampling at all 20 locations was completed in a single day during each event.

In July 2019, a brief rainfall event occurred between 6 and 7 pm the evening of the 29th prior to sampling on the 30th. The amount of precipitation recorded at the Oscoda-Wurtsmith station was approximately 0.79 inches. Measured discharge in the Au Sable River near Au Sable, MI (at

USGS gauging station 04137500) increased from approximately 1,100 cfs to a peak of approximately 1,500 cfs during the sampling period on July 30th before returning to 1,100 cfs (the 33 year median daily statistic) on August 1st.

No significant rainfall fell in the area the day before or during sampling on September 24th, although approximately a half inch fell on the 22nd two days prior to the sampling event. Measured discharge in the Au Sable River rose steadily from approximately 1,100 cfs beginning on the 22nd to a peak of approximately 2,000 cfs during the sampling period on the 24th before gradually diminishing on the 25th and 26th.

No rainfall fell within two days before or during sampling on November 20th in 2019. Measured discharge in the Au Sable River declined steadily from a peak of approximately 1,700 cfs on the 17th to approximately 1,300 cfs on the 20th. Stream discharge on the 20th was equal to the 33 year median daily statistic for the location.

Insignificant rainfall (0.03 inches) fell within two days prior to the sampling on April 7th in 2021. Measured discharge in the Au Sable River was steady below the 33 year median daily statistic of approximately 2,000 cfs at about 1,400 cfs.

Conductivity measured at bottom, middle and surface depths on July 30th and again on September 24th, 2019, remained remarkably constant between 306 and 308 µS/cm at both sampling locations at the mouth of the Au Sable River, before slightly increasing to between 323 and 325 µS/cm measured across all depths at the two locations on November 20th (**Appendix A**). Turbidity measured at bottom, middle and surface depths on September 24th and again on November 20th, 2019, remained remarkably constant between 0.4 and 0.5 NTU at both sampling locations on the Au Sable River, after slightly decreasing from between 0.9 to 1.3 NTU measured across all depths at the two locations earlier on July 30th. In April 2021, conductivity measured at bottom, middle and surface depths at both sampling locations at the mouth of the Au Sable River was 308 µS/cm, while turbidity ranged from 1.4 to 1.6 NTU.

Overall, there was little to no difference in measured conductivity and turbidity at the two Au Sable River locations across events and at different depths. Similar findings were observed for pH and water temperature, although water temperature differed according to seasonal variation as expected (**Appendix A**).

Mean conductivity along all transects on Lake Huron was consistently lower in July and September 2019 (summer) compared to November 2019 (fall) and April 2021 (spring). Conductivity did not vary between seasons by more than 80 µS/cm at any given transect and was slightly higher on average near Oscoda (224 to 233 µS/cm) compared to Tawas City (213 to 214 µS/cm). Mean turbidity was consistently higher in July and April compared to September and November and did not vary by more than 1 NTU at any given transect. Turbidity was also slightly higher on average near Oscoda (0.45 to 0.62 NTU) compared to Tawas City (0.31 NTU). There was also very little difference among transects in average water temperature and pH.

No statistical analyses were conducted comparing water quality parameters among sampling sites. Based on transect mean values alone, however, the mild influence of the Au Sable River on Lake Huron conductivity and turbidity appear limited to ON1 and OS1, the transects immediately north and south of the river mouth.

PFOS and PFOA Concentrations

The number of water samples with detectable concentrations of PFOS was 246 out of 260 total samples or 95% (**Table 4**). The number of water samples with estimated PFOS concentrations was 209 out of the 246 with detects, or 85%. Thirty-seven of the water samples collected during the study had PFOS concentrations above the RL. Of these, 11 were measured from the Au Sable River locations (**Table 4**). Mean PFOS concentrations averaged between 3.4 and 3.5 ng/L on the Au Sable River and were equal to or less than the reporting limit of 2 ng/L (background) in Lake Huron.

The highest measured PFOS concentration in any sample was 760 ng/L (ON2c – Surface; April 2021), which is two orders of magnitude higher than the next highest measured PFOS concentration of 6.7 ng/L from the Au Sable River at US23 in July 2019 (**Table 4**). All other PFOS concentrations from water samples collected from ON2 at any depth or transect location were either estimated or below detection. The PFOS concentration of 760 ng/L is considered an outlier due to significant data quality concerns with this sample[1] and was excluded from summary calculations and analyses.

The number of water samples with detectable concentrations of PFOA was 244 out of 260 total samples or 94% (**Table 4**). The number of water samples with estimated PFOA concentrations was 241 out of the 244 with detects, or 99%. Only three of the water samples collected during the study had PFOA concentrations above the RL. Mean PFOA concentrations averaged between 0.8 and 1.4 ng/L across all transect locations and were below the reporting limit of 2 ng/L.

The highest measured PFOA concentration in any sample was 3.9 ng/L (ON1c – Mid-depth; September 2019) (**Table 4**).

[1] At the time of sampling and shipment, this sample was clear and free of any visible debris. Upon receipt, the analytical laboratory noted that the sample was discolored, and sedimentation was present in the sample prior to analysis. This contamination interfered with the analysis and required a 10x dilution which ultimately increased the detection and reporting limits in the sample above HNVs. After discussion with the analytical laboratory, it was determined that contamination occurred sometime between sampling and analysis. Due to the data quality concerns with this sample, EGLE determined this was an outlier and not a true surface water PFAS concentration.

Table 4. PFOS and PFOA concentrations measured in surface water samples collected from the Au Sable River and Lake Huron on July 30, September 24, and November 20, 2019, and April 7, 2021. Concentrations exceeding the Part 4, Rule 57 Human Non-Cancer Value (HNV; value of 12 ng/L) are bolded and italicized. ND denotes a non-detect.

Sample ID	Sample Location Description	Latitude	Longitude	Sampling Event	PFOS[1] (ng/L)	PFOA[1] (ng/L)
AS001	Au Sable River at US23	44.40731	-83.32459	July 2019	6.7	1.4 J
AS001	Au Sable River at US23	44.40731	-83.32459	September 2019	2.2	0.88 J
AS001	Au Sable River at US23	44.40731	-83.32459	November 2019	2.6	1 J
AS001[R]	Au Sable River at US23	44.40731	-83.32459	November 2019	2.7	1 J
AS001	Au Sable River at US23	44.40731	-83.32459	April 2021	2.2	ND
AS002	Au Sable River at Mill St.	44.4154	-83.3308	July 2019	6.4	1.7 J
AS002[D]	Au Sable River at Mill St	44.4154	-83.3308	July 2019	6.3	1.8 J
AS002	Au Sable River at Mill St	44.4154	-83.3308	September 2019	2.8	0.91 J
AS002	Au Sable River at Mill St	44.4154	-83.3308	November 2019	2.3	0.99 J
AS022[D]	Au Sable River at Mill St	44.4154	-83.3308	November 2019	2.3	0.97 J
AS002	Au Sable River at Mill St	44.4154	-83.3308	April 2021	2.5	ND
ON1a-B	Lake Huron: Oscoda North 1, Site a; Bottom	44.40866	-83.31673	July 2019	1.3 J	1.4 J
ON1a-B	Lake Huron: Oscoda North 1, Site a; Bottom	44.40866	-83.31673	September 2019	1.3 J	1.5 J
ON1a-B[R]	Lake Huron: Oscoda North 1, Site a; Bottom	44.40866	-83.31673	September 2019	1.2 J	1.3 J
ON1a-B	Lake Huron: Oscoda North 1, Site a; Bottom	44.40866	-83.31673	November 2019	1.3 J	1.2 J
ON1a-B	Lake Huron: Oscoda North 1, Site a; Bottom	44.40866	-83.31673	April 2021	1.8 J	1.3 J
ON1a-M	Lake Huron: Oscoda North 1, Site a; Mid-depth	44.40866	-83.31673	July 2019	1.2 J	1.2 J
ON1a-M	Lake Huron: Oscoda North 1, Site a; Mid-depth	44.40866	-83.31673	September 2019	1.2 J I	1.6 J
ON1a-M	Lake Huron: Oscoda North 1, Site a; Mid-depth	44.40866	-83.31673	November 2019	1.3 J	1.2 J
ON1a-M	Lake Huron: Oscoda North 1, Site a; Mid-depth	44.40866	-83.31673	April 2021	1.8	1.2 J
ON1a-S	Lake Huron: Oscoda North 1, Site a; Surface	44.40866	-83.31673	July 2019	1.2 J	1.3 J
ON1a-S	Lake Huron: Oscoda North 1, Site a; Surface	44.40866	-83.31673	September 2019	1.5 J	1.7 J
ON1a-S	Lake Huron: Oscoda North 1, Site a; Surface	44.40866	-83.31673	November 2019	1.4 J	1.2 J
ON1a-S	Lake Huron: Oscoda North 1, Site a; Surface	44.40866	-83.31673	April 2021	1.7 J	1.3 J
ON1b-B	Lake Huron: Oscoda North 1, Site b; Bottom	44.40946	-83.30894	July 2019	1.2 J	1.2 J
ON1b-B	Lake Huron: Oscoda North 1, Site b; Bottom	44.40946	-83.30894	September 2019	1.7 J	1.8 J
ON1b-B	Lake Huron: Oscoda North 1, Site b; Bottom	44.40946	-83.30894	November 2019	2.2	1.2 J

Sample ID	Sample Location Description	Latitude	Longitude	Sampling Event	PFOS[1] (ng/L)	PFOA[1] (ng/L)
ON1b-B	Lake Huron: Oscoda North 1, Site b; Bottom	44.40946	-83.30894	April 2021	2	1.4 J
ON1b-M	Lake Huron: Oscoda North 1, Site b; Mid-depth	44.40946	-83.30894	July 2019	1.3 J	1.4 J
ON1b-M	Lake Huron: Oscoda North 1, Site b; Mid-depth	44.40946	-83.30894	September 2019	1.8 J I	1.5 J
ON1b-M	Lake Huron: Oscoda North 1, Site b; Mid-depth	44.40946	-83.30894	November 2019	1.8 J	1.2 J
ON1b-M[D]	Lake Huron: Oscoda North 1, Site b; Mid-depth	44.40946	-83.30894	November 2019	1.8 J	1.1 J
ON1b-M	Lake Huron: Oscoda North 1, Site b; Mid-depth	44.40946	-83.30894	April 2021	1.7 J	1.3 J
ON1b-M[D]	Lake Huron: Oscoda North 1, Site b; Mid-depth	44.40946	-83.30894	April 2021	1.9 J	1 J
ON1b-S	Lake Huron: Oscoda North 1, Site b; Surface	44.40946	-83.30894	July 2019	1.2 J	1.4 J
ON1b-S	Lake Huron: Oscoda North 1, Site b; Surface	44.40946	-83.30894	September 2019	1.6 J I	1.5 J
ON1b-S	Lake Huron: Oscoda North 1, Site b; Surface	44.40946	-83.30894	November 2019	2.4	1.1 J
ON1b-S	Lake Huron: Oscoda North 1, Site b; Surface	44.40946	-83.30894	April 2021	1.7 J	1.4 J
ON1c-B	Lake Huron: Oscoda North 1, Site c; Bottom	44.41034	-83.30124	July 2019	1.1 J	1.2 J
ON1c-B	Lake Huron: Oscoda North 1, Site c; Bottom	44.41034	-83.30124	September 2019	1.5 J	1.8 J
ON1c-B	Lake Huron: Oscoda North 1, Site c; Bottom	44.41034	-83.30124	November 2019	2	1.2 J
ON1c-B	Lake Huron: Oscoda North 1, Site c; Bottom	44.41034	-83.30124	April 2021	1.9	1.2 J
ON1c-M	Lake Huron: Oscoda North 1, Site c; Mid-depth	44.41034	-83.30124	July 2019	1.3 J	1.3 J
ON1c-M	Lake Huron: Oscoda North 1, Site c; Mid-depth	44.41034	-83.30124	September 2019	2.7 I CI	3.9
ON1c-M	Lake Huron: Oscoda North 1, Site c; Mid-depth	44.41034	-83.30124	November 2019	1.5 J	1.2 J
ON1c-M	Lake Huron: Oscoda North 1, Site c; Mid-depth	44.41034	-83.30124	April 2021	1.5 J	1.1 J
ON1c-S	Lake Huron: Oscoda North 1, Site c; Surface	44.41034	-83.30124	July 2019	1.3 J	1.4 J
ON1c-S[R]	Lake Huron: Oscoda North 1, Site c; Surface	44.41034	-83.30124	July 2019	1.2 J	1.4 J
ON1c-S	Lake Huron: Oscoda North 1, Site c; Surface	44.41034	-83.30124	September 2019	1.6 J I B	1.1 J
ON1c-S	Lake Huron: Oscoda North 1, Site c; Surface	44.41034	-83.30124	November 2019	1.7 J	1.2 J
ON1c-S	Lake Huron: Oscoda North 1, Site c; Surface	44.41034	-83.30124	April 2021	1.6 J	1.2 J
ON2a-B	Lake Huron: Oscoda North 2, Site a; Bottom	44.42114	-83.32191	July 2019	1.2 J	1 J
ON2a-B	Lake Huron: Oscoda North 2, Site a; Bottom	44.42114	-83.32191	September 2019	1.3 J B	1.2 J
ON2a-B	Lake Huron: Oscoda North 2, Site a; Bottom	44.42114	-83.32191	November 2019	2	1.3 J
ON2a-B	Lake Huron: Oscoda North 2, Site a; Bottom	44.42114	-83.32191	April 2021	1.8 J	1.3 J
ON2a-M	Lake Huron: Oscoda North 2, Site a; Mid-depth	44.42114	-83.32191	July 2019	1.1 J	1.1 J
ON2a-M	Lake Huron: Oscoda North 2, Site a; Mid-depth	44.42114	-83.32191	September 2019	1.6 J B	1.2 J

Sample ID	Sample Location Description	Latitude	Longitude	Sampling Event	PFOS[1] (ng/L)	PFOA[1] (ng/L)
ON2a-M	Lake Huron: Oscoda North 2, Site a; Mid-depth	44.42114	-83.32191	November 2019	1.4 J	1.2 J
ON2a-M	Lake Huron: Oscoda North 2, Site a; Mid-depth	44.42114	-83.32191	April 2021	1.9	1.1 J
ON2a-S	Lake Huron: Oscoda North 2, Site a; Surface	44.42114	-83.32191	July 2019	3.4	1.4 J
ON2a-S	Lake Huron: Oscoda North 2, Site a; Surface	44.42114	-83.32191	September 2019	1.4 J B	1.3 J
ON2a-S	Lake Huron: Oscoda North 2, Site a; Surface	44.42114	-83.32191	November 2019	1.3 J	1.3 J
ON2a-S	Lake Huron: Oscoda North 2, Site a; Surface	44.42114	-83.32191	April 2021	1.7 J	1.3 J
ON2b-B	Lake Huron: Oscoda North 2, Site b; Bottom	44.42113	-83.31461	July 2019	1.1 J	1.1 J
ON2b-B	Lake Huron: Oscoda North 2, Site b; Bottom	44.42113	-83.31461	September 2019	1.3 J B	1.1 J
ON2b-B	Lake Huron: Oscoda North 2, Site b; Bottom	44.42113	-83.31461	November 2019	1.5 J	1.3 J
ON2b-B	Lake Huron: Oscoda North 2, Site b; Bottom	44.42113	-83.31461	April 2021	2	1.3 J
ON2b-B[R]	Lake Huron: Oscoda North 2, Site b; Bottom	44.42113	-83.31461	April 2021	1.6 J	1.3 J
ON2b-M	Lake Huron: Oscoda North 2, Site b; Mid-depth	44.42113	-83.31461	July 2019	1.2 J	1.1 J
ON2b-M	Lake Huron: Oscoda North 2, Site b; Mid-depth	44.42113	-83.31461	September 2019	1.3 J B	1.2 J
ON2b-M[D]	Lake Huron: Oscoda North 2, Site b; Mid-depth	44.42113	-83.31461	September 2019	1.4 J	1.3 J
ON2b-M	Lake Huron: Oscoda North 2, Site b; Mid-depth	44.42113	-83.31461	November 2019	1.5 J	1.2 J
ON2b-M	Lake Huron: Oscoda North 2, Site b; Mid-depth	44.42113	-83.31461	April 2021	2	1.3 J
ON2b-S	Lake Huron: Oscoda North 2, Site b; Surface	44.42113	-83.31461	July 2019	1.3 J	1.3 J
ON2b-S	Lake Huron: Oscoda North 2, Site b; Surface	44.42113	-83.31461	September 2019	1.5 J B	1.1 J
ON2b-S	Lake Huron: Oscoda North 2, Site b; Surface	44.42113	-83.31461	November 2019	1.3 J	1.2 J
ON2b-S	Lake Huron: Oscoda North 2, Site b; Surface	44.42113	-83.31461	April 2021	1.6 J	1.2 J
ON2c-B	Lake Huron: Oscoda North 2, Site c; Bottom	44.42115	-83.3065	July 2019	1.1 J	1.3 J
ON2c-B	Lake Huron: Oscoda North 2, Site c; Bottom	44.42115	-83.3065	September 2019	1.4 J I B	1 J
ON2c-B	Lake Huron: Oscoda North 2, Site c; Bottom	44.42115	-83.3065	November 2019	1.5 J	1.2 J
ON2c-B	Lake Huron: Oscoda North 2, Site c; Bottom	44.42115	-83.3065	April 2021	1.8	1.3 J
ON2c-M	Lake Huron: Oscoda North 2, Site c; Mid-depth	44.42115	-83.3065	July 2019	1.3 J	1.3 J
ON2c-M	Lake Huron: Oscoda North 2, Site c; Mid-depth	44.42115	-83.3065	September 2019	1.4 J B	1.1 J
ON2c-M	Lake Huron: Oscoda North 2, Site c; Mid-depth	44.42115	-83.3065	November 2019	1.7 J	1.3 J
ON2c-M	Lake Huron: Oscoda North 2, Site c; Mid-depth	44.42115	-83.3065	April 2021	ND	ND
ON2c-S	Lake Huron: Oscoda North 2, Site c; Surface	44.42115	-83.3065	July 2019	1.2 J	1.2 J
ON2c-S	Lake Huron: Oscoda North 2, Site c; Surface	44.42115	-83.3065	September 2019	1.4 J B	1.1 J

Sample ID	Sample Location Description	Latitude	Longitude	Sampling Event	PFOS[1] (ng/L)	PFOA[1] (ng/L)
ON2c-S	Lake Huron: Oscoda North 2, Site c; Surface	44.42115	-83.3065	November 2019	1.3 J	1.4 J
ON2c-S	Lake Huron: Oscoda North 2, Site c; Surface	44.42115	-83.3065	April 2021	***760** J I	ND
OS1a-B	Lake Huron: Oscoda South 1, Site a; Bottom	44.40425	-83.31707	July 2019	1.4 J	1.6 J
OS1a-B	Lake Huron: Oscoda South 1, Site a; Bottom	44.40425	-83.31707	September 2019	1.1 J I	2
OS1a-B	Lake Huron: Oscoda South 1, Site a; Bottom	44.40425	-83.31707	November 2019	1.8 J	1.1 J
OS1a-B	Lake Huron: Oscoda South 1, Site a; Bottom	44.40425	-83.31707	April 2021	2	0.82 J
OS1a-M	Lake Huron: Oscoda South 1, Site a; Mid-depth	44.40425	-83.31707	July 2019	1.2 J	1.2 J
OS1a-M	Lake Huron: Oscoda South 1, Site a; Mid-depth	44.40425	-83.31707	September 2019	1.3 J	1.2 J
OS1a-M	Lake Huron: Oscoda South 1, Site a; Mid-depth	44.40425	-83.31707	November 2019	1.3 J	1.3 J
OS1a-M	Lake Huron: Oscoda South 1, Site a; Mid-depth	44.40425	-83.31707	April 2021	2.2	1 J
OS1a-S	Lake Huron: Oscoda South 1, Site a; Surface	44.40425	-83.31707	July 2019	1.5 J	1.3 J
OS1a-S	Lake Huron: Oscoda South 1, Site a; Surface	44.40425	-83.31707	September 2019	1.4 J I CI	1.4 J
OS1a-S	Lake Huron: Oscoda South 1, Site a; Surface	44.40425	-83.31707	November 2019	1.3 J	1.4 J
OS1a-S	Lake Huron: Oscoda South 1, Site a; Surface	44.40425	-83.31707	April 2021	1.9	1.2 J
OS1b-B	Lake Huron: Oscoda South 1, Site b; Bottom	44.403	-83.31016	July 2019	1.3 J	1.5 J
OS1b-B	Lake Huron: Oscoda South 1, Site b; Bottom	44.403	-83.31016	September 2019	1.4 J	1.4 J
OS1b-B	Lake Huron: Oscoda South 1, Site b; Bottom	44.403	-83.31016	November 2019	1.7 J	1.2 J
OS1b-B	Lake Huron: Oscoda South 1, Site b; Bottom	44.403	-83.31016	April 2021	2.1	1.1 J
OS1b-M	Lake Huron: Oscoda South 1, Site b; Mid-depth	44.403	-83.31016	July 2019	1.6 J	1.6 J
OS1b-M	Lake Huron: Oscoda South 1, Site b; Mid-depth	44.403	-83.31016	September 2019	1.3 J	1.6 J
OS1b-M	Lake Huron: Oscoda South 1, Site b; Mid-depth	44.403	-83.31016	November 2019	1.7 J	1.2 J
OS1b-M	Lake Huron: Oscoda South 1, Site b; Mid-depth	44.403	-83.31016	April 2021	2	1.3 J
OS1b-S	Lake Huron: Oscoda South 1, Site b; Surface	44.403	-83.31016	July 2019	3.6	2
OS1b-S	Lake Huron: Oscoda South 1, Site b; Surface	44.403	-83.31016	September 2019	1.4 J	1.2 J
OS1b-S	Lake Huron: Oscoda South 1, Site b; Surface	44.403	-83.31016	November 2019	1.5 J	1.2 J
OS1b-S	Lake Huron: Oscoda South 1, Site b; Surface	44.403	-83.31016	April 2021	1.9	1.3 J
OS1c-B	Lake Huron: Oscoda South 1, Site c; Bottom	44.40162	-83.3023	July 2019	1.2 J	1.3 J
OS1c-B	Lake Huron: Oscoda South 1, Site c; Bottom	44.40162	-83.3023	September 2019	1.3 J	1.5 J
OS1c-B	Lake Huron: Oscoda South 1, Site c; Bottom	44.40162	-83.3023	November 2019	1.4 J	1.3 J
OS1c-B	Lake Huron: Oscoda South 1, Site c; Bottom	44.40162	-83.3023	April 2021	1.7 J	1.2 J

Sample ID	Sample Location Description	Latitude	Longitude	Sampling Event	PFOS[1] (ng/L)	PFOA[1] (ng/L)
OS1c-M	Lake Huron: Oscoda South 1, Site c; Mid-depth	44.40162	-83.3023	July 2019	1.2 J	1.4 J
OS1c-M	Lake Huron: Oscoda South 1, Site c; Mid-depth	44.40162	-83.3023	September 2019	1.5 J I	1.4 J
OS1c-M	Lake Huron: Oscoda South 1, Site c; Mid-depth	44.40162	-83.3023	November 2019	1.3 J	1.2 J
OS1c-M	Lake Huron: Oscoda South 1, Site c; Mid-depth	44.40162	-83.3023	April 2021	1.6 J	1.2 J
OS1c-M[D]	Lake Huron: Oscoda South 1, Site c; Mid-depth	44.40162	-83.3023	April 2021	1.7 J	1.2 J
OS1c-S	Lake Huron: Oscoda South 1, Site c; Surface	44.40162	-83.3023	July 2019	1.4 J	1.3 J
OS1c-S	Lake Huron: Oscoda South 1, Site c; Surface	44.40162	-83.3023	September 2019	1.3 J I	1.5 J
OS1c-S	Lake Huron: Oscoda South 1, Site c; Surface	44.40162	-83.3023	November 2019	1.3 J	1.3 J
OS1c-S	Lake Huron: Oscoda South 1, Site c; Surface	44.40162	-83.3023	April 2021	1.7 J	1.4 J
OS2a-B	Lake Huron: Oscoda South 2, Site a; Bottom	44.39185	-83.32234	July 2019	1.4 J	1.2 J
OS2a-B[D]	Lake Huron: Oscoda South 2, Site a; Bottom	44.39185	-83.32234	September 2019	1.2 J	1.3 J
OS2a-B	Lake Huron: Oscoda South 2, Site a; Bottom	44.39185	-83.32234	September 2019	1.5 J	1.3 J
OS2a-B	Lake Huron: Oscoda South 2, Site a; Bottom	44.39185	-83.32234	November 2019	1.5 J	1.2 J
OS2a-B	Lake Huron: Oscoda South 2, Site a; Bottom	44.39185	-83.32234	April 2021	2	1 J
OS2a-M	Lake Huron: Oscoda South 2, Site a; Mid-depth	44.39185	-83.32234	July 2019	1.5 J	1.3 J
OS2a-M[D]	Lake Huron: Oscoda South 2, Site a; Mid-depth	44.39185	-83.32234	July 2019	1.3 J	1.4 J
OS2a-M	Lake Huron: Oscoda South 2, Site a; Mid-depth	44.39185	-83.32234	September 2019	1.4 J	1.4 J
OS2a-M	Lake Huron: Oscoda South 2, Site a; Mid-depth	44.39185	-83.32234	November 2019	1.5 J	1.2 J
OS2a-M[R]	Lake Huron: Oscoda South 2, Site a; Mid-depth	44.39185	-83.32234	November 2019	1.2 J	1.2 J
OS2a-M	Lake Huron: Oscoda South 2, Site a; Mid-depth	44.39185	-83.32234	April 2021	2.3	1 J
OS2a-S	Lake Huron: Oscoda South 2, Site a; Surface	44.39185	-83.32234	July 2019	2.2	1.4 J
OS2a-S	Lake Huron: Oscoda South 2, Site a; Surface	44.39185	-83.32234	September 2019	1.2 J	1.2 J
OS2a-S	Lake Huron: Oscoda South 2, Site a; Surface	44.39185	-83.32234	November 2019	1.5 J	1.3 J
OS2a-S	Lake Huron: Oscoda South 2, Site a; Surface	44.39185	-83.32234	April 2021	2.1	1.1 J
OS2a-S[R]	Lake Huron: Oscoda South 2, Site a; Surface	44.39185	-83.32234	April 2021	2.1	0.96 J
OS2b-B	Lake Huron: Oscoda South 2, Site b; Bottom	44.39001	-83.31543	July 2019	1.3 J	1.3 J
OS2b-B	Lake Huron: Oscoda South 2, Site b; Bottom	44.39001	-83.31543	September 2019	1.4 J	1.3 J
OS2b-B	Lake Huron: Oscoda South 2, Site b; Bottom	44.39001	-83.31543	November 2019	1.4 J	1.3 J
OS2b-B	Lake Huron: Oscoda South 2, Site b; Bottom	44.39001	-83.31543	April 2021	1.8 J	1.4 J

Sample ID	Sample Location Description	Latitude	Longitude	Sampling Event	PFOS[1] (ng/L)	PFOA[1] (ng/L)
OS2b-M	Lake Huron: Oscoda South 2, Site b; Mid-depth	44.39001	-83.31543	July 2019	1.3 J	1.3 J
OS2b-M	Lake Huron: Oscoda South 2, Site b; Mid-depth	44.39001	-83.31543	September 2019	1.4 J I	1.2 J
OS2b-M	Lake Huron: Oscoda South 2, Site b; Mid-depth	44.39001	-83.31543	November 2019	1.3 J	1.3 J
OS2b-M	Lake Huron: Oscoda South 2, Site b; Mid-depth	44.39001	-83.31543	April 2021	1.9 J	1.1 J
OS2b-S	Lake Huron: Oscoda South 2, Site b; Surface	44.39001	-83.31543	July 2019	2.6	1.5 J
OS2b-S	Lake Huron: Oscoda South 2, Site b; Surface	44.39001	-83.31543	September 2019	1.3 J	1.4 J
OS2b-S	Lake Huron: Oscoda South 2, Site b; Surface	44.39001	-83.31543	November 2019	1.2 J	1.3 J
OS2b-S	Lake Huron: Oscoda South 2, Site b; Surface	44.39001	-83.31543	April 2021	1.6 J	1.2 J
OS2c-B	Lake Huron: Oscoda South 2, Site c; Bottom	44.38799	-83.30795	July 2019	1.2 J	1.2 J
OS2c-B	Lake Huron: Oscoda South 2, Site c; Bottom	44.38799	-83.30795	September 2019	1.5 J I	1.7 J
OS2c-B	Lake Huron: Oscoda South 2, Site c; Bottom	44.38799	-83.30795	November 2019	1.3 J	1.3 J
OS2c-B	Lake Huron: Oscoda South 2, Site c; Bottom	44.38799	-83.30795	April 2021	1.7 J	1.4 J
OS2c-M[R]	Lake Huron: Oscoda South 2, Site c; Mid-depth	44.38799	-83.30795	July 2019	1.2 J	1.3 J
OS2c-M	Lake Huron: Oscoda South 2, Site c; Mid-depth	44.38799	-83.30795	July 2019	1.4 J	1.3 J
OS2c-M	Lake Huron: Oscoda South 2, Site c; Mid-depth	44.38799	-83.30795	September 2019	1.6 J I	1.5 J
OS2c-M	Lake Huron: Oscoda South 2, Site c; Mid-depth	44.38799	-83.30795	November 2019	1.3 J H	1.3 J H
OS2c-M	Lake Huron: Oscoda South 2, Site c; Mid-depth	44.38799	-83.30795	April 2021	1.9 I	1.3 J
OS2c-S	Lake Huron: Oscoda South 2, Site c; Surface	44.38799	-83.30795	July 2019	2	1.4 J
OS2c-S	Lake Huron: Oscoda South 2, Site c; Surface	44.38799	-83.30795	September 2019	1.7 J	1.6 J
OS2c-S	Lake Huron: Oscoda South 2, Site c; Surface	44.38799	-83.30795	November 2019	1.4 J H	1.1 J H
OS2c-S	Lake Huron: Oscoda South 2, Site c; Surface	44.38799	-83.30795	April 2021	1.4 J	1.2 J
TN1a-B	Lake Huron: Tawas North 1, Site a; Bottom	44.25608	-83.43578	July 2019	1.1 J	1.2 J
TN1a-B	Lake Huron: Tawas North 1, Site a; Bottom	44.25608	-83.43578	September 2019	1.3 J	1.7 J
TN1a-B	Lake Huron: Tawas North 1, Site a; Bottom	44.25608	-83.43578	November 2019	1.4 J H	1.1 J H
TN1a-B	Lake Huron: Tawas North 1, Site a; Bottom	44.25608	-83.43578	April 2021	1.6 J	1.9 J
TN1a-M	Lake Huron: Tawas North 1, Site a; Mid-depth	44.25608	-83.43578	July 2019	1.2 J	1.2 J
TN1a-M	Lake Huron: Tawas North 1, Site a; Mid-depth	44.25608	-83.43578	September 2019	1.3 J	1.4 J
TN1a-M	Lake Huron: Tawas North 1, Site a; Mid-depth	44.25608	-83.43578	November 2019	1.4 J H	1.2 J H
TN1a-M	Lake Huron: Tawas North 1, Site a; Mid-depth	44.25608	-83.43578	April 2021	1.4 J	1.4 J
TN1a-S	Lake Huron: Tawas North 1, Site a; Surface	44.25608	-83.43578	July 2019	1.2 J	1.3 J

Sample ID	Sample Location Description	Latitude	Longitude	Sampling Event	PFOS[1] (ng/L)	PFOA[1] (ng/L)
TN1a-S	Lake Huron: Tawas North 1, Site a; Surface	44.25608	-83.43578	September 2019	1.5 J	1.5 J
TN1a-S	Lake Huron: Tawas North 1, Site a; Surface	44.25608	-83.43578	November 2019	1.3 J H	1.3 J H
TN1a-S	Lake Huron: Tawas North 1, Site a; Surface	44.25608	-83.43578	April 2021	1.5 J	1.4 J
TN1b-B	Lake Huron: Tawas North 1, Site b; Bottom	44.25262	-83.43004	July 2019	1.1 J	1.1 J
TN1b-B	Lake Huron: Tawas North 1, Site b; Bottom	44.25262	-83.43004	September 2019	1.5 J	1.4 J
TN1b-B	Lake Huron: Tawas North 1, Site b; Bottom	44.25262	-83.43004	November 2019	1 J H	1.1 J H
TN1b-B[D]	Lake Huron: Tawas North 1, Site b; Bottom	44.25262	-83.43004	April 2021	1.4 J	1.4 J
TN1b-B	Lake Huron: Tawas North 1, Site b; Bottom	44.25262	-83.43004	April 2021	1.5 J	1.4 J
TN1b-M	Lake Huron: Tawas North 1, Site b; Mid-depth	44.25262	-83.43004	July 2019	1.1 J	1.1 J
TN1b-M	Lake Huron: Tawas North 1, Site b; Mid-depth	44.25262	-83.43004	September 2019	1.3 J	1.4 J
TN1b-M[R]	Lake Huron: Tawas North 1, Site b; Mid-depth	44.25262	-83.43004	September 2019	1.2 J	1.3 J
TN1b-M	Lake Huron: Tawas North 1, Site b; Mid-depth	44.25262	-83.43004	November 2019	1.3 J H	1.2 J H
TN1b-M	Lake Huron: Tawas North 1, Site b; Mid-depth	44.25262	-83.43004	April 2021	1.4 J	1.4 J
TN1b-S	Lake Huron: Tawas North 1, Site b; Surface	44.25262	-83.43004	July 2019	1.4 J	1.3 J
TN1b-S	Lake Huron: Tawas North 1, Site b; Surface	44.25262	-83.43004	September 2019	1.5 J	1.5 J
TN1b-S	Lake Huron: Tawas North 1, Site b; Surface	44.25262	-83.43004	November 2019	1.2 J H	1.3 J H
TN1b-S	Lake Huron: Tawas North 1, Site b; Surface	44.25262	-83.43004	April 2021	1.5 J	1.4 J
TN1c-B	Lake Huron: Tawas North 1, Site c; Bottom	44.24902	-83.42414	July 2019	1.3 J	1.2 J
TN1c-B[D]	Lake Huron: Tawas North 1, Site c; Bottom	44.24902	-83.42414	July 2019	1.2 J	1.4 J
TN1c-B	Lake Huron: Tawas North 1, Site c; Bottom	44.24902	-83.42414	September 2019	1.3 J	1.5 J
TN1c-B	Lake Huron: Tawas North 1, Site c; Bottom	44.24902	-83.42414	November 2019	1.3 J H	1.2 J H
TN1c-B	Lake Huron: Tawas North 1, Site c; Bottom	44.24902	-83.42414	April 2021	1.6 J	1.4 J
TN1c-M	Lake Huron: Tawas North 1, Site c; Mid-depth	44.24902	-83.42414	July 2019	1.2 J	1.3 J
TN1c-M	Lake Huron: Tawas North 1, Site c; Mid-depth	44.24902	-83.42414	September 2019	1.5 J I	1.2 J
TN1c-M	Lake Huron: Tawas North 1, Site c; Mid-depth	44.24902	-83.42414	November 2019	1.4 J H	1.3 J H
TN1c-M	Lake Huron: Tawas North 1, Site c; Mid-depth	44.24902	-83.42414	April 2021	1.5 J	1.3 J
TN1c-M[R]	Lake Huron: Tawas North 1, Site c; Mid-depth	44.24902	-83.42414	April 2021	1.4 J	1.3 J
TN1c-S	Lake Huron: Tawas North 1, Site c; Surface	44.24902	-83.42414	July 2019	1.4 J	1.4 J
TN1c-S	Lake Huron: Tawas North 1, Site c; Surface	44.24902	-83.42414	September 2019	1.3 J	1.5 J

Sample ID	Sample Location Description	Latitude	Longitude	Sampling Event	PFOS[1] (ng/L)	PFOA[1] (ng/L)
TN1c-S[D]	Lake Huron: Tawas North 1, Site c; Surface	44.24902	-83.42414	September 2019	1.3 J	1.3 J
TN1c-S	Lake Huron: Tawas North 1, Site c; Surface	44.24902	-83.42414	November 2019	1.5 J H	1.3 J H
TN1c -S[R]	Lake Huron: Tawas North 1, Site c; Surface	44.24902	-83.42414	November 2019	1.3 J	1.3 J
TN1c-S	Lake Huron: Tawas North 1, Site c; Surface	44.24902	-83.42414	April 2021	1.6 J	1.3 J
TN2a-B	Lake Huron: Tawas North 2, Site a; Bottom	44.28076	-83.41761	July 2019	1.1 J	1.1 J
TN2a-B	Lake Huron: Tawas North 2, Site a; Bottom	44.28076	-83.41761	September 2019	1.2 J	1.3 J
TN2a-B[R]	Lake Huron: Tawas North 2, Site a; Bottom	44.28076	-83.41761	September 2019	1.3 J	1.3 J
TN2a-B	Lake Huron: Tawas North 2, Site a; Bottom	44.28076	-83.41761	November 2019	1.3 J H	1.2 J H
TN2a-B	Lake Huron: Tawas North 2, Site a; Bottom	44.28076	-83.41761	April 2021	1.6 J	1.3 J
TN2a-M	Lake Huron: Tawas North 2, Site a; Mid-depth	44.28076	-83.41761	July 2019	1.3 J	1.3 J
TN2a-M	Lake Huron: Tawas North 2, Site a; Mid-depth	44.28076	-83.41761	September 2019	1.3 J	1.5 J
TN2a-M	Lake Huron: Tawas North 2, Site a; Mid-depth	44.28076	-83.41761	November 2019	1.3 J H	1.2 J H
TN2a-M	Lake Huron: Tawas North 2, Site a; Mid-depth	44.28076	-83.41761	April 2021	1.4 J	1.3 J
TN2a-S	Lake Huron: Tawas North 2, Site a; Surface	44.28076	-83.41761	July 2019	1.1 J	1.4 J
TN2a-S	Lake Huron: Tawas North 2, Site a; Surface	44.28076	-83.41761	September 2019	2 I	1.3 J
TN2a-S	Lake Huron: Tawas North 2, Site a; Surface	44.28076	-83.41761	November 2019	1.4 J H	1.3 J H
TN2a-S	Lake Huron: Tawas North 2, Site a; Surface	44.28076	-83.41761	April 2021	ND	1.5 J
TN2b-B	Lake Huron: Tawas North 2, Site b; Bottom	44.27896	-83.41095	July 2019	1.2 J	1.2 J
TN2b-B[R]	Lake Huron: Tawas North 2, Site b; Bottom	44.27896	-83.41095	July 2019	1.3 J	1.2 J
TN2b-B	Lake Huron: Tawas North 2, Site b; Bottom	44.27896	-83.41095	September 2019	1.2 J	1.3 J
TN2b-B	Lake Huron: Tawas North 2, Site b; Bottom	44.27896	-83.41095	November 2019	1.4 J H	1.2 J H
TN2b-B[D]	Lake Huron: Tawas North 2, Site b; Bottom	44.27896	-83.41095	November 2019	1.2 J	1.3 J
TN2b-B	Lake Huron: Tawas North 2, Site b; Bottom	44.27896	-83.41095	April 2021	1.6 J	1.5 J
TN2b-M	Lake Huron: Tawas North 2, Site b; Mid-depth	44.27896	-83.41095	July 2019	1.2 J	1.4 J
TN2b-M	Lake Huron: Tawas North 2, Site b; Mid-depth	44.27896	-83.41095	September 2019	1.1 J	1.3 J
TN2b-M	Lake Huron: Tawas North 2, Site b; Mid-depth	44.27896	-83.41095	November 2019	1.4 J H	1.2 J H
TN2b-M	Lake Huron: Tawas North 2, Site b; Mid-depth	44.27896	-83.41095	April 2021	1.2 J	1.6 J
TN2b-S	Lake Huron: Tawas North 2, Site b; Surface	44.27896	-83.41095	July 2019	1.4 J	1.4 J
TN2b-S	Lake Huron: Tawas North 2, Site b; Surface	44.27896	-83.41095	September 2019	1.4 J	1.4 J

Sample ID	Sample Location Description	Latitude	Longitude	Sampling Event	PFOS[1] (ng/L)	PFOA[1] (ng/L)
TN2b-S	Lake Huron: Tawas North 2, Site b; Surface	44.27896	-83.41095	November 2019	1.4 J H	1.2 J H
TN2b-S	Lake Huron: Tawas North 2, Site b; Surface	44.27896	-83.41095	April 2021	1.4 J	1.4 J
TN2c-B	Lake Huron: Tawas North 2, Site c; Bottom	44.27698	-83.40355	July 2019	1.2 J	1.3 J
TN2c-B	Lake Huron: Tawas North 2, Site c; Bottom	44.27698	-83.40355	September 2019	1.3 J I	1.4 J
TN2c-B	Lake Huron: Tawas North 2, Site c; Bottom	44.27698	-83.40355	November 2019	1.5 J H	1.2 J H
TN2c-B	Lake Huron: Tawas North 2, Site c; Bottom	44.27698	-83.40355	April 2021	1.5 J	1.4 J
TN2c-M	Lake Huron: Tawas North 2, Site c; Mid-depth	44.27698	-83.40355	July 2019	1.2 J	1.3 J
TN2c-M	Lake Huron: Tawas North 2, Site c; Mid-depth	44.27698	-83.40355	September 2019	1.4 J	1.3 J
TN2c-M	Lake Huron: Tawas North 2, Site c; Mid-depth	44.27698	-83.40355	November 2019	1.3 J H	1.1 J H
TN2c-M	Lake Huron: Tawas North 2, Site c; Mid-depth	44.27698	-83.40355	April 2021	1.5 J	1.4 J
TN2c-S	Lake Huron: Tawas North 2, Site c; Surface	44.27698	-83.40355	July 2019	1.3 J	1.4 J
TN2c-S	Lake Huron: Tawas North 2, Site c; Surface	44.27698	-83.40355	September 2019	1.4 J	1.4 J
TN2c-S	Lake Huron: Tawas North 2, Site c; Surface	44.27698	-83.40355	November 2019	1.3 J H	1.2 J H
TN2c-S	Lake Huron: Tawas North 2, Site c; Surface	44.27698	-83.40355	April 2021	1.5 J	1.4 J

1 Qualifiers: J - result is above the method reporting limit (MDL) but below the laboratory reporting limit (RL). B - Compound was found in the blank and sample. CI - Chromatographic interference giving rise to possible high bias. H - Sample was prepared or analyzed beyond the specified holding time. I - Value is an estimated maximum possible concentration. * Indicates value is an identified outlier.
D Duplicate Sample
R Replicate Sample

For both PFOS (**Table 5**) and PFOA (**Table 6**), results of the 2-way ANOVA indicated statistically significant differences in concentrations at different transects, but no significant differences in concentrations at different depths.

Table 5. Two-way ANOVA test examining the effects of water depth and transect location on Lake Huron PFOS concentrations.

	DF	Sum Sq.	Mean Sq.	F-value	P-value
Depth	2	0.038	0.019	0.862	0.424
Transect	5	0.428	0.086	3.897	**0.002**
Depth:Transect	10	0.088	0.009	0.399	0.946
Residuals	197	4.329	0.022		

DF – degrees of freedom; Sum Sq. – sum of squares; Mean Sq. – Mean square

Table 6. Two-way ANOVA test examining the effects of water depth and transect location on Lake Huron PFOA concentrations.

	DF	Sum Sq.	Mean Sq.	F-value	P-value
Depth	2	0.008	0.004	0.280	0.756
Transect	5	0.277	0.055	4.093	**0.001**
Depth:Transect	10	0.055	0.006	0.409	0.941
Residuals	198	2.676	0.014		

DF – degrees of freedom; Sum Sq. – sum of squares; Mean Sq. – Mean square

Post hoc Tukey tests were performed to determine which specific pairs of transects had PFOS and PFOA concentrations that were significantly different from one another. Results of the PFOS Tukey test indicated that concentrations at transect TN2 were statistically significantly lower than transects ON1, OS1, and OS2 (**Table 7**). Results of the PFOA Tukey test indicated that concentrations at transect ON2 were statistically significantly lower than transects ON1, OS1, TN1 and TN2 (**Table 8**).

Table 7. Pairwise comparison results in Lake Huron PFOS concentrations collected at transects downstream of the following a *post hoc* Tukey Test.

Transect 1	Transect 2	Difference[1]	P-value
Oscoda North 1	Oscoda North 2	n.s.	0.591
Oscoda North 1	Oscoda South 1	n.s.	1.0
Oscoda North 1	Oscoda South 2	n.s.	1.0
Oscoda North 1	Tawas North 1	n.s.	0.098
Oscoda North 1	Tawas North 2	>	**0.015**
Oscoda North 2	Oscoda South 1	n.s.	0.738
Oscoda North 2	Oscoda South 2	n.s.	0.741
Oscoda North 2	Tawas North 1	n.s.	0.922
Oscoda North 2	Tawas North 2	n.s.	0.564
Oscoda South 1	Oscoda South 2	n.s.	1.0
Oscoda South 1	Tawas North 1	n.s.	0.167
Oscoda South 1	Tawas North 2	>	**0.030**
Oscoda South 2	Tawas North 1	n.s.	0.168
Oscoda South 2	Tawas North 2	>	**0.031**
Tawas North 1	Tawas North 2	n.s.	0.985

[1] "n.s."- no significant difference; ">" - Transect 1 > Transect 2; "<" – Transect 1 < Transect 2

Table 8. Pairwise comparison results in Lake Huron PFOA concentrations collected at transects downstream of the following a *post hoc* Tukey Test.

Transect 1	Transect 2	Difference[1]	P-value
Oscoda North 1	Oscoda North 2	>	**0.002**
Oscoda North 1	Oscoda South 1	n.s.	0.996
Oscoda North 1	Oscoda South 2	n.s.	0.863
Oscoda North 1	Tawas North 1	n.s.	0.997
Oscoda North 1	Tawas North 2	n.s.	0.991
Oscoda North 2	Oscoda South 1	<	**0.010**
Oscoda North 2	Oscoda South 2	n.s.	0.064
Oscoda North 2	Tawas North 1	<	**0.008**
Oscoda North 2	Tawas North 2	<	**0.013**
Oscoda South 1	Oscoda South 2	n.s.	0.989
Oscoda South 1	Tawas North 1	n.s.	1.0
Oscoda South 1	Tawas North 2	n.s.	1.0
Oscoda South 2	Tawas North 1	n.s.	0.984
Oscoda South 2	Tawas North 2	n.s.	0.994
Tawas North 1	Tawas North 2	n.s.	1.0

[1] "n.s."- no significant difference; ">" - Transect 1 > Transect 2; "<" – Transect 1 < Transect 2

Finally, aggregate differences in Lake Huron PFOS concentrations between Oscoda and Tawas transects were examined using a Welch two sample t-test. Results of this test (t= 4.40, p<0.001) indicated PFOS concentrations were statistically significantly different, with concentrations from samples collected at Oscoda transects being significantly higher than those collected at the Tawas transects. The analysis was repeated for PFOA (t= -1.77, p=0.078), and the difference between aggregate PFOA concentrations from samples collected at Oscoda and Tawas was not statistically significant.

Although some statistical differences were observed between PFOS and PFOA concentrations across transects, the differences were not toxicologically relevant. The overall ranges of mean PFOS and PFOA concentrations across the six transects were similar. For PFOS, the inter-transect concentration range was 1.31 ng/L at TN1 to 1.59 ng/L at ON1. For PFOA, the inter-transect concentration range was 1.15 ng/L at ON2 to 1.39 ng/L at ON1. In addition, nearly all intra-transect mean PFOS and PFOA concentrations were <2 ng/L (refer to **Table 4**), and the majority of sample concentrations were estimated values that were lower than the RL but greater than the MDL.

No water samples exceeded the Rule 57 surface water quality values for the protection of human health and aquatic life for PFOS and PFOA[2] with the exception of the obvious outlier of 760 ng/L for PFOS collected on Lake Huron at ON2c (Surface) in April 2021.

[2] The Rule 57 Human Non-Cancer Value (HNV) for PFOS is 12 nanograms per liter (ng/L; parts per trillion) in surface waters not used as a source of drinking water, and 11 ng/L for those surface waters used as a drinking water source. The HNVs for PFOA are 420 ng/L and 12,000 ng/L for drinking and non-drinking water sources, respectively. The Rule 57 Aquatic Maximum Value (AMV) and Final Chronic Value (FCV) for PFOS is 880,000 and 7,700 ng/L, respectively. The Rule 57 AMV and FCV for PFOA is 780,000 and 140,000 ng/L, respectively.

Total PFAS Concentrations

Total PFAS concentrations were remarkably similar in Lake Huron and generally between 6 and 9 ng/L (**Table 9**). Water samples collected from the Au Sable River had slightly higher concentrations of total PFAS overall (means of 10.52 and 10.72 ng/L at Au Sable River AS001 and AS002, respectively) for roughly the same number of PFAS quantified compared to total PFAS detected along the Lake Huron transects. Only four water samples in Lake Huron contained total PFAS above 10 ng/L: OS1b - Surface, July 2019; OS2a - Mid-depth, September 2019; TN1a - Surface, April 2021; TN1a - Bottom, April 2021. As the majority of PFAS measured in samples were estimated, the small differences observed between magnitude and number of PFAS quantified among transects was likely due to precision in quantitative detection.

Beside the PFOS concentration of 760 ng/L measured at ON2c surface depth in April 2021, other identified outliers based on comparison to the entire dataset were PFBS measured at a concentration of 420 ng/L at ON2c surface depth in April 2021, FOSA measured at a concentration of 130 ng/L at ON2c mid depth in April 2021, and 6:2 FTS measured at a concentration of 93 ng/L and 8:2 FTS measured at a concentration of 24 ng/L at ON1c mid depth in September 2019. All of these reported values were over one to two orders of magnitude higher than all other detected values for the same analyte in the dataset and had known or suspected data quality concerns. For example, the ON2c surface depth sample in April 2021 had interference due to possible contamination (see footnote 1 above). The ON2c mid depth sample from April 2021 also required a 10x dilution which ultimately increased the detection and reporting limits in the sample, and the ON1c mid depth sample in September 2019 with the high reported values for 6:2 and 8:2 FTS was the only sample where the two analytes were detected in the entire dataset.

Table 10 provides a summary of the highest (maximum recorded) concentration of other PFAS detected in Lake Huron during each sampling event, along with the number of samples the analyte was detected during the event out of a maximum of 64 samples. Other PFAS with elevated concentrations relative to all other PFAS include PFBA, PFHxA, PFPeA, PFHpA, and FOSA. In addition to these PFAS homologs, others with high levels of occurrence based on detection include PFHxS and PFBS.

Table 11 provides a comparison of the highest (maximum recorded) concentration of PFAS detected at the mouth of the Au Sable River at US23 (AS001) and in Lake Huron adjacent to the river mouth (ON1a and OS1a - see Figure 2), by sampling event. Maximum values for ON1a and OS1a include all three sampling depths (bottom, mid depth, and surface).There is little difference in PFAS composition between the Au Sable River and in Lake Huron immediately above and below the river mouth. In general, the same PFAS detected at the river mouth were also detected in Lake Huron, with only minor differences. Concentration of any given PFAS was also generally the same or less in Lake Huron compared to the Au Sable River at the mouth.

Based on the results from this study, no significant plume of PFAS appears to be entering Lake Huron from the Au Sable River that might impact Tawas City drinking water.

Table 9. Total PFAS concentrations (the sum of 24 analytes above their method detection limit) detected in surface water samples collected from the Au Sable River and Lake Huron on July 30, September 24, and November 20, 2019, and April 7, 2021.

Sample ID	Sample Location Description	Latitude	Longitude	Sampling Event	Σ PFAS (ng/L)	# Analytes Detected
AS001	Au Sable River at US23	44.40731	-83.32459	July 2019	17.74	9
AS001	Au Sable River at US23	44.40731	-83.32459	September 2019	8.96	10
AS001	Au Sable River at US23	44.40731	-83.32459	November 2019	10.07	8
AS001[R]	Au Sable River at US23	44.40731	-83.32459	November 2019	10.20	8
AS001	Au Sable River at US23	44.40731	-83.32459	April 2021	5.26	5
AS002	Au Sable River at Mill St.	44.4154	-83.3308	July 2019	18.28	10
AS002[D]	Au Sable River at Mill St.	44.4154	-83.3308	July 2019	17.78	9
AS002	Au Sable River at Mill St.	44.4154	-83.3308	September 2019	9.37	10
AS002	Au Sable River at Mill St.	44.4154	-83.3308	November 2019	9.77	8
AS002[D]	Au Sable River at Mill St.	44.4154	-83.3308	November 2019	9.51	8
AS002	Au Sable River at Mill St.	44.4154	-83.3308	April 2021	5.84	6
ON1a-B	Lake Huron: Oscoda North 1, Site a; Bottom	44.40866	-83.31673	July 2019	5.76	7
ON1a-B	Lake Huron: Oscoda North 1, Site a; Bottom	44.40866	-83.31673	September 2019	7.24	7
ON1a-B[R]	Lake Huron: Oscoda North 1, Site a; Bottom	44.40866	-83.31673	September 2019	7.01	9
ON1a-B	Lake Huron: Oscoda North 1, Site a; Bottom	44.40866	-83.31673	November 2019	7.38	9
ON1a-B	Lake Huron: Oscoda North 1, Site a; Bottom	44.40866	-83.31673	April 2021	9.51	9
ON1a-M	Lake Huron: Oscoda North 1, Site a; Mid-depth	44.40866	-83.31673	July 2019	6.83	9
ON1a-M	Lake Huron: Oscoda North 1, Site a; Mid-depth	44.40866	-83.31673	September 2019	5.89	6
ON1a-M	Lake Huron: Oscoda North 1, Site a; Mid-depth	44.40866	-83.31673	November 2019	7.43	9
ON1a-M	Lake Huron: Oscoda North 1, Site a; Mid-depth	44.40866	-83.31673	April 2021	6.44	7
ON1a-S	Lake Huron: Oscoda North 1, Site a; Surface	44.40866	-83.31673	July 2019	6.76	9
ON1a-S	Lake Huron: Oscoda North 1, Site a; Surface	44.40866	-83.31673	September 2019	7.57	8
ON1a-S	Lake Huron: Oscoda North 1, Site a; Surface	44.40866	-83.31673	November 2019	7.42	9
ON1a-S	Lake Huron: Oscoda North 1, Site a; Surface	44.40866	-83.31673	April 2021	3.82	3
ON1b-B	Lake Huron: Oscoda North 1, Site b; Bottom	44.40946	-83.30894	July 2019	6.10	8

Sample ID	Sample Location Description	Latitude	Longitude	Sampling Event	Σ PFAS (ng/L)	# Analytes Detected
ON1b-B	Lake Huron: Oscoda North 1, Site b; Bottom	44.40946	-83.30894	September 2019	7.63	8
ON1b-B	Lake Huron: Oscoda North 1, Site b; Bottom	44.40946	-83.30894	November 2019	9.60	9
ON1b-B	Lake Huron: Oscoda North 1, Site b; Bottom	44.40946	-83.30894	April 2021	5.37	4
ON1b-M	Lake Huron: Oscoda North 1, Site b; Mid-depth	44.40946	-83.30894	July 2019	5.88	8
ON1b-M	Lake Huron: Oscoda North 1, Site b; Mid-depth	44.40946	-83.30894	September 2019	5.93	6
ON1b-M	Lake Huron: Oscoda North 1, Site b; Mid-depth	44.40946	-83.30894	November 2019	8.66	10
ON1b-M[D]	Lake Huron: Oscoda North 1, Site b; Mid-depth	44.40946	-83.30894	November 2019	8.33	8
ON1b-M	Lake Huron: Oscoda North 1, Site b; Mid-depth	44.40946	-83.30894	April 2021	6.23	6
ON1b-M[D]	Lake Huron: Oscoda North 1, Site b; Mid-depth	44.40946	-83.30894	April 2021	6.17	7
ON1b-S	Lake Huron: Oscoda North 1, Site b; Surface	44.40946	-83.30894	July 2019	6.51	8
ON1b-S	Lake Huron: Oscoda North 1, Site b; Surface	44.40946	-83.30894	September 2019	6.76	7
ON1b-S	Lake Huron: Oscoda North 1, Site b; Surface	44.40946	-83.30894	November 2019	9.18	8
ON1b-S	Lake Huron: Oscoda North 1, Site b; Surface	44.40946	-83.30894	April 2021	5.43	5
ON1c-B	Lake Huron: Oscoda North 1, Site c; Bottom	44.41034	-83.30124	July 2019	5.69	8
ON1c-B	Lake Huron: Oscoda North 1, Site c; Bottom	44.41034	-83.30124	September 2019	6.18	6
ON1c-B	Lake Huron: Oscoda North 1, Site c; Bottom	44.41034	-83.30124	November 2019	8.93	8
ON1c-B	Lake Huron: Oscoda North 1, Site c; Bottom	44.41034	-83.30124	April 2021	5.91	6
ON1c-M	Lake Huron: Oscoda North 1, Site c; Mid-depth	44.41034	-83.30124	July 2019	5.43	6
ON1c-M	Lake Huron: Oscoda North 1, Site c; Mid-depth	44.41034	-83.30124	September 2019	150.94	12
ON1c-M	Lake Huron: Oscoda North 1, Site c; Mid-depth	44.41034	-83.30124	November 2019	8.18	8
ON1c-M	Lake Huron: Oscoda North 1, Site c; Mid-depth	44.41034	-83.30124	April 2021	4.80	4
ON1c-S	Lake Huron: Oscoda North 1, Site c; Surface	44.41034	-83.30124	July 2019	6.97	9
ON1c-S[R]	Lake Huron: Oscoda North 1, Site c; Surface	44.41034	-83.30124	July 2019	6.71	9
ON1c-S	Lake Huron: Oscoda North 1, Site c; Surface	44.41034	-83.30124	September 2019	9.06	12
ON1c-S	Lake Huron: Oscoda North 1, Site c; Surface	44.41034	-83.30124	November 2019	8.25	8
ON1c-S	Lake Huron: Oscoda North 1, Site c; Surface	44.41034	-83.30124	April 2021	5.09	5
ON2a-B	Lake Huron: Oscoda North 2, Site a; Bottom	44.42114	-83.32191	July 2019	5.66	8

Sample ID	Sample Location Description	Latitude	Longitude	Sampling Event	Σ PFAS (ng/L)	# Analytes Detected
ON2a-B	Lake Huron: Oscoda North 2, Site a; Bottom	44.42114	-83.32191	September 2019	7.13	10
ON2a-B	Lake Huron: Oscoda North 2, Site a; Bottom	44.42114	-83.32191	November 2019	9.07	8
ON2a-B	Lake Huron: Oscoda North 2, Site a; Bottom	44.42114	-83.32191	April 2021	6.76	8
ON2a-M	Lake Huron: Oscoda North 2, Site a; Mid-depth	44.42114	-83.32191	July 2019	6.87	9
ON2a-M	Lake Huron: Oscoda North 2, Site a; Mid-depth	44.42114	-83.32191	September 2019	7.15	8
ON2a-M	Lake Huron: Oscoda North 2, Site a; Mid-depth	44.42114	-83.32191	November 2019	7.40	8
ON2a-M	Lake Huron: Oscoda North 2, Site a; Mid-depth	44.42114	-83.32191	April 2021	6.53	7
ON2a-S	Lake Huron: Oscoda North 2, Site a; Surface	44.42114	-83.32191	July 2019	8.75	8
ON2a-S	Lake Huron: Oscoda North 2, Site a; Surface	44.42114	-83.32191	September 2019	6.79	8
ON2a-S	Lake Huron: Oscoda North 2, Site a; Surface	44.42114	-83.32191	November 2019	7.16	9
ON2a-S	Lake Huron: Oscoda North 2, Site a; Surface	44.42114	-83.32191	April 2021	7.50	7
ON2b-B	Lake Huron: Oscoda North 2, Site b; Bottom	44.42113	-83.31461	July 2019	5.71	8
ON2b-B	Lake Huron: Oscoda North 2, Site b; Bottom	44.42113	-83.31461	September 2019	6.70	8
ON2b-B	Lake Huron: Oscoda North 2, Site b; Bottom	44.42113	-83.31461	November 2019	7.50	8
ON2b-B	Lake Huron: Oscoda North 2, Site b; Bottom	44.42113	-83.31461	April 2021	6.68	7
ON2b-B^{R}	Lake Huron: Oscoda North 2, Site b; Bottom	44.42113	-83.31461	April 2021	6.64	8
ON2b-M	Lake Huron: Oscoda North 2, Site b; Mid-depth	44.42113	-83.31461	July 2019	6.25	8
ON2b-M	Lake Huron: Oscoda North 2, Site b; Mid-depth	44.42113	-83.31461	September 2019	6.73	9
ON2b-M^{D}	Lake Huron: Oscoda North 2, Site b; Mid-depth	44.42113	-83.31461	September 2019	7.01	9
ON2b-M	Lake Huron: Oscoda North 2, Site b; Mid-depth	44.42113	-83.31461	November 2019	8.00	10
ON2b-M	Lake Huron: Oscoda North 2, Site b; Mid-depth	44.42113	-83.31461	April 2021	6.84	7
ON2b-S	Lake Huron: Oscoda North 2, Site b; Surface	44.42113	-83.31461	July 2019	6.28	8
ON2b-S	Lake Huron: Oscoda North 2, Site b; Surface	44.42113	-83.31461	September 2019	6.97	9
ON2b-S	Lake Huron: Oscoda North 2, Site b; Surface	44.42113	-83.31461	November 2019	7.04	9
ON2b-S	Lake Huron: Oscoda North 2, Site b; Surface	44.42113	-83.31461	April 2021	6.78	8
ON2c-B	Lake Huron: Oscoda North 2, Site c; Bottom	44.42115	-83.3065	July 2019	5.80	7
ON2c-B	Lake Huron: Oscoda North 2, Site c; Bottom	44.42115	-83.3065	September 2019	5.95	7

Sample ID	Sample Location Description	Latitude	Longitude	Sampling Event	Σ PFAS (ng/L)	# Analytes Detected
ON2c-B	Lake Huron: Oscoda North 2, Site c; Bottom	44.42115	-83.3065	November 2019	7.83	8
ON2c-B	Lake Huron: Oscoda North 2, Site c; Bottom	44.42115	-83.3065	April 2021	6.61	7
ON2c-M	Lake Huron: Oscoda North 2, Site c; Mid-depth	44.42115	-83.3065	July 2019	6.57	8
ON2c-M	Lake Huron: Oscoda North 2, Site c; Mid-depth	44.42115	-83.3065	September 2019	8.98	11
ON2c-M	Lake Huron: Oscoda North 2, Site c; Mid-depth	44.42115	-83.3065	November 2019	9.86	8
ON2c-M	Lake Huron: Oscoda North 2, Site c; Mid-depth	44.42115	-83.3065	April 2021	130.00	1
ON2c-S	Lake Huron: Oscoda North 2, Site c; Surface	44.42115	-83.3065	July 2019	5.41	7
ON2c-S	Lake Huron: Oscoda North 2, Site c; Surface	44.42115	-83.3065	September 2019	7.55	11
ON2c-S	Lake Huron: Oscoda North 2, Site c; Surface	44.42115	-83.3065	November 2019	7.37	9
ON2c-S	Lake Huron: Oscoda North 2, Site c; Surface	44.42115	-83.3065	April 2021	1180.00	2
OS1a-B	Lake Huron: Oscoda South 1, Site a; Bottom	44.40425	-83.31707	July 2019	8.28	9
OS1a-B	Lake Huron: Oscoda South 1, Site a; Bottom	44.40425	-83.31707	September 2019	6.27	7
OS1a-B	Lake Huron: Oscoda South 1, Site a; Bottom	44.40425	-83.31707	November 2019	8.18	8
OS1a-B	Lake Huron: Oscoda South 1, Site a; Bottom	44.40425	-83.31707	April 2021	5.45	5
OS1a-M	Lake Huron: Oscoda South 1, Site a; Mid-depth	44.40425	-83.31707	July 2019	5.31	7
OS1a-M	Lake Huron: Oscoda South 1, Site a; Mid-depth	44.40425	-83.31707	September 2019	6.29	7
OS1a-M	Lake Huron: Oscoda South 1, Site a; Mid-depth	44.40425	-83.31707	November 2019	7.21	8
OS1a-M	Lake Huron: Oscoda South 1, Site a; Mid-depth	44.40425	-83.31707	April 2021	5.50	4
OS1a-S	Lake Huron: Oscoda South 1, Site a; Surface	44.40425	-83.31707	July 2019	6.46	8
OS1a-S	Lake Huron: Oscoda South 1, Site a; Surface	44.40425	-83.31707	September 2019	6.76	8
OS1a-S	Lake Huron: Oscoda South 1, Site a; Surface	44.40425	-83.31707	November 2019	7.67	8
OS1a-S	Lake Huron: Oscoda South 1, Site a; Surface	44.40425	-83.31707	April 2021	5.16	4
OS1b-B	Lake Huron: Oscoda South 1, Site b; Bottom	44.403	-83.31016	July 2019	6.95	8
OS1b-B	Lake Huron: Oscoda South 1, Site b; Bottom	44.403	-83.31016	September 2019	7.15	8
OS1b-B	Lake Huron: Oscoda South 1, Site b; Bottom	44.403	-83.31016	November 2019	8.52	8
OS1b-B	Lake Huron: Oscoda South 1, Site b; Bottom	44.403	-83.31016	April 2021	5.80	4
OS1b-M	Lake Huron: Oscoda South 1, Site b; Mid-depth	44.403	-83.31016	July 2019	8.94	9
OS1b-M	Lake Huron: Oscoda South 1, Site b; Mid-depth	44.403	-83.31016	September 2019	7.54	8

Sample ID	Sample Location Description	Latitude	Longitude	Sampling Event	Σ PFAS (ng/L)	# Analytes Detected
OS1b-M	Lake Huron: Oscoda South 1, Site b; Mid-depth	44.403	-83.31016	November 2019	8.22	8
OS1b-M	Lake Huron: Oscoda South 1, Site b; Mid-depth	44.403	-83.31016	April 2021	6.60	5
OS1b-S	Lake Huron: Oscoda South 1, Site b; Surface	44.403	-83.31016	July 2019	12.80	9
OS1b-S	Lake Huron: Oscoda South 1, Site b; Surface	44.403	-83.31016	September 2019	7.14	7
OS1b-S	Lake Huron: Oscoda South 1, Site b; Surface	44.403	-83.31016	November 2019	7.93	8
OS1b-S	Lake Huron: Oscoda South 1, Site b; Surface	44.403	-83.31016	April 2021	5.84	5
OS1c-B	Lake Huron: Oscoda South 1, Site c; Bottom	44.40162	-83.3023	July 2019	6.54	8
OS1c-B	Lake Huron: Oscoda South 1, Site c; Bottom	44.40162	-83.3023	September 2019	5.52	6
OS1c-B	Lake Huron: Oscoda South 1, Site c; Bottom	44.40162	-83.3023	November 2019	7.34	8
OS1c-B	Lake Huron: Oscoda South 1, Site c; Bottom	44.40162	-83.3023	April 2021	5.80	6
OS1c-M	Lake Huron: Oscoda South 1, Site c; Mid-depth	44.40162	-83.3023	July 2019	7.30	8
OS1c-M	Lake Huron: Oscoda South 1, Site c; Mid-depth	44.40162	-83.3023	September 2019	5.70	6
OS1c-M	Lake Huron: Oscoda South 1, Site c; Mid-depth	44.40162	-83.3023	November 2019	7.13	8
OS1c-M	Lake Huron: Oscoda South 1, Site c; Mid-depth	44.40162	-83.3023	April 2021	5.66	6
OS1c-M[D]	Lake Huron: Oscoda South 1, Site c; Mid-depth	44.40162	-83.3023	April 2021	6.15	7
OS1c-S	Lake Huron: Oscoda South 1, Site c; Surface	44.40162	-83.3023	July 2019	7.13	9
OS1c-S	Lake Huron: Oscoda South 1, Site c; Surface	44.40162	-83.3023	September 2019	6.19	6
OS1c-S	Lake Huron: Oscoda South 1, Site c; Surface	44.40162	-83.3023	November 2019	7.39	9
OS1c-S	Lake Huron: Oscoda South 1, Site c; Surface	44.40162	-83.3023	April 2021	6.16	6
OS2a-B	Lake Huron: Oscoda South 2, Site a; Bottom	44.39185	-83.32234	July 2019	7.31	9
OS2a-B[D]	Lake Huron: Oscoda South 2, Site a; Bottom	44.39185	-83.32234	September 2019	7.58	11
OS2a-B	Lake Huron: Oscoda South 2, Site a; Bottom	44.39185	-83.32234	September 2019	8.10	10
OS2a-B	Lake Huron: Oscoda South 2, Site a; Bottom	44.39185	-83.32234	November 2019	7.61	8
OS2a-B	Lake Huron: Oscoda South 2, Site a; Bottom	44.39185	-83.32234	April 2021	5.40	4
OS2a-M	Lake Huron: Oscoda South 2, Site a; Mid-depth	44.39185	-83.32234	July 2019	7.23	9
OS2a-M[D]	Lake Huron: Oscoda South 2, Site a; Mid-depth	44.39185	-83.32234	July 2019	6.61	9
OS2a-M	Lake Huron: Oscoda South 2, Site a; Mid-depth	44.39185	-83.32234	September 2019	10.28	10

Sample ID	Sample Location Description	Latitude	Longitude	Sampling Event	Σ PFAS (ng/L)	# Analytes Detected
OS2a-M	Lake Huron: Oscoda South 2, Site a; Mid-depth	44.39185	-83.32234	November 2019	7.76	8
OS2a-M^{R}	Lake Huron: Oscoda South 2, Site a; Mid-depth	44.39185	-83.32234	November 2019	6.96	8
OS2a-M	Lake Huron: Oscoda South 2, Site a; Mid-depth	44.39185	-83.32234	April 2021	5.49	4
OS2a-S	Lake Huron: Oscoda South 2, Site a; Surface	44.39185	-83.32234	July 2019	9.57	9
OS2a-S	Lake Huron: Oscoda South 2, Site a; Surface	44.39185	-83.32234	September 2019	7.25	9
OS2a-S	Lake Huron: Oscoda South 2, Site a; Surface	44.39185	-83.32234	November 2019	7.67	8
OS2a-S	Lake Huron: Oscoda South 2, Site a; Surface	44.39185	-83.32234	April 2021	4.68	4
OS2a-S^{R}	Lake Huron: Oscoda South 2, Site a; Surface	44.39185	-83.32234	April 2021	6.66	8
OS2b-B	Lake Huron: Oscoda South 2, Site b; Bottom	44.39001	-83.31543	July 2019	6.52	9
OS2b-B	Lake Huron: Oscoda South 2, Site b; Bottom	44.39001	-83.31543	September 2019	7.35	9
OS2b-B	Lake Huron: Oscoda South 2, Site b; Bottom	44.39001	-83.31543	November 2019	7.33	8
OS2b-B	Lake Huron: Oscoda South 2, Site b; Bottom	44.39001	-83.31543	April 2021	7.00	7
OS2b-M	Lake Huron: Oscoda South 2, Site b; Mid-depth	44.39001	-83.31543	July 2019	6.72	10
OS2b-M	Lake Huron: Oscoda South 2, Site b; Mid-depth	44.39001	-83.31543	September 2019	8.07	10
OS2b-M	Lake Huron: Oscoda South 2, Site b; Mid-depth	44.39001	-83.31543	November 2019	7.13	8
OS2b-M	Lake Huron: Oscoda South 2, Site b; Mid-depth	44.39001	-83.31543	April 2021	4.91	5
OS2b-S	Lake Huron: Oscoda South 2, Site b; Surface	44.39001	-83.31543	July 2019	9.54	9
OS2b-S	Lake Huron: Oscoda South 2, Site b; Surface	44.39001	-83.31543	September 2019	7.58	9
OS2b-S	Lake Huron: Oscoda South 2, Site b; Surface	44.39001	-83.31543	November 2019	7.03	8
OS2b-S	Lake Huron: Oscoda South 2, Site b; Surface	44.39001	-83.31543	April 2021	4.96	4
OS2c-B	Lake Huron: Oscoda South 2, Site c; Bottom	44.38799	-83.30795	July 2019	6.17	8
OS2c-B	Lake Huron: Oscoda South 2, Site c; Bottom	44.38799	-83.30795	September 2019	6.15	6
OS2c-B	Lake Huron: Oscoda South 2, Site c; Bottom	44.38799	-83.30795	November 2019	7.29	9
OS2c-B	Lake Huron: Oscoda South 2, Site c; Bottom	44.38799	-83.30795	April 2021	5.90	6
OS2c-M^{R}	Lake Huron: Oscoda South 2, Site c; Mid-depth	44.38799	-83.30795	July 2019	6.49	9
OS2c-M	Lake Huron: Oscoda South 2, Site c; Mid-depth	44.38799	-83.30795	July 2019	6.62	9
OS2c-M	Lake Huron: Oscoda South 2, Site c; Mid-depth	44.38799	-83.30795	September 2019	8.23	8

Sample ID	Sample Location Description	Latitude	Longitude	Sampling Event	Σ PFAS (ng/L)	# Analytes Detected
OS2c-M	Lake Huron: Oscoda South 2, Site c; Mid-depth	44.38799	-83.30795	November 2019	6.80	8
OS2c-M	Lake Huron: Oscoda South 2, Site c; Mid-depth	44.38799	-83.30795	April 2021	5.84	5
OS2c-S	Lake Huron: Oscoda South 2, Site c; Surface	44.38799	-83.30795	July 2019	8.08	8
OS2c-S	Lake Huron: Oscoda South 2, Site c; Surface	44.38799	-83.30795	September 2019	8.10	8
OS2c-S	Lake Huron: Oscoda South 2, Site c; Surface	44.38799	-83.30795	November 2019	6.66	8
OS2c-S	Lake Huron: Oscoda South 2, Site c; Surface	44.38799	-83.30795	April 2021	5.38	5
TN1a-B	Lake Huron: Tawas North 1, Site a; Bottom	44.25608	-83.43578	July 2019	5.90	8
TN1a-B	Lake Huron: Tawas North 1, Site a; Bottom	44.25608	-83.43578	September 2019	7.74	9
TN1a-B	Lake Huron: Tawas North 1, Site a; Bottom	44.25608	-83.43578	November 2019	7.17	9
TN1a-B	Lake Huron: Tawas North 1, Site a; Bottom	44.25608	-83.43578	April 2021	14.72	9
TN1a-M	Lake Huron: Tawas North 1, Site a; Mid-depth	44.25608	-83.43578	July 2019	6.41	9
TN1a-M	Lake Huron: Tawas North 1, Site a; Mid-depth	44.25608	-83.43578	September 2019	7.20	8
TN1a-M	Lake Huron: Tawas North 1, Site a; Mid-depth	44.25608	-83.43578	November 2019	7.48	9
TN1a-M	Lake Huron: Tawas North 1, Site a; Mid-depth	44.25608	-83.43578	April 2021	6.50	7
TN1a-S	Lake Huron: Tawas North 1, Site a; Surface	44.25608	-83.43578	July 2019	6.78	9
TN1a-S	Lake Huron: Tawas North 1, Site a; Surface	44.25608	-83.43578	September 2019	7.70	9
TN1a-S	Lake Huron: Tawas North 1, Site a; Surface	44.25608	-83.43578	November 2019	7.29	8
TN1a-S	Lake Huron: Tawas North 1, Site a; Surface	44.25608	-83.43578	April 2021	10.28	9
TN1b-B	Lake Huron: Tawas North 1, Site b; Bottom	44.25262	-83.43004	July 2019	5.24	8
TN1b-B	Lake Huron: Tawas North 1, Site b; Bottom	44.25262	-83.43004	September 2019	6.78	7
TN1b-B	Lake Huron: Tawas North 1, Site b; Bottom	44.25262	-83.43004	November 2019	5.83	8
TN1b-B[D]	Lake Huron: Tawas North 1, Site b; Bottom	44.25262	-83.43004	April 2021	6.22	7
TN1b-B	Lake Huron: Tawas North 1, Site b; Bottom	44.25262	-83.43004	April 2021	6.89	8
TN1b-M	Lake Huron: Tawas North 1, Site b; Mid-depth	44.25262	-83.43004	July 2019	5.65	8
TN1b-M	Lake Huron: Tawas North 1, Site b; Mid-depth	44.25262	-83.43004	September 2019	8.03	10
TN1b-M[R]	Lake Huron: Tawas North 1, Site b; Mid-depth	44.25262	-83.43004	September 2019	7.52	10
TN1b-M	Lake Huron: Tawas North 1, Site b; Mid-depth	44.25262	-83.43004	November 2019	7.25	9

Sample ID	Sample Location Description	Latitude	Longitude	Sampling Event	Σ PFAS (ng/L)	# Analytes Detected
TN1b-M	Lake Huron: Tawas North 1, Site b; Mid-depth	44.25262	-83.43004	April 2021	6.49	7
TN1b-S	Lake Huron: Tawas North 1, Site b; Surface	44.25262	-83.43004	July 2019	6.64	8
TN1b-S	Lake Huron: Tawas North 1, Site b; Surface	44.25262	-83.43004	September 2019	8.22	9
TN1b-S	Lake Huron: Tawas North 1, Site b; Surface	44.25262	-83.43004	November 2019	7.11	8
TN1b-S	Lake Huron: Tawas North 1, Site b; Surface	44.25262	-83.43004	April 2021	7.10	9
TN1c-B	Lake Huron: Tawas North 1, Site c; Bottom	44.24902	-83.42414	July 2019	6.43	8
TN1c-B^{D}	Lake Huron: Tawas North 1, Site c; Bottom	44.24902	-83.42414	July 2019	6.51	9
TN1c-B	Lake Huron: Tawas North 1, Site c; Bottom	44.24902	-83.42414	September 2019	7.64	9
TN1c-B	Lake Huron: Tawas North 1, Site c; Bottom	44.24902	-83.42414	November 2019	7.06	9
TN1c-B	Lake Huron: Tawas North 1, Site c; Bottom	44.24902	-83.42414	April 2021	7.51	9
TN1c-M	Lake Huron: Tawas North 1, Site c; Mid-depth	44.24902	-83.42414	July 2019	6.76	9
TN1c-M	Lake Huron: Tawas North 1, Site c; Mid-depth	44.24902	-83.42414	September 2019	7.94	9
TN1c-M	Lake Huron: Tawas North 1, Site c; Mid-depth	44.24902	-83.42414	November 2019	7.98	10
TN1c-M	Lake Huron: Tawas North 1, Site c; Mid-depth	44.24902	-83.42414	April 2021	6.90	8
TN1c-M^{R}	Lake Huron: Tawas North 1, Site c; Mid-depth	44.24902	-83.42414	April 2021	6.24	8
TN1c-S	Lake Huron: Tawas North 1, Site c; Surface	44.24902	-83.42414	July 2019	7.27	9
TN1c-S	Lake Huron: Tawas North 1, Site c; Surface	44.24902	-83.42414	September 2019	8.41	9
TN1c-S^{D}	Lake Huron: Tawas North 1, Site c; Surface	44.24902	-83.42414	September 2019	7.88	10
TN1c-S	Lake Huron: Tawas North 1, Site c; Surface	44.24902	-83.42414	November 2019	7.87	8
TN1c-S^{R}	Lake Huron: Tawas North 1, Site c; Surface	44.24902	-83.42414	November 2019	7.07	9
TN1c-S	Lake Huron: Tawas North 1, Site c; Surface	44.24902	-83.42414	April 2021	7.09	9
TN2a-B	Lake Huron: Tawas North 2, Site a; Bottom	44.28076	-83.41761	July 2019	5.43	8
TN2a-B	Lake Huron: Tawas North 2, Site a; Bottom	44.28076	-83.41761	September 2019	7.20	10
TN2a-B^{R}	Lake Huron: Tawas North 2, Site a; Bottom	44.28076	-83.41761	September 2019	7.02	9
TN2a-B	Lake Huron: Tawas North 2, Site a; Bottom	44.28076	-83.41761	November 2019	6.81	8
TN2a-B	Lake Huron: Tawas North 2, Site a; Bottom	44.28076	-83.41761	April 2021	5.45	6
TN2a-M	Lake Huron: Tawas North 2, Site a; Mid-depth	44.28076	-83.41761	July 2019	7.16	9

Sample ID	Sample Location Description	Latitude	Longitude	Sampling Event	Σ PFAS (ng/L)	# Analytes Detected
TN2a-M	Lake Huron: Tawas North 2, Site a; Mid-depth	44.28076	-83.41761	September 2019	7.97	11
TN2a-M	Lake Huron: Tawas North 2, Site a; Mid-depth	44.28076	-83.41761	November 2019	7.10	9
TN2a-M	Lake Huron: Tawas North 2, Site a; Mid-depth	44.28076	-83.41761	April 2021	6.95	6
TN2a-S	Lake Huron: Tawas North 2, Site a; Surface	44.28076	-83.41761	July 2019	6.33	9
TN2a-S	Lake Huron: Tawas North 2, Site a; Surface	44.28076	-83.41761	September 2019	7.73	9
TN2a-S	Lake Huron: Tawas North 2, Site a; Surface	44.28076	-83.41761	November 2019	7.27	9
TN2a-S	Lake Huron: Tawas North 2, Site a; Surface	44.28076	-83.41761	April 2021	4.06	4
TN2b-B	Lake Huron: Tawas North 2, Site b; Bottom	44.27896	-83.41095	July 2019	6.25	9
TN2b-B^{R}	Lake Huron: Tawas North 2, Site b; Bottom	44.27896	-83.41095	July 2019	6.18	8
TN2b-B	Lake Huron: Tawas North 2, Site b; Bottom	44.27896	-83.41095	September 2019	7.24	10
TN2b-B	Lake Huron: Tawas North 2, Site b; Bottom	44.27896	-83.41095	November 2019	6.86	8
TN2b-B^{D}	Lake Huron: Tawas North 2, Site b; Bottom	44.27896	-83.41095	November 2019	6.94	9
TN2b-B	Lake Huron: Tawas North 2, Site b; Bottom	44.27896	-83.41095	April 2021	4.37	4
TN2b-M	Lake Huron: Tawas North 2, Site b; Mid-depth	44.27896	-83.41095	July 2019	7.04	10
TN2b-M	Lake Huron: Tawas North 2, Site b; Mid-depth	44.27896	-83.41095	September 2019	7.14	10
TN2b-M	Lake Huron: Tawas North 2, Site b; Mid-depth	44.27896	-83.41095	November 2019	7.08	8
TN2b-M	Lake Huron: Tawas North 2, Site b; Mid-depth	44.27896	-83.41095	April 2021	4.66	4
TN2b-S	Lake Huron: Tawas North 2, Site b; Surface	44.27896	-83.41095	July 2019	6.93	9
TN2b-S	Lake Huron: Tawas North 2, Site b; Surface	44.27896	-83.41095	September 2019	8.15	11
TN2b-S	Lake Huron: Tawas North 2, Site b; Surface	44.27896	-83.41095	November 2019	7.43	9
TN2b-S	Lake Huron: Tawas North 2, Site b; Surface	44.27896	-83.41095	April 2021	6.56	8
TN2c-B	Lake Huron: Tawas North 2, Site c; Bottom	44.27698	-83.40355	July 2019	6.53	9
TN2c-B	Lake Huron: Tawas North 2, Site c; Bottom	44.27698	-83.40355	September 2019	7.84	9
TN2c-B	Lake Huron: Tawas North 2, Site c; Bottom	44.27698	-83.40355	November 2019	7.64	9
TN2c-B	Lake Huron: Tawas North 2, Site c; Bottom	44.27698	-83.40355	April 2021	7.18	9
TN2c-M	Lake Huron: Tawas North 2, Site c; Mid-depth	44.27698	-83.40355	July 2019	7.14	10
TN2c-M	Lake Huron: Tawas North 2, Site c; Mid-depth	44.27698	-83.40355	September 2019	7.53	9

Sample ID	Sample Location Description	Latitude	Longitude	Sampling Event	Σ PFAS (ng/L)	# Analytes Detected
TN2c-M	Lake Huron: Tawas North 2, Site c; Mid-depth	44.27698	-83.40355	November 2019	6.58	8
TN2c-M	Lake Huron: Tawas North 2, Site c; Mid-depth	44.27698	-83.40355	April 2021	6.91	8
TN2c-S	Lake Huron: Tawas North 2, Site c; Surface	44.27698	-83.40355	July 2019	7.20	10
TN2c-S	Lake Huron: Tawas North 2, Site c; Surface	44.27698	-83.40355	September 2019	7.56	9
TN2c-S	Lake Huron: Tawas North 2, Site c; Surface	44.27698	-83.40355	November 2019	7.22	9
TN2c-S	Lake Huron: Tawas North 2, Site c; Surface	44.27698	-83.40355	April 2021	6.74	8

[D] Duplicate Sample
[R] Replicate Sample

Table 10. Summary of highest (maximum recorded) concentration of PFAS detected in Lake Huron on July 30, September 24, and November 20, 2019, and April 7, 2021. Bold, italicized values indicate values for other PFAS exceeding the maximum recorded value of both PFOS and PFOA for the same sampling event. Maximum number of detects for any given sampling event is 64.

	July 30, 2019		September 24, 2019		November 20, 2019		April 7, 2021	
Analyte	**Max (ng/L)**	**Number detected**	**Max (ng/L)[a]**	**Number detected**	**Max (ng/L)**	**Number detected**	**Max (ng/L)[b]**	**Number detected**
Perfluorooctane sulfonate (PFOS)	3.60	59	2.70	60	2.40	58	2.30	57
Perfluorooctanoic acid (PFOA)	2.00	59	3.90	60	1.40	58	1.90	58
Perfluorobutanoic acid (PFBA)	1.80	59	3.50	60	***3.60***	60	***2.40***	1
Perfluorohexanesulfonic acid (PFHxS)	1.70	62	1.00	61	1.80	61	1.40	58
Perfluorohexanoic acid (PFHxA)	1.10	53	***7.50***	50	1.00	58	1.30	54
Perfluoropentanoic acid (PFPeA)	1.00	58	***10.00***	60	0.87	57	0.87	30
Perfluoroheptanoic acid (PFHpA)	0.89	59	***3.90***	59	0.74	58	0.74	43
Perfluorooctanesulfonamide (FOSA)	0.71	2	0.78	44	0.47	6	***7.10***	6
Perfluorononanoic acid (PFNA)	0.49	33	0.85	33	0.36	21	0.31	12
Perfluorotetradecanoic acid (PFTeA)	0.48	5	0.38	8	0.00	0	0.00	0
Perfluorobutanesulfonic acid (PFBS)	0.36	55	0.43	22	0.37	58	0.45	38
6:2 FTS	0.00	0	2.10	1	0.00	0	0.00	0
Perfluorododecanoic acid (PFDoA)	0.00	0	1.70	2	0.00	0	0.00	0
4:2 FTS	0.00	0	0.00	0	0.00	0	0.00	0
8:2 FTS	0.00	0	0.00	0	0.00	0	0.00	0
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.00	0	0.00	0	0.00	0	0.00	0
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.00	0	0.00	0	0.00	0	0.00	0
Perfluorodecanesulfonic acid (PFDS)	0.00	0	0.00	0	0.00	0	0.00	0
Perfluorodecanoic acid (PFDA)	0.00	0	0.00	0	0.00	0	0.36	9
Perfluoroheptanesulfonic Acid (PFHpS)	0.00	0	0.00	0	0.00	0	0.00	0
Perfluorononanesulfonic acid (PFNS)	0.00	0	0.00	0	0.00	0	0.00	0
Perfluoropentanesulfonic acid (PFPeS)	0.00	0	0.00	0	0.00	0	0.00	0

	July 30, 2019		September 24, 2019		November 20, 2019		April 7, 2021	
Analyte	**Max (ng/L)**	**Number detected**	**Max (ng/L)[a]**	**Number detected**	**Max (ng/L)**	**Number detected**	**Max (ng/L)[b]**	**Number detected**
Perfluorotridecanoic acid (PFTriA)	0.00	0	0.00	0	0.00	0	0.00	0
Perfluoroundecanoic acid (PFUnA)	0.00	0	0.00	0	0.00	0	0.00	0

[a] Removed outliers: 6:2 FTS (93 ng/L); 8:2 FTS (24 ng/L)

[b] Removed outliers: PFOS (760 ng/L); PFBS (420 ng/L); FOSA (130 ng/L)

Table 11. Comparison of highest (maximum recorded) concentration of PFAS detected in the Au Sable River at US 23 (AS001) and in Lake Huron adjacent to the river mouth (ON1a and OS1a), by sampling event on July 30, September 24, and November 20, 2019, and April 7, 2021. Bold values indicate detected concentrations. Maximum values for ON1a and OS1a include all three sampling depths (bottom, mid depth, and surface).

	Maximum Concentration (ng/L)											
	July 30, 2019			September 24, 2019			November 20, 2019			April 7, 2021		
Analyte	**AS001**	**ON1a**	**OS1a**	**AS001**	**ON1a**	**OS1a**	**AS001**	**ON1a**	**OS1a**	**AS001**	**ON1a**	**OS1a**
4:2 FTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:2 FTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8:2 FTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Perfluorobutanesulfonic acid (PFBS)	**0.48**	**0.24**	**0.29**	**0.21**	0.00	0.00	**0.35**	**0.30**	**0.32**	**0.30**	**0.31**	0.00
Perfluorobutanoic acid (PFBA)	**2.30**	**0.99**	**0.91**	**1.20**	**1.10**	**1.10**	**1.70**	**1.40**	**1.40**	0.00	**2.40**	0.00
Perfluorodecanesulfonic acid (PFDS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Perfluorodecanoic acid (PFDA)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.30**	0.00
Perfluorododecanoic acid (PFDoA)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Perfluoroheptanesulfonic Acid (PFHpS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Perfluoroheptanoic acid (PFHpA)	**0.90**	**0.59**	**0.64**	**0.48**	**0.68**	**0.53**	**0.47**	**0.52**	**0.59**	**0.38**	**0.57**	**0.31**
Perfluorohexanesulfonic acid (PFHxS)	**3.10**	**0.80**	**0.73**	**1.70**	**0.84**	**0.85**	**2.40**	**1.00**	**1.50**	**1.40**	**0.94**	**1.40**
Perfluorohexanoic acid (PFHxA)	**1.20**	**0.91**	**0.90**	**0.68**	**1.50**	**1.10**	**0.85**	**0.86**	**0.98**	**0.98**	**1.30**	**1.00**
Perfluorononanesulfonic acid (PFNS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Perfluorononanoic acid (PFNA)	**0.46**	**0.32**	0.00	0.00	0.00	**0.26**	0.00	**0.31**	0.00	0.00	0.00	0.00
Perfluorooctane sulfonate (PFOS)	**6.70**	**1.30**	**1.50**	**2.20**	**1.50**	**1.40**	**2.60**	**1.40**	**1.80**	**2.20**	**1.80**	**2.20**
Perfluorooctanesulfonamide (FOSA)	0.00	0.00	0.00	**0.55**	**0.50**	**0.38**	0.00	0.00	0.00	0.00	0.00	0.00
Perfluorooctanoic acid (PFOA)	**1.40**	**1.40**	**1.50**	**0.88**	**1.70**	**2.00**	**1.00**	**1.20**	**1.40**	0.00	**1.30**	**1.20**
Perfluoropentanesulfonic acid (PFPeS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Perfluoropentanoic acid (PFPeA)	**1.20**	**0.79**	**0.84**	**0.69**	**0.60**	**0.59**	**0.70**	**0.71**	**0.70**	0.00	**0.64**	0.00
Perfluorotetradecanoic acid (PFTeA)	0.00	0.00	0.00	**0.37**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Perfluorotridecanoic acid (PFTriA)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Perfluoroundecanoic acid (PFUnA)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Σ PFAS (ng/L)	**17.74**	**7.34**	**7.31**	**8.96**	**8.42**	**8.21**	**10.07**	**7.70**	**8.69**	**5.26**	**9.56**	**6.11**
# PFAS	**9**	**9**	**8**	**9**	**8**	**9**	**8**	**9**	**9**	**5**	**9**	**5**

REFERENCES

MDEQ. (2018a). General PFAS Sampling Guidance.
https://www.michigan.gov/documents/pfasresponse/General_PFAS_Sampling_Guidance

MDEQ. (2018b). Surface Water PFAS Sampling Guidance.
https://www.michigan.gov/documents/pfasresponse/Surface_Water_PFAS_Sampling_Guidance

MDEQ. (2018c). Michigan Surface Water Perfluoroalkyl and Polyfluoroalkyl Compound (PFAS) Investigation: Quality Assurance Project Plan (QAPP).

Appendix A. Ancillary data collected in situ from the Au Sable River and Lake Huron on July 30, September 24, and November 20, 2019, and April 7, 2021.

Location	Depth ID	Date	Time	Depth to bottom (m)	Depth at sample (m)	Water Temp (°C)	pH	Conductivity (µS/cm)	Turbidity (NTU)
AS001	Bottom	7/30/2019	7:42	5.0	4.0	23.8	7.92	306	0.9
AS001	Bottom	9/24/2019	15:26	4.4	3.4	20.3	7.87	308	0.5
AS001	Bottom	11/20/2019	15:40	5.0	4.0	3.1	7.60	325	0.4
AS001	Bottom	4/7/2021	14:58	3.3	2.3	8.1	8.22	308	1.4
AS001	Middle	7/30/2019	7:42	5.0	2.5	23.8	7.92	306	0.9
AS001	Middle	9/24/2019	15:26	4.4	2.2	20.3	7.87	308	0.5
AS001	Middle	11/20/2019	15:40	5.0	2.5	3.1	7.60	324	0.4
AS001	Middle	4/7/2021	14:58	3.3	1.6	8.1	8.23	308	1.4
AS001	Surface	7/30/2019	7:42	5.0	1.0	23.8	7.93	306	0.9
AS001	Surface	9/24/2019	15:26	4.4	1.0	20.3	7.84	308	0.5
AS001	Surface	11/20/2019	15:40	5.0	1.0	3.0	7.62	324	0.5
AS001	Surface	4/7/2021	14:58	3.3	1.0	8.1	8.22	308	1.4
AS002	Bottom	7/30/2019	6:56	4.2	3.2	23.8	7.79	306	1.0
AS002	Bottom	9/24/2019	15:38	3.8	2.8	20.4	8.00	308	0.5
AS002	Bottom	11/20/2019	16:00	4.0	3.0	3.0	7.67	323	0.4
AS002	Bottom	4/7/2021	15:15	4.4	3.3	8.4	8.23	308	1.6
AS002	Middle	7/30/2019	6:56	4.2	2.1	23.8	7.86	306	1.3
AS002	Middle	9/24/2019	15:38	3.8	1.9	20.4	7.98	308	0.5
AS002	Middle	11/20/2019	16:00	4.0	2.0	3.0	7.68	323	0.4
AS002	Middle	4/7/2021	15:15	4.4	2.2	8.4	8.23	308	1.5
AS002	Surface	7/30/2019	6:56	4.2	1.0	23.8	7.55	307	0.9
AS002	Surface	9/24/2019	15:38	3.8	1.0	20.4	7.97	308	0.5
AS002	Surface	11/20/2019	16:00	4.0	1.0	3.0	7.70	323	0.4
AS002	Surface	4/7/2021	15:15	4.4	1.0	8.4	8.23	308	1.6
ON1a	Bottom	7/30/2019	10:02	6.6	5.6	14.8	8.38	202	0.7
ON1a	Bottom	9/24/2019	13:59	7.2	6.2	9.2	7.60	207	0.1
ON1a	Bottom	11/20/2019	10:50	6.5	5.5	2.2	7.86	246	0.9
ON1a	Bottom	4/7/2021	14:39	6.1	5.1	6.7	8.18	242	0.9

Location	Depth ID	Date	Time	Depth to bottom (m)	Depth at sample (m)	Water Temp (°C)	pH	Conductivity (µS/cm)	Turbidity (NTU)
ON1a	Middle	7/30/2019	10:02	6.6	3.3	16.3	8.36	199	0.5
ON1a	Middle	9/24/2019	13:57	7.2	3.6	9.2	7.60	207	0.1
ON1a	Middle	11/20/2019	10:50	6.5	3.3	2.2	7.86	246	0.8
ON1a	Middle	4/7/2021	14:39	6.1	3.0	7.0	8.18	244	1.0
ON1a	Surface	7/30/2019	10:02	6.6	1.0	16.8	8.34	202	0.6
ON1a	Surface	9/24/2019	13:55	7.2	1.0	10.3	7.64	213	0.0
ON1a	Surface	11/20/2019	10:50	6.5	1.0	2.3	7.91	244	0.4
ON1a	Surface	4/7/2021	14:39	6.1	1.0	7.0	8.19	244	1.0
ON1b	Bottom	7/30/2019	9:40	7.8	6.8	13.1	8.31	204	0.6
ON1b	Bottom	9/24/2019	13:40	7.5	6.5	8.9	7.77	207	0.3
ON1b	Bottom	11/20/2019	10:30	8.0	7.0	2.6	7.80	292	0.6
ON1b	Bottom	4/7/2021	14:27	7.2	6.6	6.5	8.20	251	0.8
ON1b	Middle	7/30/2019	9:40	7.8	3.9	13.8	8.33	203	0.6
ON1b	Middle	9/24/2019	13:38	7.5	3.8	9.2	7.96	206	0.0
ON1b	Middle	11/20/2019	10:30	8.0	4.0	2.5	7.84	284	0.6
ON1b	Middle	4/7/2021	14:27	7.2	3.6	6.7	8.20	256	0.8
ON1b	Surface	7/30/2019	9:40	7.8	1.0	17.3	8.30	204	0.5
ON1b	Surface	9/24/2019	13:36	7.5	1.0	10.6	7.92	212	0.0
ON1b	Surface	11/20/2019	10:30	8.0	1.0	2.3	7.94	258	0.5
ON1b	Surface	4/7/2021	14:27	7.2	1.0	6.8	8.21	257	0.8
ON1c	Bottom	7/30/2019	9:20	8.6	7.6	12.2	8.30	205	0.3
ON1c	Bottom	9/24/2019	13:27	8.6	7.6	8.7	7.58	207	0.1
ON1c	Bottom	11/20/2019	10:20	8.5	7.5	2.5	7.81	282	0.5
ON1c	Bottom	4/7/2021	14:17	8.1	7.0	6.0	8.19	246	0.9
ON1c	Middle	7/30/2019	9:20	8.6	4.3	12.8	8.34	204	0.6
ON1c	Middle	9/24/2019	13:25	8.6	4.3	9.1	7.61	206	0.0
ON1c	Middle	11/20/2019	10:20	8.5	4.3	2.4	7.84	274	0.4
ON1c	Middle	4/7/2021	14:17	8.1	4.1	6.0	8.18	246	0.9
ON1c	Surface	7/30/2019	9:20	8.6	1.0	17.8	8.33	204	0.6
ON1c	Surface	9/24/2019	13:23	8.6	1.0	11.4	7.59	216	0.0

Location	Depth ID	Date	Time	Depth to bottom (m)	Depth at sample (m)	Water Temp (°C)	pH	Conductivity (µS/cm)	Turbidity (NTU)
ON1c	Surface	11/20/2019	10:20	8.5	1.0	2.3	7.94	258	0.4
ON1c	Surface	4/7/2021	14:17	8.1	1.0	6.1	8.19	245	0.9
ON2a	Bottom	7/30/2019	8:13	5.8	4.8	14.7	8.12	202	0.6
ON2a	Bottom	9/24/2019	14:12	5.5	4.5	10.3	7.84	207	0.0
ON2a	Bottom	11/20/2019	8:23	5.5	4.5	2.3	7.89	270	0.6
ON2a	Bottom	4/7/2021	14:03	5.1	4.0	6.8	8.20	253	1.1
ON2a	Middle	7/30/2019	8:13	5.8	2.9	16.4	8.10	199	0.5
ON2a	Middle	9/24/2019	14:10	5.5	2.8	10.4	7.91	206	0.0
ON2a	Middle	11/20/2019	8:23	5.5	2.8	2.3	7.49	241	0.3
ON2a	Middle	4/7/2021	14:03	5.1	2.3	7.2	8.20	257	1.1
ON2a	Surface	7/30/2019	8:13	5.8	1.0	16.4	8.29	199	0.5
ON2a	Surface	9/24/2019	14:08	5.5	1.0	10.7	8.00	206	0.0
ON2a	Surface	11/20/2019	8:23	5.5	1.0	2.1	7.99	236	0.3
ON2a	Surface	4/7/2021	14:03	5.1	1.0	7.1	8.20	257	1.0
ON2b	Bottom	7/30/2019	8:41	7.2	6.2	13.9	8.23	203	0.6
ON2b	Bottom	9/24/2019	14:50	7.2	6.2	9.3	7.77	207	0.1
ON2b	Bottom	11/20/2019	8:50	7.5	6.5	2.4	7.81	259	0.6
ON2b	Bottom	4/7/2021	13:53	6.7	5.5	6.3	8.18	245	0.8
ON2b	Middle	7/30/2019	8:41	7.2	3.6	16.7	8.24	204	0.5
ON2b	Middle	9/24/2019	14:48	7.2	3.6	9.8	7.82	206	0.0
ON2b	Middle	11/20/2019	8:50	7.5	3.8	2.5	7.86	232	0.2
ON2b	Middle	4/7/2021	13:53	6.7	3.5	6.3	8.17	246	0.7
ON2b	Surface	7/30/2019	8:41	7.2	1.0	17.3	8.24	204	0.6
ON2b	Surface	9/24/2019	14:46	7.2	1.0	10.8	7.88	205	0.0
ON2b	Surface	11/20/2019	8:50	7.5	1.0	2.5	7.89	228	0.2
ON2b	Surface	4/7/2021	13:53	6.7	1.0	6.3	8.18	245	0.7
ON2c	Bottom	7/30/2019	8:57	9.0	8.0	12.5	8.30	205	0.6
ON2c	Bottom	9/24/2019	15:06	8.8	7.8	7.0	7.86	207	0.2
ON2c	Bottom	11/20/2019	9:04	9.0	8.0	2.5	7.75	260	0.7
ON2c	Bottom	4/7/2021	13:41	8.4	7.4	5.8	8.16	239	0.8

Location	Depth ID	Date	Time	Depth to bottom (m)	Depth at sample (m)	Water Temp (°C)	pH	Conductivity (µS/cm)	Turbidity (NTU)
ON2c	Middle	7/30/2019	8:57	9.0	4.5	12.9	8.33	205	0.6
ON2c	Middle	9/24/2019	15:04	8.8	4.4	7.6	7.91	206	0.1
ON2c	Middle	11/20/2019	9:04	9.0	4.5	2.6	7.80	230	0.2
ON2c	Middle	4/7/2021	13:41	8.4	4.2	5.8	8.16	234	0.8
ON2c	Surface	7/30/2019	8:57	9.0	1.0	17.6	8.30	205	0.6
ON2c	Surface	9/24/2019	15:02	8.8	1.0	10.9	7.96	206	0.0
ON2c	Surface	11/20/2019	9:04	9.0	1.0	2.5	7.82	228	0.1
ON2c	Surface	4/7/2021	13:41	8.4	1.0	5.9	8.18	234	0.8
OS1a	Bottom	7/30/2019	10:26	4.2	3.2	14.9	8.36	202	0.6
OS1a	Bottom	9/24/2019	12:29	4.2	3.2	9.6	7.21	208	0.9
OS1a	Bottom	11/20/2019	11:00	4.0	3.0	2.6	7.87	286	0.6
OS1a	Bottom	4/7/2021	13:22	3.7	2.7	7.1	8.19	272	1.2
OS1a	Middle	7/30/2019	10:26	4.2	2.1	15.7	8.35	202	0.7
OS1a	Middle	9/24/2019	12:27	4.2	2.1	9.6	7.21	209	0.6
OS1a	Middle	11/20/2019	11:00	4.0	2.0	2.4	7.90	269	0.7
OS1a	Middle	4/7/2021	13:22	3.7	1.7	7.2	8.20	277	1.2
OS1a	Surface	7/30/2019	10:26	4.2	1.0	16.1	8.34	203	0.6
OS1a	Surface	9/24/2019	12:25	4.2	1.0	11.2	7.18	223	0.3
OS1a	Surface	11/20/2019	11:00	4.0	1.0	2.5	7.95	268	0.7
OS1a	Surface	4/7/2021	13:22	3.7	1.0	7.6	8.21	271	1.1
OS1b	Bottom	7/30/2019	10:58	6.8	5.8	13.5	8.36	203	0.8
OS1b	Bottom	9/24/2019	13:00	6.8	5.8	8.9	7.33	207	0.6
OS1b	Bottom	11/20/2019	11:15	7.0	6.0	2.4	7.84	287	0.5
OS1b	Bottom	4/7/2021	13:11	5.9	4.5	6.8	8.19	261	0.9
OS1b	Middle	7/30/2019	10:58	6.8	3.4	13.6	8.37	203	0.6
OS1b	Middle	9/24/2019	12:48	6.8	3.4	9.0	7.36	207	0.2
OS1b	Middle	11/20/2019	11:15	7.0	3.5	2.4	7.89	269	0.4
OS1b	Middle	4/7/2021	13:11	5.9	2.8	6.8	8.19	261	0.9
OS1b	Surface	7/30/2019	10:58	6.8	1.0	18.4	8.29	223	0.7
OS1b	Surface	9/24/2019	12:46	6.8	1.0	9.4	7.36	210	0.4

Location	Depth ID	Date	Time	Depth to bottom (m)	Depth at sample (m)	Water Temp (°C)	pH	Conductivity (µS/cm)	Turbidity (NTU)
OS1b	Surface	11/20/2019	11:15	7.0	1.0	2.7	7.94	235	0.3
OS1b	Surface	4/7/2021	13:11	5.9	1.0	6.9	8.20	261	0.9
OS1c	Bottom	7/30/2019	11:13	8.8	7.8	12.3	8.36	205	0.6
OS1c	Bottom	9/24/2019	13:05	9.0	8.0	8.9	7.65	208	0.2
OS1c	Bottom	11/20/2019	11:35	7.5	6.5	2.3	7.93	237	0.5
OS1c	Bottom	4/7/2021	12:58	8.5	7.3	5.9	8.15	239	0.9
OS1c	Middle	7/30/2019	11:13	8.8	4.4	13.5	8.38	204	0.6
OS1c	Middle	9/24/2019	13:03	9.0	4.5	9.1	7.75	208	0.1
OS1c	Middle	11/20/2019	11:35	7.5	3.8	2.3	7.96	236	0.4
OS1c	Middle	4/7/2021	12:58	8.5	4.2	6.0	8.15	240	0.9
OS1c	Surface	7/30/2019	11:13	8.8	1.0	17.5	8.36	204	0.5
OS1c	Surface	9/24/2019	13:01	9.0	1.0	12.9	7.69	237	0.1
OS1c	Surface	11/20/2019	11:35	7.5	1.0	2.4	8.01	236	0.3
OS1c	Surface	4/7/2021	12:58	8.5	1.0	6.1	8.13	241	0.9
OS2a	Bottom	7/30/2019	12:09	5.0	4.5	15.3	8.43	201	0.7
OS2a	Bottom	9/24/2019	12:00	4.8	3.8	9.2	7.78	207	0.6
OS2a	Bottom	11/20/2019	12:50	5.0	4.0	2.3	7.16	251	0.7
OS2a	Bottom	4/7/2021	12:38	4.0	2.8	7.3	8.20	274	1.1
OS2a	Middle	7/30/2019	12:09	5.0	2.5	17.0	8.38	206	0.6
OS2a	Middle	9/24/2019	11:58	4.8	2.4	9.8	7.81	208	0.5
OS2a	Middle	11/20/2019	12:50	5.0	2.5	2.3	7.16	248	0.7
OS2a	Middle	4/7/2021	12:38	4.0	2.0	7.2	8.20	276	1.1
OS2a	Surface	7/30/2019	12:09	5.0	1.0	17.6	8.35	213	0.6
OS2a	Surface	9/24/2019	11:56	4.8	1.0	10.5	7.85	208	0.3
OS2a	Surface	11/20/2019	12:50	5.0	1.0	2.3	7.16	246	0.6
OS2a	Surface	4/7/2021	12:38	4.0	1.0	7.2	8.19	275	1.1
OS2b	Bottom	7/30/2019	11:52	6.6	5.6	14.7	8.39	202	0.6
OS2b	Bottom	9/24/2019	11:36	6.8	5.8	8.9	7.84	208	0.7
OS2b	Bottom	11/20/2019	12:30	6.5	5.5	2.4	7.08	234	0.5
OS2b	Bottom	4/7/2021	12:27	6.0	4.9	6.5	8.18	247	0.9

Location	Depth ID	Date	Time	Depth to bottom (m)	Depth at sample (m)	Water Temp (°C)	pH	Conductivity (µS/cm)	Turbidity (NTU)
OS2b	Middle	7/30/2019	11:52	6.6	3.3	15.0	8.39	203	0.6
OS2b	Middle	9/24/2019	11:34	6.8	3.4	10.1	7.92	208	0.3
OS2b	Middle	11/20/2019	12:30	6.5	3.3	2.3	7.10	228	0.2
OS2b	Middle	4/7/2021	12:27	6.0	3.0	6.6	8.18	250	1.0
OS2b	Surface	7/30/2019	11:52	6.6	1.0	18.2	8.32	223	0.7
OS2b	Surface	9/24/2019	11:32	6.8	1.0	10.3	7.99	208	0.3
OS2b	Surface	11/20/2019	12:30	6.5	1.0	2.4	7.16	228	0.2
OS2b	Surface	4/7/2021	12:27	6.0	1.0	6.6	8.19	249	0.9
OS2c	Bottom	7/30/2019	11:35	9.2	8.2	12.7	8.33	205	0.6
OS2c	Bottom	9/24/2019	11:02	9.6	8.6	8.0	7.90	208	0.7
OS2c	Bottom	11/20/2019	12:18	9.5	8.5	2.7	6.87	294	0.3
OS2c	Bottom	4/7/2021	12:11	8.8	7.8	5.8	8.13	236	0.9
OS2c	Middle	7/30/2019	11:35	9.2	4.6	13.8	8.34	204	0.6
OS2c	Middle	9/24/2019	11:00	9.6	4.8	10.0	7.92	208	0.3
OS2c	Middle	11/20/2019	12:18	9.5	4.8	2.6	6.92	222	0.0
OS2c	Middle	4/7/2021	12:11	8.8	3.9	5.8	8.16	236	0.9
OS2c	Surface	7/30/2019	11:35	9.2	1.0	18.1	8.31	215	0.6
OS2c	Surface	9/24/2019	10:58	9.6	1.0	11.9	7.98	233	0.2
OS2c	Surface	11/20/2019	12:18	9.5	1.0	2.7	7.01	222	0.0
OS2c	Surface	4/7/2021	12:11	8.8	1.0	5.8	8.17	236	0.9
TN1a	Bottom	7/30/2019	14:12	6.5	5.5	14.3	8.27	203	0.5
TN1a	Bottom	9/24/2019	8:45	6.6	5.6	8.6	7.63	207	0.2
TN1a	Bottom	11/20/2019	13:30	6.0	5.0	3.3	7.39	219	0.0
TN1a	Bottom	4/7/2021	10:58	5.6	4.6	6.1	8.14	221	0.8
TN1a	Middle	7/30/2019	14:12	6.5	3.3	15.5	8.26	202	0.6
TN1a	Middle	9/24/2019	8:42	6.6	3.3	9.2	7.66	208	0.2
TN1a	Middle	11/20/2019	13:30	6.0	3.0	3.3	7.39	219	0.2
TN1a	Middle	4/7/2021	10:58	5.6	3.0	6.1	8.12	221	0.8
TN1a	Surface	7/30/2019	14:12	6.5	1.0	20.5	8.26	209	0.4
TN1a	Surface	9/24/2019	8:39	6.6	1.0	11.9	7.64	211	0.3

Location	Depth ID	Date	Time	Depth to bottom (m)	Depth at sample (m)	Water Temp (°C)	pH	Conductivity (µS/cm)	Turbidity (NTU)
TN1a	Surface	11/20/2019	13:30	6.0	1.0	3.3	7.40	219	-0.2
TN1a	Surface	4/7/2021	10:58	5.6	1.0	6.1	8.16	221	0.8
TN1b	Bottom	7/30/2019	14:30	9.8	8.8	13.2	8.27	204	0.6
TN1b	Bottom	9/24/2019	8:57	9.4	8.4	8.7	7.86	207	0.2
TN1b	Bottom	11/20/2019	14:00	10.0	9.0	3.2	7.48	219	-0.3
TN1b	Bottom	4/7/2021	11:14	9.2	8.2	5.3	8.11	221	0.8
TN1b	Middle	7/30/2019	14:30	9.8	4.9	14.7	8.31	203	0.6
TN1b	Middle	9/24/2019	8:55	9.4	4.7	10.8	7.85	210	0.2
TN1b	Middle	11/20/2019	14:00	10.0	5.0	3.2	7.50	219	-0.2
TN1b	Middle	4/7/2021	11:14	9.2	4.5	5.3	8.13	221	0.9
TN1b	Surface	7/30/2019	14:30	9.8	1.0	21.0	8.33	209	0.1
TN1b	Surface	9/24/2019	8:53	9.4	1.0	13.6	7.84	215	0.4
TN1b	Surface	11/20/2019	14:00	10.0	1.0	3.3	7.55	218	-0.3
TN1b	Surface	4/7/2021	11:14	9.2	1.0	5.3	8.13	221	0.9
TN1c	Bottom	7/30/2019	14:53	13.8	12.8	12.5	8.29	205	0.3
TN1c	Bottom	9/24/2019	9:21	13.0	12.0	8.6	7.98	207	0.2
TN1c	Bottom	11/20/2019	14:15	13.5	12.5	3.5	7.52	218	-0.3
TN1c	Bottom	4/7/2021	11:29	12.8	11.6	4.8	8.12	222	0.7
TN1c	Middle	7/30/2019	14:53	13.8	6.4	15.1	8.36	206	0.1
TN1c	Middle	9/24/2019	9:19	13.0	6.5	10.0	7.92	210	0.2
TN1c	Middle	11/20/2019	14:15	13.5	7.3	3.4	7.54	218	-0.3
TN1c	Middle	4/7/2021	11:29	12.8	6.5	4.8	8.11	222	0.7
TN1c	Surface	7/30/2019	14:53	13.8	1.0	21.5	8.38	212	0.2
TN1c	Surface	9/24/2019	9:17	13.0	1.0	17.0	7.84	219	0.5
TN1c	Surface	11/20/2019	14:15	13.5	1.0	3.4	7.57	218	-0.3
TN1c	Surface	4/7/2021	11:29	12.8	1.0	4.9	8.13	222	0.7
TN2a	Bottom	7/30/2019	16:02	6.6	5.6	15.1	8.29	202	0.3
TN2a	Bottom	9/24/2019	10:23	6.4	5.4	10.5	7.91	208	0.4
TN2a	Bottom	11/20/2019	15:10	6.0	5.0	3.1	7.60	220	0.0
TN2a	Bottom	4/7/2021	9:52	5.7	4.8	5.4	8.10	221	0.9

Location	Depth ID	Date	Time	Depth to bottom (m)	Depth at sample (m)	Water Temp (°C)	pH	Conductivity (µS/cm)	Turbidity (NTU)
TN2a	Middle	7/30/2019	16:02	6.6	3.3	16.3	8.31	201	0.2
TN2a	Middle	9/24/2019	10:21	6.4	3.2	10.7	7.94	208	0.3
TN2a	Middle	11/20/2019	15:10	6.0	3.0	3.1	7.67	220	0.0
TN2a	Middle	4/7/2021	9:52	5.7	2.8	5.5	8.12	221	0.9
TN2a	Surface	7/30/2019	16:02	6.6	1.0	18.4	8.37	203	0.2
TN2a	Surface	9/24/2019	10:19	6.4	1.0	11.0	8.00	208	0.2
TN2a	Surface	11/20/2019	15:10	6.0	1.0	3.4	7.72	218	0.0
TN2a	Surface	4/7/2021	9:52	5.7	1.0	5.4	8.10	220	0.8
TN2b	Bottom	7/30/2019	15:34	7.8	6.8	13.7	8.28	204	0.3
TN2b	Bottom	9/24/2019	10:10	7.8	6.8	10.0	7.84	208	0.4
TN2b	Bottom	11/20/2019	14:50	8.0	7.0	3.2	7.64	220	0.0
TN2b	Bottom	4/7/2021	10:26	7.2	6.3	5.0	8.08	221	0.8
TN2b	Middle	7/30/2019	15:34	7.8	3.9	14.8	8.30	203	0.3
TN2b	Middle	9/24/2019	10:08	7.8	3.9	11.0	7.81	209	0.1
TN2b	Middle	11/20/2019	14:50	8.0	4.0	3.2	7.66	220	0.0
TN2b	Middle	4/7/2021	10:26	7.2	3.6	5.2	8.11	221	0.8
TN2b	Surface	7/30/2019	15:34	7.8	1.0	20.6	8.33	207	0.2
TN2b	Surface	9/24/2019	10:06	7.8	1.0	11.0	7.82	209	0.2
TN2b	Surface	11/20/2019	14:50	8.0	1.0	3.4	7.69	219	0.0
TN2b	Surface	4/7/2021	10:26	7.2	1.0	5.2	8.10	221	0.7
TN2c	Bottom	7/30/2019	15:22	8.8	7.8	13.3	8.31	204	0.4
TN2c	Bottom	9/24/2019	9:46	8.8	7.8	9.5	7.97	208	0.2
TN2c	Bottom	11/20/2019	14:30	9.0	8.0	3.2	7.57	219	-0.1
TN2c	Bottom	4/7/2021	10:38	8.2	7.3	4.9	8.12	221	0.8
TN2c	Middle	7/30/2019	15:22	8.8	4.4	16.7	8.34	201	0.3
TN2c	Middle	9/24/2019	9:44	8.8	4.4	10.4	8.00	208	0.2
TN2c	Middle	11/20/2019	14:30	9.0	4.5	3.2	7.58	219	-0.2
TN2c	Middle	4/7/2021	10:38	8.2	4.1	4.9	8.08	221	0.8
TN2c	Surface	7/30/2019	15:22	8.8	1.0	21.5	8.37	209	0.1
TN2c	Surface	9/24/2019	9:42	8.8	1.0	11.1	8.04	209	0.2

Location	Depth ID	Date	Time	Depth to bottom (m)	Depth at sample (m)	Water Temp (°C)	pH	Conductivity (µS/cm)	Turbidity (NTU)
TN2c	Surface	11/20/2019	14:30	9.0	1.0	3.2	7.60	219	-0.2
TN2c	Surface	4/7/2021	10:38	8.2	1.0	5.0	8.10	221	0.8