BURNS McDONNELL

PFAS Sampling and Analysis Report
Camp Ripley Training Center
15000 Highway 115
Little Falls, Minnesota 56345-4173

Minnesota Department of Military Affairs

MNDMA Project No. 20129

7/9/2021

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prepared for

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prepared by

Burns & McDonnell
Bloomington, Minnesota

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LIST OF ABBREVIATIONS

Abbreviation	Term/Phrase/Name
ARNG	Army National Guard
ARNG-IEZ	Army Installations and Environment Directorate
CRTC	Camp Ripley Training Center
HASP	Health and Safety Plan
HFPO-DA	Hexafluoropropylene oxide dimer acid; GenX
IDW	investigation-derived waste
LCS/LCSD	Laboratory Control Sample/Laboratory Control Sample Duplicate
LOQ	Limit of Quantification
MDH	Minnesota Department of Health
MDL	Method Detection Limit
MNDMA	Minnesota Department of Military Affairs
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NEtFOSAA	N-ethyl-perfluorooctane sulfonamidoacetic acid
NGB	National Guard Bureau
NMeFOSAA	N-methyl-perfluorooctane sulfonamidoacetic acid
ng/L	nanograms per liter
NTP	Notice to Proceed with Work
PARCC	Precision, Accuracy, Representativeness, Comparability, and Completeness
PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFTeA	perfluorotetradecanoic acid
PFTriA	perfluorotridecanoic acid
PFUnA	perfluoroundecanoic acid
PMP	Project Management Plan
QA	Quality assurance
QC	Quality control
REC	Percent Recovery
RFP	Request for Proposal – Per- and Polyfluoroalkyl Substance (PFAS) Sampling and Analysis for Drinking Water Supply
RPD	Relative percent difference

Abbreviation	Term/Phrase/Name
Site	Highway 115, Little Falls, Minnesota 56345-4173
su	Standard unit
SWIFT	StateWide Integrated Financial Tools
UJ	Qualified as estimated at the reporting limit
USEPA	United Stated Environmental Protection Agency

1.0 INTRODUCTION

The Minnesota Department of Military Affairs (MNDMA) contracted Burns & McDonnell to provide professional technical services to evaluate the presence of Per- and Polyfluoroalkyl Substances (PFAS) in drinking water wells located within the 53,000-acre Camp Ripley Training Center (CRTC) at Highway 115, Little Falls, Minnesota 56345 (Site). These measures were undertaken by the MNMDA to satisfy the National Guard Bureau (NGB) Army Installations and Environment Directorate (ARNG-IEZ) requirement of monitoring Army National Guard (ARNG) owned and operated potable water systems for PFAS. The CRTC complex contains 19 drinking water wells and the Water Treatment Plant influent and effluent that were sampled for PFAS in response to the ARNG-IEZ requirement.

This PFAS Sampling and Analysis Report was prepared by Burns & McDonnell under the *StateWide Integrated Financial Tools (SWIFT) Contract No. 174500,* dated April 8, 2020, *Amendment No. 1 – Consulting Services for Per- and Polyfluoroalkyl Substance (PFAS) Sampling and Analysis for Drinking Water Supply*, dated September 22, 2020, and most recent *Project Management Plan (PMP), Revision 1*, dated May 14, 2021.

2.0 SITE DESCRIPTION AND HISTORY

The following describes the setting of the Site and historic PFAS sampling events.

2.1 Site Setting

The CRTC is a 53,000-acre regional training center that supports the training requirements of military and civilian agencies. The CRTC is located in north central Morrison County, extending from 7 miles north of Little Falls, Minnesota to the south and east of Pillager, Minnesota. The installation is bordered by Highway 115 to the south, the Mississippi River to the east, the Crow Wing River to the north, and Highway 1 to the west. The address for the CRTC is 15000 Highway 115, Little Falls, Minnesota 56345.

2.2 Land Use

Land use at the Site consists or numerous ranges and state-of-the art training facilities to support military and civilian agencies. Land use surrounding the Site is primarily agricultural to the south and east and forested land to the north and west.

2.3 Purpose and Objectives

The purpose of this sampling activity was to evaluate the presence or absence of PFAS at concentrations above the analytical laboratory method detection limit (MDL) in samples collected from drinking water wells and Water Treatment Plant influent and effluent at the locations presented on **Figure 1** (sample location details provided by the MNDMA are presented in **Table 1**). The performance objectives to complete and achieve this goal are the following:

- Task 1: Project Management
- Task 2: PFAS Sampling
- Task 3: Sample Analysis and Data Evaluation
- Task 4: Data Analysis
- Task 5: PFAS Sampling and Analysis Report (this report)

2.4 Previous PFAS Sampling Event

A previous PFAS sampling event was conducted from March 20 through March 21, 2017, by Tetra Tech, Inc. The results from this event were provided to Burns & McDonnell by the MNDMA. As specified in the MNDMA RFP, the results from the 2017 investigation were added to **Table 2** for comparison to the second quarter 2020 through first quarter 2021 PFAS sampling event results.

2.5 Pre-Mobilization Activities

Upon receiving the Notice to Proceed with Work (NTP) from the MNDMA, dated April 9, 2020, Burns & McDonnell developed a draft PMP that was submitted to the MNDMA on April 22, 2020. The final PMP was submitted to the MNDMA on April 23, 2020. The PMP was revised in May 2021 to account for the additional sampling events authorized by Amendment No. 1. The PMP contained the following:

- Project status update communication plan.
- Activity-based schedule supporting the technical approach.
- Activities and milestones outlined to support and manage completion of the activities.
- Activity coordination plans (complying with MNDMA schedule).
- Technical approach specifications to achieving the performance objectives.
- Project team members roles and responsibilities identification.

In addition to the PMP, a project-specific health and safety plan (HASP) was prepared and finalized prior to the initial second quarter 2020 sampling event, this document was internal to Burns & McDonnell.

After finalization of project documents, a project kickoff teleconference was conducted on May 6, 2020. The purpose of this meeting was to identify sampling locations, coordinate logistics, and set firm sampling dates for the first sampling event.

2.6 PFAS Sampling

Burns & McDonnell completed the PFAS sampling events on May 12, 2020, September 29, 2020, November 23, 2020, and February 24, 2021. Samples were collected from 19 drinking water wells and the Water Treatment Plant influent and effluent during each sampling event. The sample locations are presented on **Figure 1**. Field investigations and sample analysis were performed in accordance with the procedures and guidelines presented in the RFP. The samples were analyzed via Environmental Protection Agency (EPA) Method 537.1. The analytical results were used to evaluate the presence or absence of PFAS in drinking water wells at the project site. Trip Reports and photos from the PFAS sampling events were submitted to the MNMDA on May 29, 2020, October 26, 2020, December 10, 2020, and March 19, 2021. The Trip Reports and are included in **Appendix A.** Photos specific to the most recent sampling event (February 24, 2021) are also included in **Appendix** A and photos from the previous three events can be viewed in the Trip Reports individually stored by the MNDMA.

2.7 Sampling Methodologies and Collection

Drinking water supply well and Water Treatment Plant samples were collected from spigots or sink faucets following the procedures presented in *SWIFT Contract No. 174500*. Per *SWIFT Contract No. 174500*, samples were only collected once the spigots had been purged for at least 10 minutes. However, due to an issue with the well pump for Well No. 451231 (D-Range), purging prior to sampling on November 23, 2020, and February 24, 2021, was only conducted for 6.75 and 2.5 minutes, respectively. Prior to the start of sampling, field personnel washed their hands using Alconox and lab certified PFAS-free water, then rinsed thoroughly in the PFAS-free water prior to donning clean nitrile gloves. A new pair of nitrile gloves was donned prior to collecting each sample. The following protocols were followed to prevent sample contamination:

1) The MNDMA's *Bottle Selection and other Sampling Considerations when Sampling for PFAS* (**Appendix B**), and
2) Burns & McDonnell's SOP 410 *Sampling Protocols for Perfluoroalkyl and Polyfluoroalkyl Substances* (**Appendix C**).

Labels were affixed to bottles after being closed. The samples were immediately packed on ice for shipment to the off-site laboratory. Packing materials that contain fluorine were avoided, as a precaution. In accordance with the MNDMA RFP and/or EPA Method 537.1 , field quality control samples were collected and assessed in accordance with the table below.

FIELD QUALITY CONTROL SAMPLES		
QC Sample	**Frequency**	**Measurement Performance Criteria**
Field Duplicate	One per 10 field samples	Values > 2X LOQ: RPD must be ≤30% Values ≤ 2X LOQ: RPD must be ≤30%
Matrix Spike/Matrix Spike Duplicate	One per 20 field samples[1]	RPD ≤ 30%; 70-130% of true value
Field Reagent Blank	One per day or one per 10 samples (whichever is more)	No target analytes ≥ ½ LOQ, unless target analytes in field samples are > 10x those in rinsate blank
Cooler Temperature Blank	One per cooler	Temperature must be above freezing and ≤ 6°C

1 = Analyzed more frequently than one per twenty samples or per Sample Delivery Group.

The samples were analyzed for PFAS by EPA Method 537.1 by Eurofins TestAmerica Laboratories, Inc. in West Sacramento, California.

2.8 Decontamination

No reusable equipment was used during the sampling event. As a result, decontamination of non-dedicated sampling equipment was not required and equipment rinsate blank samples were not necessary. Personnel collecting samples decontaminated their hands prior to sample collection and between sampling locations as presented in Section 2.7.

2.9 Investigation-Derived Waste

Per MNDMA *Addendum No. 1*, dated March 6, 2020, the water purged from the spigots, sink faucets and sampling process was not considered to be investigation-derived waste and was discharged to the drain.

2.10 Health and Safety

Field activities were performed in accordance with Burns & McDonnell's HASP (Burns & McDonnell, 2020).

3.0 ANALYTICAL RESULTS

PFAS analytical results are summarized in **Table 2**. The laboratory reports for the second quarter 2020 through first quarter 2021 sampling events (four events) were provided to the MNDMA on June 3, 2020, October 12, 2020, December 9, 2020, and March 15, 2021.

As shown in **Table 2**, PFAS were detected above the analytical laboratory MDL during all four events in samples collected from the following sampling well locations: Well No. 224577 (H Well), Well No. 622775 (N Well), Water Treatment Plant (Post- Treatment), and Well No. 267561 (North Range). PFAS were not detected above the MDL during all four events in the following sample well locations: Well No. 470668 (L Well), Well No. 451231 (D-Range), Well No. 451230 (Plumbley Water Supply Point), Well No. 786124 (ISBC), Well No. 790987 (West Range, new classroom), Well No. 495630 (West Range, old classroom), Well No. 799708 (Center Range, new classroom), Well No. 720427 (Center Range, old classroom), Well No. 551064 (East Range), Well No. 768279 (CACTF), Well No. 810678 (MSTC), Well No. 677254 (A-12 Range), Well No. 451238 (A-4 Range), and Well No. 470506 (F-Range/Biathlon).

The following sample well locations had three sampling events where PFAS were detected above the MDL and only one sampling event where PFAS were not detected above the MDL:

- Water Treatment Plan (Pre-Treatment): PFAS were detected above the MDL in samples collected from this location during the second quarter 2020, fourth quarter 2020, and first quarter 2021 sampling events; but were not detected above the MDL during the third quarter 2020 sampling event.
- Well No. 451237 (A-3 Range): PFAS were detected above the MDL in samples collected from this location during the second quarter 2020 through fourth quarter 2020 sampling events; but were not detected above the MDL during the first quarter 2021 sampling event.

For sample well location Well No. 641304 (Ammunition Surveillance Building), all PFAS analytes were shown as detected above the MDL during the second quarter 2020 sampling event. However, PFAS were not detected at this location during the subsequent three sampling events (third quarter 2020, fourth quarter 2020, and first quarter 2021). The trend of PFAS not being detected above the MDL was observed after the fourth quarter 2020 sampling event, and the laboratory was contacted on December 8, 2020, to inquire if there was a reason all PFAS analytes were detected during the initial second quarter 2020 sampling event. The laboratory confirmed in correspondence that it was likely due to the laboratory incorrectly adding a small portion of either the matrix spike (MS) or matrix spike duplicate (MSD) aliquot

to the sample when going through the solid phase extraction column. Over six months had passed since the second quarter 2020 sampling event, so sample had been disposed of and a re-extraction was unable to be performed.

Detected concentrations of PFAS were compared to the EPA 2016 Health Advisory Limits and Minnesota Department of Health (MDH) 2020 Drinking Water Guidance Values, where available. All detected PFAS concentrations were below their respective EPA 2016 Health Advisory Limits and MDH 2020 Drinking Water Guidance Values.

4.0 Quality Assurance/Quality Control

Four event-specific *Quality Assurance (QA)/Quality Control (QC) Review of Analytical Data* memos were submitted to the MNDMA which can be found in (**Appendix D**). QA/QC sample results were reviewed in accordance with guidelines presented in USEPA's *Data Review and Validation Guidelines for Perfluoroalkyl Substances (PFASs) Analyzed Using EPA Method 537* (USEPA, 2018). The following summarizes the four QA/QC reviews in relation to the Precision, Accuracy, Representativeness, Comparability, and Completeness (PARCC) components.

4.1 Precision

Precision is defined as the level of agreement among individual measurements of the same chemical or physical property. During the data validation process, precision was evaluated by review of duplicated data using relative percent difference (RPD). This evaluation included review of RPDs for the laboratory control sample/laboratory control sample duplicate (LCS/LCSD), site-specific MS/MSD, and field duplicates. Control limits for the LCS/LCSD and MS/MSD were established by the laboratory and/or EPA Method 537.1 (see table in Section 2.7), while control limits for the field duplicates were based on criteria presented in analytical method EPA 537.1. All RPDs were within their respective control limits, and no data validation qualifiers were added based on the precision reviews.

4.2 Accuracy

Accuracy measures the bias of a measurement system and may be defined as the degree of agreement between a measurement and its accepted or true value. The accuracy of the analytical results was assessed by examining the results of blank samples and spike recovery studies.

- Blank results were used to evaluate whether field or laboratory handling may have contaminated samples and adversely impacted analytical accuracy by causing false positive or high-biased data. The method and field blanks were non-detect in all sampling events suggesting carryover and cross-contamination were not a concern.

- Spike results were used to evaluate the ability of the laboratory to recover constituents intentionally spiked into the samples. The accuracy of the spikes was expressed as the percent recovery (REC). This included review of the surrogate, LCS/LCSD, and MS/MSD RECs, with control limits established by the laboratory. All RECs were within their respective control limits, and no data validation qualifiers were added based on the spike reviews.

4.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents the Site and meets project objectives. The following factors impact representativeness: appropriate rationale used to select sampling locations and analytical parameters, correct sample collection techniques and preservation, use of standard analytical methods, adherence to method holding times, and determination of potential analysis interferences.

Specifics related to sample location, techniques, and other field sampling details are included in Sections 2.6 and 2.7 of this report. While the lab met method-recommended holding times, a few notable observations were made during sample preparation and/or analysis as follows:

- Sample W-MN-RIPL-007-12MAY20 (from Well No. 451231 [D-Range]) yielded a pH slightly below the method-recommended preservation. This sample was qualified as estimated at the reporting limit (UJ) during the data validation.
- Various observations of sediment were observed in some samples prior to sample extraction. Associated QC results were acceptable; thus, impact was determined to be negligible.
- Several samples yielded a yellow or orange color prior to extraction, and after final volumizing. The lab was contacted to inquire if presence of these colors indicated any potential interferences during analysis. The laboratory confirmed these were analyst observations, and the colors did not impact the results (which was further indicated by acceptable QC results).

4.4 Comparability

Comparability is a qualitative parameter used to express the confidence with which one data set may be compared to another. A summary is provided in **Table 2**, which summarizes the 2017, 2020 and 2021 data for this Site.

4.5 Completeness

Completeness defines the percentage of measurements judged to be valid measurements. Completeness is assessed for both field and laboratory activities. All samples were planned as collected, and no data were rejected (R) during the data validation reviews. Hence, both field and analytical completeness were 100 percent.

4.6 QA/QC Conclusion

Overall, the laboratory met all method and project-specific protocols. All associated QC results were within their respective control limits, and no corrective actions were necessary. One sample result (Well No. 451231 [D-Range]) was qualified as estimated at the reporting limit (UJ) due to low pH value (6.3 standard units [su]), which was slightly below the recommended sample preservation range of 6.5-7.5 su. With this exception, no other data limitations were noted. All data are valid for use, as qualified, in reporting the results of the second quarter 2020 through first quarter 2021 PFAS sampling events.

5.0 CONCLUSIONS

Of the 21 sample locations, PFAS compounds were detected above the MDL at the following six sample locations:

- Well No. 224577 (H Well)
- Well No. 622775 (N Well)
- Water Treatment Plant (Pre-Treatment)
- Water Treatment (Post- Treatment)
- Well No. 267561 (North Range), and
- Well No. 451237 (A-3 Range).

PFAS compounds were also detected at a seventh sample location, Well No. 641304 (ASB), during only the second quarter 2020 event, and were not detected in the subsequent three events. However, as discussed in Section 3.0, the detection of all PFAS compounds during the first event was likely due to lab error.

Detected concentrations of PFAS were compared to the EPA 2016 Health Advisory Limits and MDH 2020 Drinking Water Guidance Values, where available. All detected PFAS concentrations were below their respective EPA 2016 Health Advisory Limits and MDH 2020 Drinking Water Guidance Values.

6.0 REFERENCES

Burns & McDonnell. 2020. Corporate Safety & Health Program. April 8, 2020.

Tetra Tech, Inc. 2020. Table of PFAS Analytical Results. March 20-21.

USEPA. 2018. Data Review and Validation Guidelines for Perfluoroalkyl Substances (PFASs) Analyzed Using EPA Method 537. November 2018.

TABLES

Table 1: Sample Location Details
Camp Ripley
Minnesota Department of Military Affairs - Project No. 20129
Burns McDonnell - Project No. 123590

Sample Location (on Figure 1)	Site ID	Building #	Description	Well #	RPUID
00370	W-MN-RIPL-001	2-248	H Well	224577	258569
00382	W-MN-RIPL-002	17-246	L Well	470668	258580
00428	W-MN-RIPL-003	17-247	N Well	622775	257443
Water Treatment Plant	W-MN-RIPL-004	2-247	Water Treatment Plant, Pre-treatment	blended (H, L, N)	N/A
Water Treatment Plant	W-MN-RIPL-005	2-247	Water Treatment Plant, Post-treatment	blended (H, L, N)	N/A
00453	W-MN-RIPL-006	24118	Ammo Surveillance Building (ASB)	641304	257453
00374	W-MN-RIPL-007	13051	D-Range	451231	258572
00391	W-MN-RIPL-008	34077	North Range	267561	258588
64246	W-MN-RIPL-009	Outdoors	Plumbly Water Supply Point	451230	251780
72920	W-MN-RIPL-010	72076	Infantry Squad Battle Course (ISBC)	786124	1068497
40920	W-MN-RIPL-011	40225	West Range, new classroom	790987	1184306
00395	W-MN-RIPL-012	40078	West Range, old classroom	495630	258792
23832	W-MN-RIPL-013	23811	Center Range ("Range Operation Bldg/Latrines", new classroom)	799708	1265785
00653	W-MN-RIPL-014	23076	Center Range ("Covered Mess", old classroom)	720427	257697
00389	W-MN-RIPL-015	25076	East Range	551064	258586
10966	W-MN-RIPL-017	10124	Combined Arms Collective Training Facility (CACTF)	768279	1092010
10967	W-MN-RIPL-018	10228	Medical Simulation Training Center (MSTC)	810678	1232503
00499	W-MN-RIPL-019	14078	A-12 Range	677254	257472
00376	W-MN-RIPL-020	14076	A-3 Range	451237	258574
00378	W-MN-RIPL-021	14077	A-4 Range	451238	258576
00380	W-MN-RIPL-022	15076	F-Range/Biathlon Range	470506	258578

Table 2: PFAS Analytical Results Summary
Camp Ripley
Minnesota Department of Military Affairs - Project No. 20129
Burns McDonnell - Project No. 123590

Unique Well ID and Description	Sample ID	Sample Well Location ID	Sample Collection Date	Time	Matrix	Units	6:2FTS	8:2FTS	N-ethyl Perfluorooctane Sulfonamidoacetic Acid (NEtFOSAA)	N-methyl Perfluorooctane Sulfonamidoacetic Acid (NMeFOSAA)	Perfluorooctanoic Acid (PFOA)	Perfluorobutane Sulfonic Acid (PFBS)	Perfluorobutanoic Acid (PFBA)	Perfluorodecanoic Acid (PFDA)	Perfluorododecanoic Acid (PFDoA)	Perfluoroheptanoic Acid (PFHpA)	Perfluorohexane Sulfonic Acid (PFHxS)	Perfluorohexanoic Acid (PFHxA)	Perfluorononanoic Acid (PFNA)	Perfluorooctane Sulfonic Acid (PFOS)	Perfluoropentanoic Acid (PFPeA)	Perfluorotetradecanoic Acid (PFTeA)	Perfluorotridecanoic Acid (PFTriA)	Perfluoroundecanoic acid (PFUnA)	DONA	F-53B Major	F-53B Minor	HFPO-DA (GenX)	Sum of PFOA and PFOS Concentrations [2]
MDH Drinking Water Guidance Value						ppt (ng/L)	---	---	---	---	35	2,000	7,000	---	---	---	47	---	---	15	NE	---	---	---	---	---	---	---	NE
EPA Lifetime Drinking Water Health Advisories						ppt (ng/L)	---	---	---	---	70	---	---	---	---	---	---	---	---	70	---	---	---	---	---	---	---	---	70
Well No. 224577 (H Well)	W-MN-RIPL-001-20MAR17	00370	03/20/2017	8:30	Water	ppt (ng/L)	<9.77	<9.77	<14.6	<14.6	<1.95	<1.95	**6.47 J**	<0.977	<1.95	<1.95	**8.47**	<1.95	<1.95	**1.65 J**	<1.95	<0.977	<1.95	<1.95	NA	NA	NA	NA	**1.65 J**
	W-MN-RIPL-DUP1-20MAR17	00370	03/20/2017	8:35	Water	ppt (ng/L)	<10.1	<10.1	<15.2	<15.2	<2.02	<2.02	**7.41**	<1.01	<2.02	<2.02	**8.43**	<2.02	<2.02	**1.79 J**	<2.02	**1.20 J**[1]	<2.02	<2.02	NA	NA	NA	NA	**1.79 J**
	W-MN-RIPL-001-12MAY20	00370	5/12/2020	7:15	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	**0.7 J M**	NA	<1.8	<1.8	<1.8	**4.3 M**	<1.8	<1.8	**1.3 J M**	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	**1.3 J M**
	W-MN-RIPL-001-29SEP20	00370	9/29/2020	7:14	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	**1.8 J**	NA	<1.9	<1.9	<1.9	**14 M**	<1.9	<1.9	**1.7 J M**	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	**1.7 J M**
	W-MN-RIPL-DUP1-29SEP20	00370	9/29/2020	7:14	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	**2.0**	NA	<1.9	<1.9	<1.9	**15 M**	<1.9	<1.9	**1.9 M**	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	**1.9 M**
	W-MN-RIPL-001-23NOV20	00370	11/23/2020	7:17	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	**1.9 M**	NA	<1.9	<1.9	<1.9	**14**	<1.9	<1.9	**2.0 M**	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	**2.0 M**
	W-MN-RIPL-DUP1-23NOV20	00370	11/23/2020	7:17	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	**2.0**	NA	<1.9	<1.9	<1.9	**14 M**	<1.9	<1.9	**2.2 M**	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	**2.2 M**
	W-MN-RIPL-001-24FEB21	00370	2/24/2021	7:17	Water	ppt (ng/L)	NA	NA	<1.6	<1.6	<1.6	**1.4 J M**	NA	<1.6	<1.6	<1.6	**11**	<1.6	<1.6	**1.4 J M**	NA	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	**1.4 J M**
	W-MN-RIPL-FB1-24FEB21	Field Blank	2/24/2021	7:17	Water	ppt (ng/L)	NA	NA	<1.7	<1.7	<1.7	<1.7	NA	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	NA	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	ND
Well No. 470668 (L Well)	W-MN-RIPL-002-20MAR17	00382	03/20/2017	8:50	Water	ppt (ng/L)	<9.75	<9.75	<14.6	<14.6	<1.95	<1.95	**3.21 J**	<0.975	<1.95	<1.95	<1.95	<1.95	<1.95	<2.93	<1.95	**1.55 J**[1]	<1.95	<1.95	NA	NA	NA	NA	ND
	W-MN-RIPL-DUP2-20MAR17	00382	03/20/2017	8:55	Water	ppt (ng/L)	<9.70	<9.70	<14.6	<14.6	<1.94	<1.94	**3.4 J**	<0.970	<1.94	<1.94	<1.94	<1.94	<1.94	<2.91	<1.94	<0.970	<1.94	<1.94	NA	NA	NA	NA	ND
	W-MN-RIPL-002-12MAY20	00382	5/12/2020	7:55	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-DUP1-12MAY20	00382	5/12/2020	7:55	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-002-29SEP20	00382	9/29/2020	7:39	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-002-23NOV20	00382	11/23/2020	7:44	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-002-24FEB21	00382	2/24/2021	7:39	Water	ppt (ng/L)	NA	NA	<1.6	<1.6	<1.6	<1.6	NA	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	NA	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	ND

Table 2: PFAS Analytical Results Summary
Camp Ripley
Minnesota Department of Military Affairs - Project No. 20129
Burns McDonnell - Project No. 123590

Unique Well ID and Description	Sample ID	Sample Well Location ID	Sample Collection Date	Time	Matrix	Units	6:2FTS	8:2FTS	N-ethyl Perfluorooctane Sulfonamidoacetic Acid (NEtFOSAA)	N-methyl Perfluorooctane Sulfonamidoacetic Acid (NMeFOSAA)	Perfluorooctanoic Acid (PFOA)	Perfluorobutane Sulfonic Acid (PFBS)	Perfluorobutanoic Acid (PFBA)	Perfluorodecanoic Acid (PFDA)	Perfluorododecanoic Acid (PFDoA)	Perfluoroheptanoic Acid (PFHpA)	Perfluorohexane Sulfonic Acid (PFHxS)	Perfluorohexanoic Acid (PFHxA)	Perfluorononanoic Acid (PFNA)	Perfluorooctane Sulfonic Acid (PFOS)	Perfluoropentanoic Acid (PFPeA)	Perfluorotetradecanoic Acid (PFTeA)	Perfluorotridecanoic Acid (PFTriA)	Perfluoroundecanoic acid (PFUnA)	DONA	F-53B Major	F-53B Minor	HFPO-DA (GenX)	Sum of PFOA and PFOS Concentrations [2]
MDH Drinking Water Guidance Value						ppt (ng/L)	---	---	---	---	35	2,000	7,000	---	---	---	47	---	---	15	NE	---	---	---	---	---	---	---	NE
EPA Lifetime Drinking Water Health Advisories						ppt (ng/L)	---	---	---	---	70	---	---	---	---	---	---	---	---	70	---	---	---	---	---	---	---	---	70
Well No. 622775 (N Well)	W-MN-RIPL-003-20MAR17	00428	03/20/2017	9:15	Water	ppt (ng/L)	<9.84	<9.84	<14.8	<14.8	<1.97	<1.97	**3.68 J**	<0.984	<1.97	<1.97	<1.97	<1.97	<1.97	<2.95	<1.97	**2.34 J** [1]	<1.97	<1.97	NA	NA	NA	NA	ND
	W-MN-RIPL-DUP3-20MAR17	00428	03/20/2017	9:20	Water	ppt (ng/L)	<10.0	<10.0	<15.0	<15.0	<2.00	<2.00	**3.57 J**	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<2.00	<1.00	<2.00	<2.00	NA	NA	NA	NA	ND
	W-MN-RIPL-003-12MAY20	00428	5/12/2020	7:35	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	**0.59 J M**	**1.3 J**	NA	<1.8	<1.8	<1.8	**3.0 M**	**0.72 J M**	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	**0.59 J M**
	W-MN-RIPL-003-29SEP20	00428	9/29/2020	7:24	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	**0.58 J M**	**1.6 J**	NA	<1.8	<1.8	<1.8	**5.9 M**	**1.0 J M**	<1.8	**1.0 J M**	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	**1.58 J M**
	W-MN-RIPL-003-23NOV20	00428	11/23/2020	7:37	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	**0.70 J M**	**1.3 J**	NA	<1.9	<1.9	<1.9	**3.8 M**	**0.94 J**	<1.9	**0.59 J M**	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	**1.29 J M**
	W-MN-RIPL-003-24FEB21	00428	2/24/2021	7:30	Water	ppt (ng/L)	NA	NA	<1.6	<1.6	**0.56 J M**	**0.96 J**	NA	<1.6	<1.6	<1.6	**3.0 M**	**0.92 J**	<1.6	**0.59 J M**	NA	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	**1.15 J M**
	W-MN-RIPL-DUP1-24FEB21	00428	2/24/2021	7:30	Water	ppt (ng/L)	NA	NA	<1.7	<1.7	**0.73 J M**	**1.0 J**	NA	<1.7	<1.7	<1.7	**3.4**	**1.0 J**	<1.7	**0.76 J M**	NA	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	**1.49 J M**
Water Treatment Plant, pre-treatment	W-MN-RIPL-004-20MAR17	Pre-Treatment	03/20/2017	9:30	Water	ppt (ng/L)	<9.86	<9.86	<14.8	<14.8	<1.97	<1.97	**3.07 J**	<0.986	<1.97	<1.97	<1.97	<1.97	<1.97	<2.96	<1.97	<0.986	<1.97	<1.97	NA	NA	NA	NA	ND
	W-MN-RIPL-004-12MAY20	Pre-Treatment	5/12/2020	8:20	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	**0.68 J**	NA	<1.8	<1.8	<1.8	**2.0 M**	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-DUP2-12MAY20	Pre-Treatment	5/12/2020	8:20	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	**0.67 J**	NA	<1.8	<1.8	<1.8	**1.7 J M**	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-004-29SEP20	Pre-Treatment	9/29/2020	7:54	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-004-23NOV20	Pre-Treatment	11/23/2020	8:01	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	**0.58 J M**	**1.2 J**	NA	<1.9	<1.9	<1.9	**3.4 M**	**0.86 J**	<1.9	**0.54 J M**	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	**1.12 J M**
	W-MN-RIPL-004-24FEB21	Pre-Treatment	2/24/2021	7:57	Water	ppt (ng/L)	NA	NA	<1.6	<1.6	**0.61 J M**	**0.91 J**	NA	<1.6	<1.6	<1.6	**2.8**	**0.88 J M**	<1.6	**0.72 J M**	NA	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	**1.33 J M**
	W-MN-RIPL-FB2-24FEB21	Field Blank	2/24/2021	7:57	Water	ppt (ng/L)	NA	NA	<1.7	<1.7	<1.7	<1.7	NA	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	NA	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	ND
Water Treatment Plant, post-treatment	W-MN-RIPL-005-20MAR17	Post-Treatment	03/20/2017	9:45	Water	ppt (ng/L)	<9.13	<9.13	<13.7	<13.7	**0.943 J**	<1.83	**6.26 J**	**0.762 J**	**10.6 J**	<1.83	<1.83	<1.83	<1.83	<2.74	<1.83	**3.07 J** [1]	**1.40 J**	**1.00 J**	NA	NA	NA	NA	**0.943 J**
	W-MN-RIPL-005-12MAY20	Post-Treatment	5/12/2020	8:25	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	**0.74 J M**	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-005-29SEP20	Post-Treatment	9/29/2020	7:59	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	**1.2 J M**	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-005-23NOV20	Post-Treatment	11/23/2020	8:08	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	**0.59 J M**	**1.2 J**	NA	<1.8	<1.8	**0.46 J**	**4.1 M**	**0.76 J M**	<1.8	**0.69 J M**	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	**1.28 J M**
	W-MN-RIPL-FB1-23NOV20	Field Blank	11/23/2020	8:08	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-005-24FEB21	Post-Treatment	2/24/2021	8:04	Water	ppt (ng/L)	NA	NA	<1.6	<1.6	**0.58 J M**	**0.96 J**	NA	<1.6	<1.6	<1.6	**3.4**	**0.74 J**	<1.6	**0.65 J M**	NA	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	**1.23 J M**
	W-MN-RIPL-DUP2-24FEB21	Post-Treatment	2/24/2021	8:04	Water	ppt (ng/L)	NA	NA	<1.7	<1.7	**0.60 J M**	**1.1 J**	NA	<1.7	<1.7	<1.7	**4.1**	**0.92 J**	<1.7	**0.82 J**	NA	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	**1.42 J M**

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Camp Ripley
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Burns McDonnell - Project No. 123590

Unique Well ID and Description	Sample ID	Sample Well Location ID	Sample Collection Date	Time	Matrix	Units	6:2FTS	8:2FTS	N-ethyl Perfluorooctane Sulfonamidoacetic Acid (NEtFOSAA)	N-methyl Perfluorooctane Sulfonamidoacetic Acid (NMeFOSAA)	Perfluorooctanoic Acid (PFOA)	Perfluorobutane Sulfonic Acid (PFBS)	Perfluorobutanoic Acid (PFBA)	Perfluorodecanoic Acid (PFDA)	Perfluorododecanoic Acid (PFDoA)	Perfluoroheptanoic Acid (PFHpA)	Perfluorohexane Sulfonic Acid (PFHxS)	Perfluorohexanoic Acid (PFHxA)	Perfluorononanoic Acid (PFNA)	Perfluorooctane Sulfonic Acid (PFOS)	Perfluoropentanoic Acid (PFPeA)	Perfluorotetradecanoic Acid (PFTeA)	Perfluorotridecanoic Acid (PFTriA)	Perfluoroundecanoic acid (PFUnA)	DONA	F-53B Major	F-53B Minor	HFPO-DA (GenX)	Sum of PFOA and PFOS Concentrations [2]
MDH Drinking Water Guidance Value						ppt (ng/L)	---	---	---	---	35	2,000	7,000	---	---	---	47	---	---	15	NE	---	---	---	---	---	---	---	NE
EPA Lifetime Drinking Water Health Advisories						ppt (ng/L)	---	---	---	---	70	---	---	---	---	---	---	---	---	70	---	---	---	---	---	---	---	---	70
Well No. 641304 (ASB)	W-MN-RIPL-006-20MAR17	00453	03/20/2017	10:20	Water	ppt (ng/L)	<8.91	<8.91	<13.4	<13.4	<1.78	<1.78	<0.891	<0.891	<1.78	<1.78	<1.78	<1.78	<1.78	<2.67	<1.78	<0.891	<1.78	<1.78	NA	NA	NA	NA	ND
	W-MN-RIPL-006-12MAY20	00453	5/12/2020	9:20	Water	ppt (ng/L)	NA	NA	**0.83 J M[3]**	**1.1 J M[3]**	**0.83 J M[3]**	**0.86 J[3]**	NA	**0.88 J M[3]**	**0.62 J M[3]**	**0.82 J M[3]**	**0.86 J M[3]**	**0.87 J M[3]**	**0.72 J M[3]**	**0.83 J M[3]**	NA	**0.64 J M[3]**	**0.6 J M[3]**	**0.75 J M[3]**	**0.81 J[3]**	**0.86 J M[3]**	**0.62 J[3]**	**0.82 J[3]**	**1.66 J M[3]**
	W-MN-RIPL-006-29SEP20	00453	9/29/2020	8:42	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-DUP2-29SEP20	00453	9/29/2020	8:42	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-006-23NOV20	00453	11/23/2020	8:50	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-006-24FEB21	00453	2/24/2021	8:42	Water	ppt (ng/L)	NA	NA	<1.6	<1.6	<1.6	<1.6	NA	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	NA	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	ND
Well No. 451231 (D-Range)	W-MN-RIPL-007-20MAR17	00374	03/20/2017	10:40	Water	ppt (ng/L)	<9.65	<9.65	<14.5	<14.5	<1.93	<1.93	**4.73 J**	<0.965	<1.93	<1.93	<1.93	<1.93	<1.93	<2.89	<1.93	**0.978 J[1]**	<1.93	<1.93	NA	NA	NA	NA	**1.17 J**
	W-MN-RIPL-007-12MAY20	00374	5/12/2020	10:00	Water	ppt (ng/L)	NA	NA	<18 UJ	<18 UJ	<18 UJ	<18 UJ	NA	<18 UJ	<18 UJ	<18 UJ	<18 UJ	<18 UJ	<18 UJ	<18 UJ	NA	<18 UJ	<18 UJ	<18 UJ	<18 UJ	<18 UJ	<18 UJ	<18 UJ	ND
	W-MN-RIPL-FB1-12MAY20	Field Blank	5/12/2020	10:00	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-007-29SEP20	00374	9/29/2020	15:01	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-007-23NOV20	00374	11/23/2020	15:10	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-007-24FEB21	00374	2/24/2021	15:05	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
Well No. 267561 (North Range)	W-MN-RIPL-008-20MAR17	00391	03/20/2017	11:05	Water	ppt (ng/L)	<8.96	<8.96	<13.4	<13.4	<1.79	<1.79	<0.896	<0.896	<1.79	<1.79	<1.79	<1.79	<1.79	**1.17 J**	<1.79	**0.910 J[1]**	<1.79	<1.79	NA	NA	NA	NA	ND
	W-MN-RIPL-008-12MAY20	00391	5/12/2020	10:40	Water	ppt (ng/L)	NA	NA	<1.8	**2.9**	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	**3.5 M**	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	**3.5 M**
	W-MN-RIPL-008-29SEP20	00391	9/29/2020	14:33	Water	ppt (ng/L)	NA	NA	<1.8	**2.2**	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	**1.4 J M**	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	**1.4 J M**
	W-MN-RIPL-DUP3-29SEP20	00391	9/29/2020	14:33	Water	ppt (ng/L)	NA	NA	<1.8	**2.3 M**	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	**1.4 J M**	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	**1.4 J M**
	W-MN-RIPL-008-23NOV20	00391	11/23/2020	14:08	Water	ppt (ng/L)	NA	NA	<1.9	**1.9 M**	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	**0.79 J M**	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	**0.79 J M**
	W-MN-RIPL-DUP3-23NOV20	00391	11/23/2020	14:08	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-008-24FEB21	00391	2/24/2021	14:10	Water	ppt (ng/L)	NA	NA	<1.6	**1.3 J**	<1.6	<1.6	NA	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	**0.43 J M**	NA	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	**0.43 J M**
	W-MN-RIPL-FB3-24FEB21	Field Blank	2/24/2021	14:10	Water	ppt (ng/L)	NA	NA	<1.7	<1.7	<1.7	<1.7	NA	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	NA	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	ND

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Minnesota Department of Military Affairs - Project No. 20129
Burns McDonnell - Project No. 123590

Unique Well ID and Description	Sample ID	Sample Well Location ID	Sample Collection Date	Time	Matrix	Units	6:2FTS	8:2FTS	N-ethyl Perfluorooctane Sulfonamidoacetic Acid (NEtFOSAA)	N-methyl Perfluorooctane Sulfonamidoacetic Acid (NMeFOSAA)	Perfluorooctanoic Acid (PFOA)	Perfluorobutane Sulfonic Acid (PFBS)	Perfluorobutanoic Acid (PFBA)	Perfluorodecanoic Acid (PFDA)	Perfluorododecanoic Acid (PFDoA)	Perfluoroheptanoic Acid (PFHpA)	Perfluorohexane Sulfonic Acid (PFHxS)	Perfluorohexanoic Acid (PFHxA)	Perfluorononanoic Acid (PFNA)	Perfluorooctane Sulfonic Acid (PFOS)	Perfluoropentanoic Acid (PFPeA)	Perfluorotetradecanoic Acid (PFTeA)	Perfluorotridecanoic Acid (PFTriA)	Perfluoroundecanoic acid (PFUnA)	DONA	F-53B Major	F-53B Minor	HFPO-DA (GenX)	Sum of PFOA and PFOS Concentrations [2]
MDH Drinking Water Guidance Value						ppt (ng/L)	---	---	---	---	35	2,000	7,000	---	---	---	47	---	---	15	NE	---	---	---	---	---	---	---	NE
EPA Lifetime Drinking Water Health Advisories						ppt (ng/L)	---	---	---	---	70	---	---	---	---	---	---	---	---	70	---	---	---	---	---	---	---	---	70
Well No. 451230 (Plumbley Water Supply Point)	W-MN-RIPL-009-20MAR17	64246	03/20/2017	11:45	Water	ppt (ng/L)	<9.83	<9.83	<14.8	<14.8	<1.97	<1.97	**2.93 J**	**0.566 J**	**0.644 J**	<1.97	<1.97	<1.97	<1.97	<2.95	<1.97	**1.47 J** [1]	**0.612 J**	<1.97	NA	NA	NA	NA	ND
	W-MN-RIPL-009-12MAY20	64246	5/12/2020	11:30	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-009-29SEP20	64246	9/29/2020	13:58	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-009-23NOV20	64246	11/23/2020	13:30	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-009-24FEB21	64246	2/24/2021	13:31	Water	ppt (ng/L)	NA	NA	<1.6	<1.6	<1.6	<1.6	NA	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	NA	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	ND
Well No. 786124 (ISBC)	W-MN-RIPL-010-20MAR17	72920	03/20/2017	12:15	Water	ppt (ng/L)	<9.08	<9.08	<13.6	<13.6	<1.82	<1.82	<0.908	<0.908	<1.82	<1.82	<1.82	<1.82	<1.82	<2.72	<1.82	<0.908	<1.82	<1.82	NA	NA	NA	NA	ND
	W-MN-RIPL-010-12MAY20	72920	5/12/2020	12:05	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-FB2-12MAY20	Field Blank	5/12/2020	12:05	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-010-29SEP20	72920	9/29/2020	13:35	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-010-23NOV20	72920	11/23/2020	13:02	Water	ppt (ng/L)	NA	NA	<2.0	<2.0	<2.0	<2.0	NA	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NA	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
	W-MN-RIPL-FB3-23NOV20	Field Blank	11/23/2020	13:02	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-010-24FEB21	72920	2/24/2021	13:01	Water	ppt (ng/L)	NA	NA	<1.6	<1.6	<1.6	<1.6	NA	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	NA	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	ND
Well No. 790987 (West Range, new classroom)	W-MN-RIPL-011-20MAR17	40920	03/20/2017	13:05	Water	ppt (ng/L)	<9.10	<9.10	<13.7	<13.7	<1.82	<1.82	<0.910	<0.910	<1.82	<1.82	<1.82	<1.82	<1.82	<2.73	<1.82	**1.41 J** [1]	**0.556 J**	<1.82	NA	NA	NA	NA	ND
	W-MN-RIPL-011-12MAY20	40920	5/12/2020	13:05	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-011-29SEP20	40920	9/29/2020	12:44	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-FB3-29SEP20	Field Blank	9/29/2020	12:44	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-011-23NOV20	40920	11/23/2020	12:16	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-011-24FEB21	40920	2/24/2021	12:04	Water	ppt (ng/L)	NA	NA	<1.6	<1.6	<1.6	<1.6	NA	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	NA	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	ND

Table 2: PFAS Analytical Results Summary
Camp Ripley
Minnesota Department of Military Affairs - Project No. 20129
Burns McDonnell - Project No. 123590

Unique Well ID and Description	Sample ID	Sample Well Location ID	Sample Collection Date	Time	Matrix	Units	6:2FTS	8:2FTS	N-ethyl Perfluorooctane Sulfonamidoacetic Acid (NEtFOSAA)	N-methyl Perfluorooctane Sulfonamidoacetic Acid (NMeFOSAA)	Perfluorooctanoic Acid (PFOA)	Perfluorobutane Sulfonic Acid (PFBS)	Perfluorobutanoic Acid (PFBA)	Perfluorodecanoic Acid (PFDA)	Perfluorododecanoic Acid (PFDoA)	Perfluoroheptanoic Acid (PFHpA)	Perfluorohexane Sulfonic Acid (PFHxS)	Perfluorohexanoic Acid (PFHxA)	Perfluorononanoic Acid (PFNA)	Perfluorooctane Sulfonic Acid (PFOS)	Perfluoropentanoic Acid (PFPeA)	Perfluorotetradecanoic Acid (PFTeA)	Perfluorotridecanoic Acid (PFTriA)	Perfluoroundecanoic acid (PFUnA)	DONA	F-53B Major	F-53B Minor	HFPO-DA (GenX)	Sum of PFOA and PFOS Concentrations [2]
MDH Drinking Water Guidance Value						ppt (ng/L)	---	---	---	---	35	2,000	7,000	---	---	---	47	---	---	15	NE	---	---	---	---	---	---	---	NE
EPA Lifetime Drinking Water Health Advisories						ppt (ng/L)	---	---	---	---	70	---	---	---	---	---	---	---	---	70	---	---	---	---	---	---	---	---	70
Well No. 495630 (West Range, old classroom)	W-MN-RIPL-012-20MAR17	00395	03/20/2017	13:20	Water	ppt (ng/L)	<9.64	<9.64	<14.5	<14.5	<1.93	<1.93	<0.964	<0.964	<1.93	<1.93	<1.93	<1.93	<1.93	<2.89	<1.93	<0.964	<1.93	<1.93	NA	NA	NA	NA	ND
	W-MN-RIPL-012-12MAY20	00395	5/12/2020	13:30	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-012-29SEP20	00395	9/29/2020	12:28	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-012-23NOV20	00395	11/23/2020	12:07	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-012-24FEB21	00395	2/24/2021	12:00	Water	ppt (ng/L)	NA	NA	<1.6	<1.6	<1.6	<1.6	NA	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	NA	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	ND
Well No. 799708 (Center Range, new classroom)	W-MN-RIPL-013-20MAR17	23832	03/20/2017	13:45	Water	ppt (ng/L)	<9.03	<9.03	<13.5	<13.5	<1.81	<1.81	<0.903	<0.903	<1.81	<1.81	<1.81	<1.81	<1.81	<2.71	<1.81	<0.903	<1.81	<1.81	NA	NA	NA	NA	ND
	W-MN-RIPL-013-12MAY20	23832	5/12/2020	13:55	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-013-29SEP20	23832	9/29/2020	12:00	Water	ppt (ng/L)	NA	NA	<2.0	<2.0	<2.0	<2.0	NA	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NA	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
	W-MN-RIPL-013-23NOV20	23832	11/23/2020	11:39	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-013-24FEB21	23832	2/24/2021	11:32	Water	ppt (ng/L)	NA	NA	<1.6	<1.6	<1.6	<1.6	NA	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	NA	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	ND
Well No. 720427 (Center Range, old classroom)	W-MN-RIPL-014-20MAR17	00653	03/20/2017	14:05	Water	ppt (ng/L)	<9.28	<9.28	<13.9	<13.9	<1.86	<1.86	<0.928	<0.928	<1.86	<1.86	<1.86	<1.86	<1.86	<2.78	<1.86	<0.928	<1.86	<1.86	NA	NA	NA	NA	ND
	W-MN-RIPL-014-12MAY20	00653	5/12/2020	14:15	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-014-29SEP20	00653	9/29/2020	11:41	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-014-23NOV20	00653	11/23/2020	11:28	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-FB2-23NOV20	Field Blank	11/23/2020	11:28	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-014-24FEB21	00653	2/24/2021	11:29	Water	ppt (ng/L)	NA	NA	<1.7	<1.7	<1.7	<1.7	NA	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	NA	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	ND

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MDH Drinking Water Guidance Value						ppt (ng/L)	---	---	---	---	35	2,000	7,000	---	---	---	47	---	---	15	NE	---	---	---	---	---	---	---	NE
EPA Lifetime Drinking Water Health Advisories						ppt (ng/L)	---	---	---	---	70	---	---	---	---	---	---	---	---	70	---	---	---	---	---	---	---	---	70
Well No. 551064 (East Range)	W-MN-RIPL-015-20MAR17	00389	03/20/2017	14:25	Water	ppt (ng/L)	<8.94	<8.94	<13.4	<13.4	<1.79	<1.79	<0.894	<0.894	<1.79	<1.79	<1.79	<1.79	<1.79	<2.68	<1.79	**1.19 J** [1]	<1.79	<1.79	NA	NA	NA	NA	ND
	W-MN-RIPL-015-12MAY20	00389	5/12/2020	14:45	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-015-29SEP20	00389	9/29/2020	11:15	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-FB2-29SEP20	Field Blank	9/29/2020	11:15	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-015-23NOV20	00389	11/23/2020	11:04	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-015-24FEB21	00389	2/24/2021	11:04	Water	ppt (ng/L)	NA	NA	<1.6	<1.6	<1.6	<1.6	NA	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	NA	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	ND
Well No. 451233 (sealed Feb 2021)	W-MN-RIPL-016-20MAR17	00393	03/20/2017	14:50	Water	ppt (ng/L)	<9.61	<9.61	<14.4	<14.4	**1.05 J** [1]	<1.92	**4.90 J**	<0.961	<1.92	<1.92	<1.92	<1.92	<1.92	**1.72 J**	<1.92	<0.961	<1.92	<1.92	NA	NA	NA	NA	**2.77 J**
Well No. 768279 (CACTF)	W-MN-RIPL-017-21MAR17	10966	03/21/2017	8:45	Water	ppt (ng/L)	<9.25	<9.25	<13.9	<13.9	<1.85	<1.85	<0.925	<0.925	<1.85	<1.85	<1.85	<1.85	<1.85	<2.77	<1.85	<0.925	<1.85	<1.85	NA	NA	NA	NA	ND
	W-MN-RIPL-017-12MAY20	10966	5/12/2020	17:40	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-017-29SEP20	10966	9/29/2020	9:05	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-017-23NOV20	10966	11/23/2020	9:13	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-017-24FEB21	10966	2/24/2021	9:04	Water	ppt (ng/L)	NA	NA	<1.7	<1.7	<1.7	<1.7	NA	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	NA	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	ND
Well No. 810678 (MSTC)	W-MN-RIPL-018-21MAR17	10967	03/21/2017	9:00	Water	ppt (ng/L)	<9.91	<9.91	<14.9	<14.9	<1.98	<1.98	**0.538 J** [1]	<0.991	<1.98	<1.98	<1.98	<1.98	<1.98	<2.97	<1.98	<0.991	<1.98	<1.98	NA	NA	NA	NA	ND
	W-MN-RIPL-018-12MAY20	10967	5/12/2020	15:30	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-018-29SEP20	10967	9/29/2020	9:28	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-018-23NOV20	10967	11/23/2020	9:37	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-018-24FEB21	10967	2/24/2021	9:15	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND

Table 2: PFAS Analytical Results Summary
Camp Ripley
Minnesota Department of Military Affairs - Project No. 20129
Burns McDonnell - Project No. 123590

Unique Well ID and Description	Sample ID	Sample Well Location ID	Sample Collection Date	Time	Matrix	Units	6:2FTS	8:2FTS	N-ethyl Perfluorooctane Sulfonamidoacetic Acid (NEtFOSAA)	N-methyl Perfluorooctane Sulfonamidoacetic Acid (NMeFOSAA)	Perfluorooctanoic Acid (PFOA)	Perfluorobutane Sulfonic Acid (PFBS)	Perfluorobutanoic Acid (PFBA)	Perfluorodecanoic Acid (PFDA)	Perfluorododecanoic Acid (PFDoA)	Perfluoroheptanoic Acid (PFHpA)	Perfluorohexane Sulfonic Acid (PFHxS)	Perfluorohexanoic Acid (PFHxA)	Perfluorononanoic Acid (PFNA)	Perfluorooctane Sulfonic Acid (PFOS)	Perfluoropentanoic Acid (PFPeA)	Perfluorotetradecanoic Acid (PFTeA)	Perfluorotridecanoic Acid (PFTriA)	Perfluoroundecanoic acid (PFUnA)	DONA	F-53B Major	F-53B Minor	HFPO-DA (GenX)	Sum of PFOA and PFOS Concentrations [2]
MDH Drinking Water Guidance Value						ppt (ng/L)	---	---	---	---	35	2,000	7,000	---	---	---	47	---	---	15	NE	---	---	---	---	---	---	---	NE
EPA Lifetime Drinking Water Health Advisories						ppt (ng/L)	---	---	---	---	70	---	---	---	---	---	---	---	---	70	---	---	---	---	---	---	---	---	70
Well No. 677254 (A-12 Range)	W-MN-RIPL-019-21MAR17	00499	03/21/2017	9:50	Water	ppt (ng/L)	<9.88	<9.88	<14.8	<14.8	<1.98	<1.98	**0.531 J** [1]	<0.988	<1.98	<1.98	<1.98	<1.98	<1.98	<2.96	<1.98	<0.988	<1.98	<1.98	NA	NA	NA	NA	ND
	W-MN-RIPL-019-12MAY20	00499	5/12/2020	17:15	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-019-29SEP20	00499	9/29/2020	9:49	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-FB1-29SEP20	Field Blank	9/29/2020	9:49	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-019-23NOV20	00499	11/23/2020	9:54	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-019-24FEB21	00499	2/24/2021	9:30	Water	ppt (ng/L)	NA	NA	<1.7	<1.7	<1.7	<1.7	NA	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	NA	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	ND
Well No. 451237 (A-3 Range)	W-MN-RIPL-020-21MAR17	00376	03/21/2017	10:05	Water	ppt (ng/L)	<9.74	<9.74	<14.6	<14.6	<1.95	<1.95	**0.544 J** [1]	<0.974	<1.95	<1.95	<1.95	<1.95	<1.95	<2.92	<1.95	<0.974	<1.95	<1.95	NA	NA	NA	NA	ND
	W-MN-RIPL-020-12MAY20	00376	5/12/2020	16:55	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	**0.49 J**	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-FB3-12MAY20	Field Blank	5/12/2020	16:55	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-020-29SEP20	00376	9/29/2020	10:10	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	**0.55 J**	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-020-23NOV20	00376	11/23/2020	10:00	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	**0.90 J**	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-DUP2-23NOV20	00376	11/23/2020	10:00	Water	ppt (ng/L)	NA	NA	<2.0	<2.0	<2.0	**0.70 J**	NA	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NA	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
	W-MN-RIPL-020-24FEB21	00376	2/24/2021	9:40	Water	ppt (ng/L)	NA	NA	<1.7	<1.7	<1.7	<1.7	NA	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	NA	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	ND
	W-MN-RIPL-DUP3-24FEB21	00376	2/24/2021	9:40	Water	ppt (ng/L)	NA	NA	<1.7	<1.7	<1.7	<1.7	NA	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	NA	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	ND

Table 2: PFAS Analytical Results Summary
Camp Ripley
Minnesota Department of Military Affairs - Project No. 20129
Burns McDonnell - Project No. 123590

Unique Well ID and Description	Sample ID	Sample Well Location ID	Sample Collection Date	Time	Matrix	Units	6:2FTS	8:2FTS	N-ethyl Perfluorooctane Sulfonamidoacetic Acid (NEtFOSAA)	N-methyl Perfluorooctane Sulfonamidoacetic Acid (NMeFOSAA)	Perfluorooctanoic Acid (PFOA)	Perfluorobutane Sulfonic Acid (PFBS)	Perfluorobutanoic Acid (PFBA)	Perfluorodecanoic Acid (PFDA)	Perfluorododecanoic Acid (PFDoA)	Perfluoroheptanoic Acid (PFHpA)	Perfluorohexane Sulfonic Acid (PFHxS)	Perfluorohexanoic Acid (PFHxA)	Perfluorononanoic Acid (PFNA)	Perfluorooctane Sulfonic Acid (PFOS)	Perfluoropentanoic Acid (PFPeA)	Perfluorotetradecanoic Acid (PFTeA)	Perfluorotridecanoic Acid (PFTriA)	Perfluoroundecanoic acid (PFUnA)	DONA	F-53B Major	F-53B Minor	HFPO-DA (GenX)	Sum of PFOA and PFOS Concentrations [2]
MDH Drinking Water Guidance Value						ppt (ng/L)	---	---	---	---	35	2,000	7,000	---	---	---	47	---	---	15	NE	---	---	---	---	---	---	---	NE
EPA Lifetime Drinking Water Health Advisories						ppt (ng/L)	---	---	---	---	70	---	---	---	---	---	---	---	---	70	---	---	---	---	---	---	---	---	70
Well No. 451238 (A-4 Range)	W-MN-RIPL-021-21MAR17	00378	03/21/2017	10:15	Water	ppt (ng/L)	<9.55	<9.55	<14.3	<14.3	<1.91	<1.91	**0.529 J**[1]	<0.955	<1.91	<1.91	<1.91	<1.91	<1.91	<2.86	<1.91	<0.955	<1.91	<1.91	NA	NA	NA	NA	ND
	W-MN-RIPL-021-12MAY20	00378	5/12/2020	16:30	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-DUP3-12MAY20	00378	5/12/2020	16:30	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-021-29SEP20	00378	9/29/2020	10:27	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-021-23NOV20	00378	11/23/2020	10:15	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-021-24FEB21	00378	2/24/2021	9:53	Water	ppt (ng/L)	NA	NA	<1.7	<1.7	<1.7	<1.7	NA	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	NA	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	ND
Well No. 470506 (F-Range/Biathlon)	W-MN-RIPL-022-21MAR17	00380	03/21/2017	10:30	Water	ppt (ng/L)	<10.0	<10.0	<15.0	<15.0	<2.00	<2.00	**1.78 J**[1]	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<2.00	<1.00	<2.00	<2.00	NA	NA	NA	NA	ND
	W-MN-RIPL-022-12MAY20	00380	5/12/2020	16:05	Water	ppt (ng/L)	NA	NA	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	NA	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	ND
	W-MN-RIPL-022-29SEP20	00380	9/29/2020	10:50	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-022-23NOV20	00380	11/23/2020	10:40	Water	ppt (ng/L)	NA	NA	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	NA	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	ND
	W-MN-RIPL-022-24FEB21	00380	2/24/2021	10:22	Water	ppt (ng/L)	NA	NA	<1.7	<1.7	<1.7	<1.7	NA	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	NA	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	ND

Notes:
Detections are shown in **BOLD**
< = Indicates concentration was not detectable above Limit of Quantitation (LOQ).
J = Flagged as estimated indicating the analyte was postively identified but the quantitation is an estimation.
M = Flagged as manual integrated
UJ = Compound was estimated at the reporting limit (sample pH was 6.3 su, which is slightly below the recommended sample preservation range of 6.5-7.5 su).
MDH = Minnesota Department of Health
ND = Not detected above Minimum Reportable Level
NE = Not established
ng/L = nanograms per liter, which is equviant to parts per trillion (ppt)
ppt = parts per trillion
USEPA = United States Environmental Protection Agency
1 = Parameter was detected in associated Field Reagent Blank
2 = Calculated manually from laboratory results.
3 = Detections of all PFAS likely due to the laboratory incorrectly adding a small portion of either the matrix spike (MS) or matrix spike duplicate (MSD) aliquot to the sample when going through the solid phase extraction column.

FIGURES

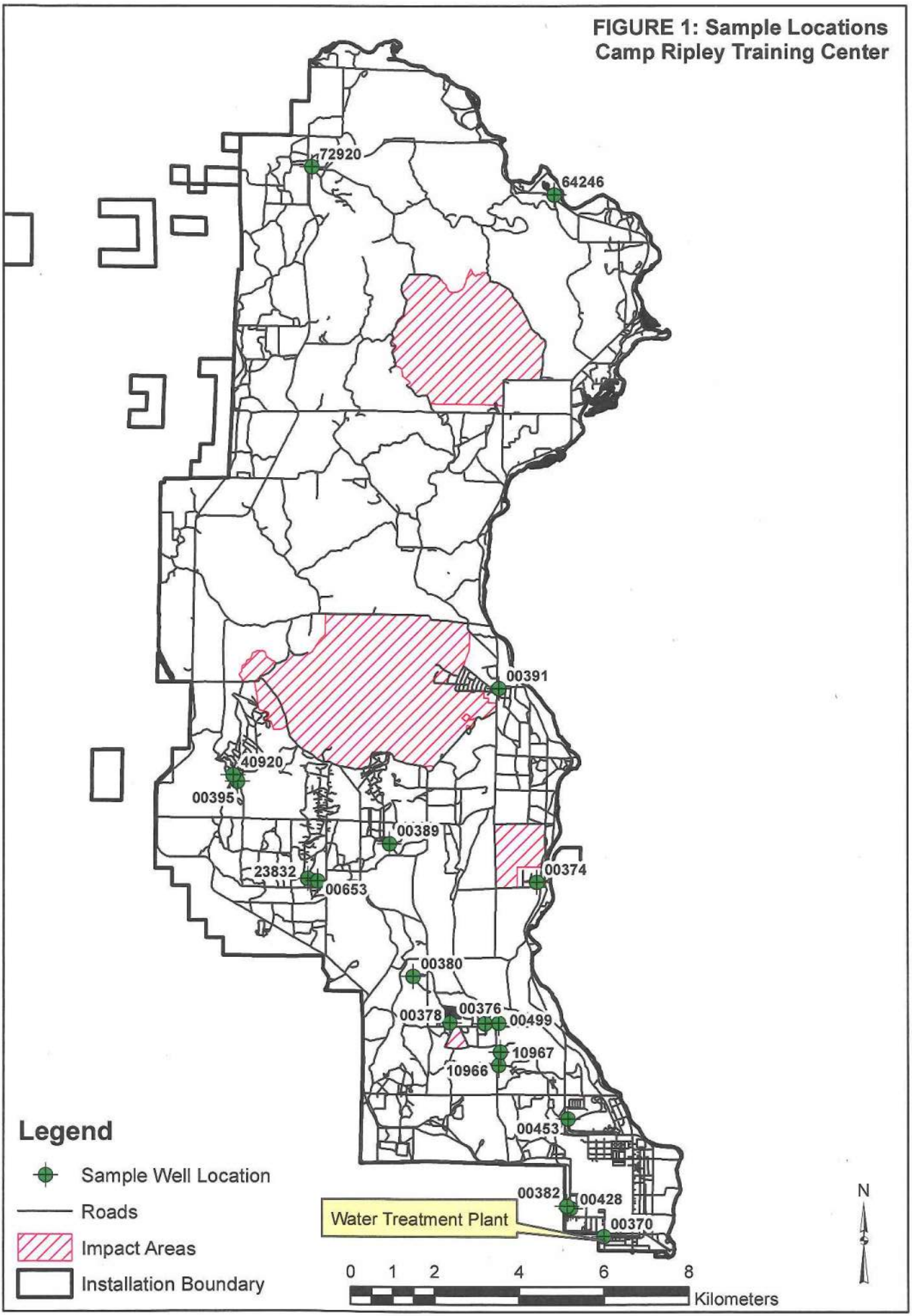


FIGURE 1: Sample Locations
Camp Ripley Training Center
72920
64246
00391
40920
00395
00389
23832
00653
00374
00380
00378
00376
00499
10967
10966
00453
00382
00428
00370
Water Treatment Plant
Legend
Sample Well Location
Roads
Impact Areas
Installation Boundary
0 1 2 4 6 8
Kilometers
N

APPENDIX A – TRIP REPORTS

Photos from the 5/12/2020 sampling event can be viewed in the Trip Reports individually stored by the MNDMA.

TRIP REPORT - MN DMA Camp Ripley PFAS Sampling

5/12/2020; Burns & McDonnell
Waylon Hirst

Field preparation involved the selection of only recommended materials and equipment referenced in the MN DMA's Bottle Selection *and other Sampling Considerations When Sampling for Per and Poly-Fluoroalkyl Substances* guidance, no prohibited materials were prepared.

0445 W. Hirst Mob to Site (Burns & McDonnell).
0658 On Site; meet with J LaForce and C. Freeman to begin sampling event (MN DMA).
0703 Begin 10-Minute purge from spigot at building 2-248 (H Well). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0715 Collect sample W-MN-RIPL-001-12MAY20. (Sample Location 00370, Well No. 224577, RPUID 258569)
0725 Begin 10-Minute purge from spigot at building 17-247 (N Well). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0735 Collect sample W-MN-RIPL-003-12MAY20. (Sample Location 00428, Well No. 622775, RPUID 257443)
0744 Begin 10-Minute purge from spigot at building 17-246 (L Well). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0755 Collect sample W-MN-RIPL-002-12MAY20. Collect DUP-1. (Sample Location 00382, Well No. 470668, RPUID 258580)
0810 Begin 10-Minute purge from water treatment plant building at pre treatment spigot and at post treatment faucet in sink (with aerator removed). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0820 Collect sample W-MN-RIPL-004-12MAY20. Collect DUP-2. (Pre-Treatment)
0825 Collect sample W-MN-RIPL-005-12MAY20. (Post-Treatment)
0909 Begin 10-Minute purge from utility sink faucet in Ammo building 24118. Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0920 Collect sample W-MN-RIPL-006-12MAY20. Collect MS/MSD. (Sample Location 00453, Well No. 641304, RPUID 257453)
0948 Begin 10-Minute purge from faucet (with aerator removed) in building 13051. Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1000 Collect sample W-MN-RIPL-007-12MAY20. Collect FB-1 with PFAS free water. (Sample Location 00374, Well No. 451231, RPUID 258572)
1026 Begin 10-Minute purge from faucet (with aerator removed) in building 34077. Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1040 Collect sample W-MN-RIPL-008-12MAY20. Collect MS/MSD. (Sample Location 00391, Well No. 267561, RPUID 258588)
1119 Begin 10-Minute purge from pump spigot (with hose detached) at Plumbley School Water Point. Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1130 Collect sample W-MN-RIPL-009-12MAY20. (Sample Location = Outdoors, Well No. 451230, RPUID 251780)
1152 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in Infantry Squad Battle Course building (72076). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1205 Collect sample W-MN-RIPL-010-12MAY20. Collect FB-2 with PFAS free water. (Sample Location 72920, Well No. 786124, RPUID 1068497)
1253 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in MPMG Classroom building (40225). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1305 Collect sample W-MN-RIPL-011-12MAY20. (Sample Location 40920, Well No. 790987, RPUID 1184306)
1319 Begin 10-Minute purge from womens bathroom faucet (with aerator removed) in Old Classroom building (40078). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1330 Collect sample W-MN-RIPL-012-12MAY20. (Sample Location 00395, Well No. 495630, RPUID 258792)
1345 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in Center Range building (23811). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1355 Collect sample W-MN-RIPL-013-12MAY20. (Sample Location 23832, Well No. 799708, RPUID 1265785)
1405 Begin 10-Minute purge from womens bathroom faucet (with aerator removed) in Center Range building (23076). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1415 Collect sample W-MN-RIPL-014-12MAY20. (Sample Location 00653, Well No. 720427, RPUID 257697)
1434 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in East Range building (25076). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1445 Collect sample W-MN-RIPL-015-12MAY20. (Sample Location 00389, Well No. 551064, RPUID 258586)
1520 Begin 10-Minute purge from womens bathroom faucet (with aerator removed) in Medical Simulation Training Center building (10228). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1530 Collect sample W-MN-RIPL-018-12MAY20. (Sample Location 10967, Well No. 810678, RPUID 1232503)
1552 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in F-Range Biathlon Range building (15076). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1605 Collect sample W-MN-RIPL-022-12MAY20. (Sample Location 00380, Well No. 470506, RPUID 258578)
1618 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in A-4 Range building (14077). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1630 Collect sample W-MN-RIPL-021-12MAY20. Collect DUP-3. (Sample Location 00378, Well No. 451238, RPUID 258576)
1643 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in A-3 Range building (14076). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1655 Collect sample W-MN-RIPL-020-12MAY20. Collect FB-3 with PFAS free water. (Sample Location 00376, Well No. 451237, RPUID 258574)
1703 Begin 10-Minute purge from womens bathroom faucet (with aerator removed) in A-12 Range building (14078). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1715 Collect sample W-MN-RIPL-019-12MAY20. (Sample Location 00499, Well No. 677254, RPUID 257472)
1728 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in CACTF building (10124). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1740 Collect sample W-MN-RIPL-017-12MAY20. (Sample Location 10966, Well No. 768279, RPUID 1092010)
1750 Demob.

W. Hirst relinquish samples to Eurofins TA in Saint Louis Park, MN on 20200513 @ 1100.

Photos from the 9/29/2020 sampling event can be viewed in the Trip Reports individually stored by the MNDMA.

TRIP REPORT - MN DMA Camp Ripley PFAS Sampling

9/29/2020; Burns & McDonnell
Waylon Hirst

Field preparation involved the selection of only recommended materials and equipment referenced in the MN DMA's Bottle Selection *and other Sampling Considerations When Sampling for Per and Poly-Fluoroalkyl Substances* guidance, no prohibited materials were prepared.

0445 W. Hirst Mob to Site (Burns & McDonnell).
0659 On Site; meet with J LaForce to begin sampling event (MN DMA).
0704 Begin 10-Minute purge from spigot at building 2-248 (H Well). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0709 Begin 10-Minute purge from spigot at building 17-247 (N Well). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0714 Collect sample W-MN-RIPL-001-29SEP20. Collect DUP1. (Sample Location 00370, Well No. 224577, RPUID 258569)
0724 Collect sample W-MN-RIPL-003-29SEP20. (Sample Location 00428, Well No. 622775, RPUID 257443)
0724 Begin 10-Minute purge from spigot at building 17-246 (L Well). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0739 Collect sample W-MN-RIPL-002-29SEP20. (Sample Location 00382, Well No. 470668, RPUID 258580)
0744 Begin 10-Minute purge from water treatment plant building at pre treatment spigot and at post treatment faucet in sink (with aerator removed). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0754 Collect sample W-MN-RIPL-004-29SEP20. (Pre-Treatment)
0759 Collect sample W-MN-RIPL-005-29SEP20. (Post-Treatment)
0832 Begin 10-Minute purge from utility sink faucet in Ammo building 24118. Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0842 Collect sample W-MN-RIPL-006-29SEP20. Collect DUP2. (Sample Location 00453, Well No. 641304, RPUID 257453)
0855 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in CACTF building (10124). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0905 Collect sample W-MN-RIPL-017-29SEP20. Collect MS/MSD. (Sample Location 10966, Well No. 768279, RPUID 1092010)
0918 Begin 10-Minute purge from womens bathroom faucet (with aerator removed) in Medical Simulation Training Center building (10228). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0928 Collect sample W-MN-RIPL-018-29SEP20. (Sample Location 10967, Well No. 810678, RPUID 1232503)
0939 Begin 10-Minute purge from womens bathroom faucet (with aerator removed) in A-12 Range building (14078). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0949 Collect sample W-MN-RIPL-019-29SEP20. Collect FB-1 with PFAS free water. (Sample Location 00499, Well No. 677254, RPUID 257472)
1000 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in A-3 Range building (14076). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1010 Collect sample W-MN-RIPL-020-29SEP20. (Sample Location 00376, Well No. 451237, RPUID 258574)
1017 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in A-4 Range building (14077). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1027 Collect sample W-MN-RIPL-021-29SEP20. (Sample Location 00378, Well No. 451238, RPUID 258576)
1040 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in F-Range Biathlon Range building (15076). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1050 Collect sample W-MN-RIPL-022-29SEP20. (Sample Location 00380, Well No. 470506, RPUID 258578)
1105 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in East Range building (25076). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1115 Collect sample W-MN-RIPL-015-29SEP20. Collect FB-2 with PFAS free water. (Sample Location 00389, Well No. 551064, RPUID 258586)
1131 Begin 10-Minute purge from womens bathroom faucet (with aerator removed) in Center Range building (23076). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1141 Collect sample W-MN-RIPL-014-29SEP20. Collect MS/MSD. (Sample Location 00653, Well No. 720427, RPUID 257697)
1150 Begin 10-Minute purge from womens bathroom faucet (with aerator removed) in Center Range building (23811). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1200 Collect sample W-MN-RIPL-013-29SEP20. (Sample Location 23832, Well No. 799708, RPUID 1265785)
1218 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in Old Classroom building (40078). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1228 Collect sample W-MN-RIPL-012-29SEP20. (Sample Location 00395, Well No. 495630, RPUID 258792)
1234 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in MPMG Classroom building (40225). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1244 Collect sample W-MN-RIPL-011-29SEP20. Collect FB-3 with PFAS free water. (Sample Location 40920, Well No. 790987, RPUID 1184306)
1325 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in Infantry Squad Battle Course building (72076). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1335 Collect sample W-MN-RIPL-010-29SEP20. (Sample Location 72920, Well No. 786124, RPUID 1068497)
1348 Begin 10-Minute purge from pump spigot (with hose detached) at Plumbley School Water Point. Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1358 Collect sample W-MN-RIPL-009-29SEP20. (Sample Location = Outdoors, Well No. 451230, RPUID 251780)
1423 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in building 34077. Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1433 Collect sample W-MN-RIPL-008-29SEP20. Collect DUP3. (Sample Location 00391, Well No. 267561, RPUID 258588)
1451 Begin 10-Minute purge from north bathroom faucet (with aerator removed) in building 13051. Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1501 Collect sample W-MN-RIPL-007-29SEP20. (Sample Location 00374, Well No. 451231, RPUID 258572)
1530 Demob.

W. Hirst relinquish samples to Eurofins TA in Saint Louis Park, MN on 20200930 @ 0830.

Photos from the 11/23/2020 sampling event can be viewed in the Trip Reports individually stored by the MNDMA.

TRIP REPORT - MN DMA Camp Ripley PFAS Sampling

11/23/2020; Burns & McDonnell
Waylon Hirst

Field preparation involved the selection of only recommended materials and equipment referenced in the MN DMA's Bottle Selection *and other Sampling Considerations When Sampling for Per and Poly-Fluoroalkyl Substances* guidance, no prohibited materials were prepared.

0445 W. Hirst Mob to Site (Burns & McDonnell).
0655 On Site; meet with C Freeman and M Bogart to begin sampling event (MN DMA).
0707 Begin 10-Minute purge from spigot at building 2-248 (H Well). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0717 Collect sample W-MN-RIPL-001-23NOV20. Collect DUP1. (Sample Location 00370, Well No. 224577, RPUID 258569)
0727 Begin 10-Minute purge from spigot at building 17-247 (N Well). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0729 Begin 10-Minute purge from spigot at building 17-246 (L Well). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0737 Collect sample W-MN-RIPL-003-23NOV20. (Sample Location 00428, Well No. 622775, RPUID 257443)
0744 Collect sample W-MN-RIPL-002-23NOV20. (Sample Location 00382, Well No. 470668, RPUID 258580)
0751 Begin 10-Minute purge from water treatment plant building at pre treatment spigot and at post treatment faucet in sink (with aerator removed). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0801 Collect sample W-MN-RIPL-004-23NOV20. (Pre-Treatment)
0808 Collect sample W-MN-RIPL-005-23NOV20. (Post-Treatment) Collect FB-1 with PFAS free water.
0840 Begin 10-Minute purge from utility sink faucet in Ammo building 24118.
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0850 Collect sample W-MN-RIPL-006-23NOV20. Collect MS/MSD. (Sample Location 00453, Well No. 641304, RPUID 257453)
0903 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in CACTF building (10124).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0913 Collect sample W-MN-RIPL-017-23NOV20. (Sample Location 10966, Well No. 768279, RPUID 1092010)
0927 Begin 10-Minute purge from womens bathroom faucet (with aerator removed) in Medical Simulation Training Center building (10228).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0937 Collect sample W-MN-RIPL-018-23NOV20. (Sample Location 10967, Well No. 810678, RPUID 1232503)
0944 Begin 10-Minute purge from womens bathroom faucet (with aerator removed) in A-12 Range building (14078).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0950 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in A-3 Range building (14076).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0954 Collect sample W-MN-RIPL-019-23NOV20. (Sample Location 00499, Well No. 677254, RPUID 257472)
1000 Collect sample W-MN-RIPL-020-23NOV20. Collect DUP2. (Sample Location 00376, Well No. 451237, RPUID 258574)
1005 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in A-4 Range building (14077).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1015 Collect sample W-MN-RIPL-021-23NOV20. (Sample Location 00378, Well No. 451238, RPUID 258576)
1030 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in F-Range Biathlon Range building (15076).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1040 Collect sample W-MN-RIPL-022-23NOV20. (Sample Location 00380, Well No. 470506, RPUID 258578)
1054 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in East Range building (25076).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1104 Collect sample W-MN-RIPL-015-23NOV20. Collect MS/MSD. (Sample Location 00389, Well No. 551064, RPUID 258586)
1118 Begin 10-Minute purge from womens bathroom faucet (with aerator removed) in Center Range building (23076).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1124 Begin 10-Minute purge from womens bathroom faucet (with aerator removed) in Center Range building (23811).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1128 Collect sample W-MN-RIPL-014-23NOV20. Collect FB-2 with PFAS free water. (Sample Location 00653, Well No. 720427, RPUID 257697)
1139 Collect sample W-MN-RIPL-013-29SEP20. (Sample Location 23832, Well No. 799708, RPUID 1265785)
1157 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in Old Classroom building (40078).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1206 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in MPMG Classroom building (40225).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1207 Collect sample W-MN-RIPL-012-23NOV20. (Sample Location 00395, Well No. 495630, RPUID 258792)
1216 Collect sample W-MN-RIPL-011-23NOV20. (Sample Location 40920, Well No. 790987, RPUID 1184306)
1252 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in Infantry Squad Battle Course building (72076).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1302 Collect sample W-MN-RIPL-010-23NOV20. Collect FB-3 with PFAS free water. (Sample Location 72920, Well No. 786124, RPUID 1068497)
1320 Begin 10-Minute purge from pump spigot (with hose detached) at Plumbley School Water Point.
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1330 Collect sample W-MN-RIPL-009-23NOV20. (Sample Location = Outdoors, Well No. 451230, RPUID 251780)
1358 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in building 34077.
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1408 Collect sample W-MN-RIPL-008-23NOV20. Collect DUP3. (Sample Location 00391, Well No. 267561, RPUID 258588)
Begin 10-Minute purge from north bathroom faucet (with aerator removed) in building 13051. Note: Due to an issue with this well pump, maintenance was being conducted during the time of sampling. This well was intermittently purged for approximately 6 minutes during a 45
1425 minute period due to the pump for this well continually shutting down.
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1510 Collect sample W-MN-RIPL-007-23NOV20. (Sample Location 00374, Well No. 451231, RPUID 258572)
1535 Demob.

W. Hirst relinquish samples to Eurofins TA in Saint Louis Park, MN on 20201124 @ 0830.

Field preparation involved the selection of only recommended materials and equipment referenced in the MN DMA's Bottle Selection *and other Sampling Considerations When Sampling for Per and Poly-Fluoroalkyl Substances* guidance, no prohibited materials were prepared.

0440 W. Hirst Mob to Site (Burns & McDonnell).
0655 On Site; meet with C Freeman to begin sampling event (MN DMA).
0707 Begin 10-Minute purge from spigot at building 2-248 (H Well). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0715 Begin 10-Minute purge from spigot at building 17-247 (N Well). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0717 Collect sample W-MN-RIPL-001-24FEB21. Collect FB-1 with PFAS free water. (Sample Location 00370, Well No. 224577, RPUID 258569)
0729 Begin 10-Minute purge from spigot at building 17-246 (L Well). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0730 Collect sample W-MN-RIPL-003-24FEB21. Collect DUP1. (Sample Location 00428, Well No. 622775, RPUID 257443)
0739 Collect sample W-MN-RIPL-002-24FEB21. (Sample Location 00382, Well No. 470668, RPUID 258580)
0747 Begin 10-Minute purge from water treatment plant building at pre treatment spigot and at post treatment faucet in sink (with aerator removed). Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0757 Collect sample W-MN-RIPL-004-24FEB21. Collect FB-2 with PFAS free water. (Pre-Treatment)
0804 Collect sample W-MN-RIPL-005-24FEB21. Collect DUP2. (Post-Treatment)
0832 Begin 10-Minute purge from utility sink faucet in Ammo building 24118.
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0842 Collect sample W-MN-RIPL-006-24FEB21. (Sample Location 00453, Well No. 641304, RPUID 257453)
0854 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in CACTF building (10124).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0900 Begin 10-Minute purge from womens bathroom faucet (with aerator removed) in Medical Simulation Training Center building (10228).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0904 Collect sample W-MN-RIPL-017-24FEB21. Collect MS/MSD. (Sample Location 10966, Well No. 768279, RPUID 1092010)
0915 Collect sample W-MN-RIPL-018-24FEB21. (Sample Location 10967, Well No. 810678, RPUID 1232503)
0920 Begin 10-Minute purge from womens bathroom faucet (with aerator removed) in A-12 Range building (14078).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0926 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in A-3 Range building (14076).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0930 Collect sample W-MN-RIPL-019-24FEB21. (Sample Location 00499, Well No. 677254, RPUID 257472)
0940 Collect sample W-MN-RIPL-020-24FEB21. Collect DUP3. (Sample Location 00376, Well No. 451237, RPUID 258574)
0943 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in A-4 Range building (14077).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
0953 Collect sample W-MN-RIPL-021-24FEB21. (Sample Location 00378, Well No. 451238, RPUID 258576)
1012 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in F-Range Biathlon Range building (15076).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1022 Collect sample W-MN-RIPL-022-24FEB21. (Sample Location 00380, Well No. 470506, RPUID 258578)
1054 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in East Range building (25076).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1104 Collect sample W-MN-RIPL-015-24FEB21. (Sample Location 00389, Well No. 551064, RPUID 258586)
1119 Begin 10-Minute purge from womens bathroom faucet (with aerator removed) in Center Range building (23076).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1122 Begin 10-Minute purge from womens bathroom faucet (with aerator removed) in Center Range building (23811).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1129 Collect sample W-MN-RIPL-014-24FEB21. (Sample Location 00653, Well No. 720427, RPUID 257697)
1132 Collect sample W-MN-RIPL-013-29SEP20. (Sample Location 23832, Well No. 799708, RPUID 1265785)
1150 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in Old Classroom building (40078).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1154 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in MPMG Classroom building (40225).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1200 Collect sample W-MN-RIPL-012-24FEB21. Collect MS/MSD. (Sample Location 00395, Well No. 495630, RPUID 258792)
1204 Collect sample W-MN-RIPL-011-24FEB21. (Sample Location 40920, Well No. 790987, RPUID 1184306)
1251 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in Infantry Squad Battle Course building (72076).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1301 Collect sample W-MN-RIPL-010-24FEB21. (Sample Location 72920, Well No. 786124, RPUID 1068497)
1321 Begin 10-Minute purge from pump spigot (with hose detached) at Plumbley School Water Point.
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1331 Collect sample W-MN-RIPL-009-24FEB21. (Sample Location = Outdoors, Well No. 451230, RPUID 251780)
1400 Begin 10-Minute purge from mens bathroom faucet (with aerator removed) in building 34077.
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1410 Collect sample W-MN-RIPL-008-24FEB21. Collect FB-3 with PFAS free water. (Sample Location 00391, Well No. 267561, RPUID 258588)
Begin 10-Minute purge from north bathroom faucet (with aerator removed) in building 13051. Note: Due to an issue with this well pump, this well was intermittently purged for approximately 2 minutes during a 30 minute period due to the pump for this well continually shutting down.
1434 Sample was collected at the first spigot after the well (see photo).
Wash hands in accordance with SOP using pfas free water and alconox. Don 2 pair of nitrile gloves prior to sampling.
1505 Collect sample W-MN-RIPL-007-24FEB21. (Sample Location 00374, Well No. 451231, RPUID 258572)
1530 Demob.

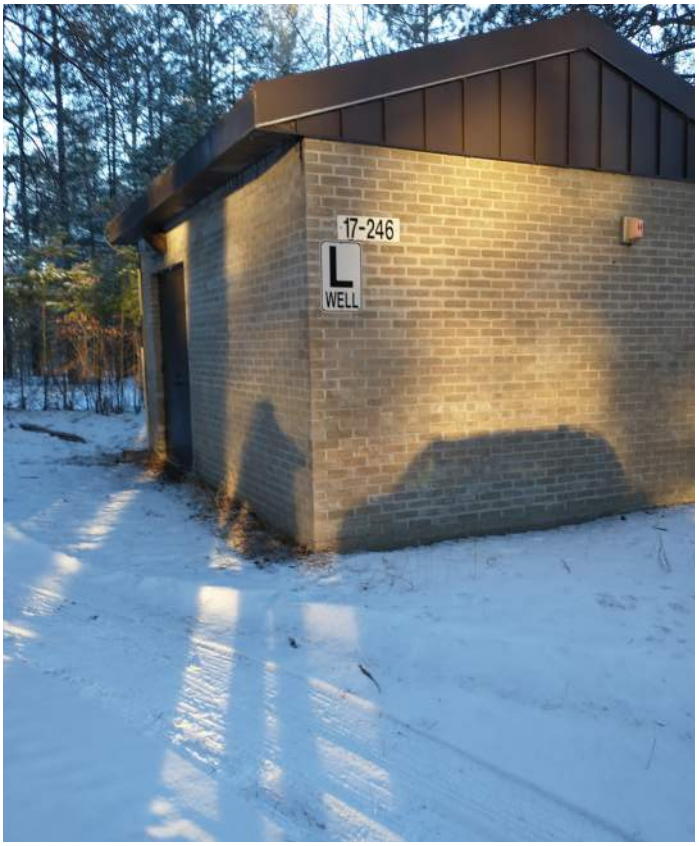
W. Hirst relinquish samples to Eurofins TA in Saint Louis Park, MN on 20210225 @ 1010.

2-248 (H Well)

2-248 (H Well) - sample loc 001

17-247 (N Well)

17-247 (N Well) - sample loc 003



17-246 (L Well)

17-246 (L Well) - sample loc 002

2-247 (WTP)

2-247 (WTP pre-treatment) - sample loc 004

2-247 (WTP post-treatment) - sample loc 005

24118 (Ammo Surveillance Building)

24118 (Ammo Surveillance Building) - sample loc 006

10124 (Combined Arms Collective Training Facility)

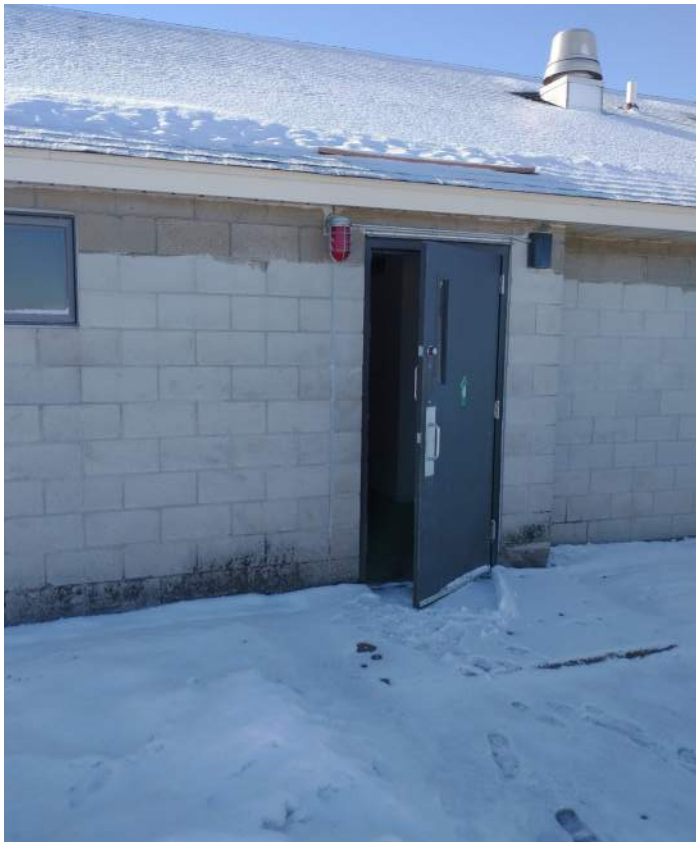
10124 (Combined Arms Collective Training Facility) - sample loc 017

10124 (Medical Simulation Training Center)

10124 (Medical Simulation Training Center) - sample loc 018

14078 (A-12 Range)

14078 (A-12 Range) - sample loc 019



14076 (A-3 Range)

14076 (A-3 Range) - sample loc 020

14077 (A-4 Range)

14077 (A-4 Range) - sample loc 021

15076 (F-Range Biathlon Range) - sample loc 022

15076 (F-Range Biathlon Range)

25076 (East Range)

25076 (East Range) - sample loc 015

23076 (Center Range - Covered Mess Old Classroom)

23076 (Center Range - Covered Mess Old Classroom) - sample loc 014

23811 (Center Range - Range Operations Building Latrines New Classroom)

23811 (Center Range - Range Operations Building Latrines New Classroom) - sample loc 013

40078 (West Range Old Classroom)

40078 (West Range Old Classroom) - sample loc 012

40225 (West Range New Classroom)

40225 (West Range New Classroom) - sample loc 011

72076 (Infantry Squad Battle Course)

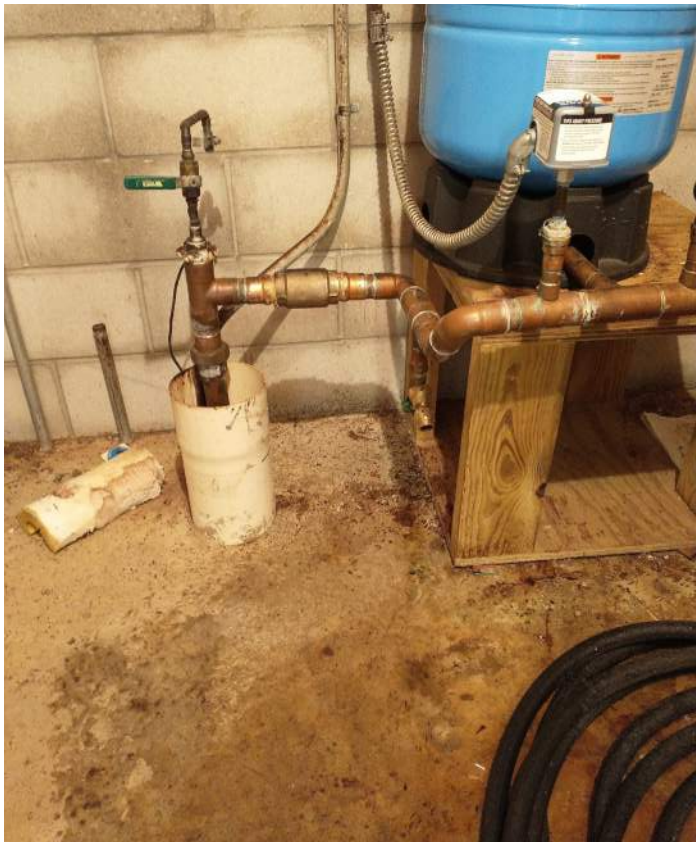
72076 (Infantry Squad Battle Course) - sample loc 010

Plumbly Water Supply Point - sample loc 009

34077 (North Range)

34077 (North Range) - sample loc 008

13051 (D-Range)



13051 (D-Range) - sample loc 007

APPENDIX B – MNDMA'S BOTTLE SELECTION AND OTHER SAMPLING CONSIDERATIONS WHEN SAMPLING FOR PFAS

Bottle Selection and other Sampling Considerations When Sampling for Per- and Poly-Fluoroalkyl Substances (PFAS)

What type of samples does this guidance apply to?

This guidance applies to any sample taken for the analysis of per- and poly-fluoroalkyl substances (PFAS). This guidance is applicable to any liquid, soil, sediment, and tissue matrix.

Why do we need special sampling guidance for this?

PFAS are a class of manufactured compounds that are extensively used to make everyday items more resistant to stains, grease, and water. These chemicals have been used in a variety of industrial, commercial and consumer products. Some of these products could be present and/or used during a routine sampling event, such as plastic bags and bottles, waterproof clothing, detergents, and waterproof pens and paper. Because the EPA has established health advisory levels that are very low concentrations (70 parts per trillion) for two PFAS, perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS), the use of these products could possibly contaminate the samples during sample collection. This includes what is used to prepare the sampling site, what is used to collect the sample, what is used to clean the sampling equipment, what the sample is collected in, and how the sample is shipped. This guidance will provide steps to take to help you avoid these potential sources of contamination.

What type of bottle do I need to collect my sample in?

All samples to be analyzed for PFAS must be collected in a high density polyethylene (HDPE) container with an unlined plastic screw cap, except as stated below for drinking water samples by Method 537 for the method specified short list of PFAS. Polypropylene bottles may be used in this instance only.

Why can't we use the polypropylene bottles that are recommended in the drinking water method (EPA Method 537)?

EPA Method 537 is used for the analysis of a short list of PFAS. Polypropylene bottles can be used for this short list of analytes by this method. While some of these analytes do adsorb onto the polypropylene container, their adsorption is reversed by the rinsing of the sample bottle, which is required by the method. Other analytes have not been studied and other methods do not require the sample bottle to be rinsed. Therefore, as a precaution, use of HDPE bottles for all other PFAS sample collection is required.

What do we need to avoid using during sampling events?

Below is a general list of prohibited materials. Specific guidelines are determined based on project requirements.

PROHIBITED Materials and Equipment
Teflon®-containing materials, when possible, should be avoided (e.g., tubing, bailers, tape, and plumbing paste). In cases where Teflon®-containing materials are unavoidable, ensure adequate purging is performed prior to sampling (e.g., in-well pumps) and/or rinse blanks are collected prior to sampling.
LDPE or polypropylene containing materials (e.g., bags or containers used to transport samples)
Paper products such as waterproof field books, plastic clipboards, binders, spiral hard cover notebooks, sticky notes or glue materials
Markers
Chemical (blue) ice packs
Decontamination soaps containing fluoro-surfactants such as Decon 90
Water that is not verified to be "PFAS-free" to be used for trip and decontamination blanks and decontamination processes
Water resistant, waterproof, stain-treated clothing or shoes including Gore-Tex™ and Tyvek® materials

Bottle Selection and other Sampling Considerations When Sampling for Per- and Poly-Fluoroalkyl Substances (PFAS)

Is there anything else I should consider as a potential source of contamination?

Yes. There is some documentation that indicates that some personal care products, as well as food and drinks, may introduce additional ways your sample may get contaminated. Therefore, these additional precautions should be taken:

- Field personnel should not use cosmetics, moisturizers, hand cream, or other related products.
- Many manufactured sunblock and insect repellents contain PFAS and should not be used.
- No food or drink shall be brought on-site, with the exception of bottled water and hydration drinks.

What can we use for our sampling event instead?

Below is a general list of recommended materials. Specific guidelines are determined based on project requirements.

Recommended Materials and Equipment
HDPE and silicon Materials include: tubing, bailers, tape, plumbing paste
Acetate liners for direct push technologies
Nitrile gloves – change often
Loose paper with Masonite or aluminum clipboards
Pens
Bags of ice
Alconox® or Liquinox®
Laboratory supplied and verified "PFAS-free" water to be used for trip and decontamination blanks and decontamination processes
Cotton construction is recommended for field clothing and should be laundered a minimum of 6 times from time of purchase due to possible PFAS related treatments. Fabric softener must be avoided. Rain gear should be made from polyurethane and wax-coated materials.

APPENDIX C – BURNS & MCDONNELL'S SOP 410 SAMPLING PROTOCOLS FOR PERFLUOROALKYL AND POLYFLUOROALKYL SUBSTANCES

SOP 410
Sampling Protocols for Perfluoroalkyl and Polyfluoroalkyl Substances

Revision 01
04/06/2018

Approved by:

04/03/2018

Martha Hildebrandt, PG, Associate Geologist,
Environmental Services Division

Date

04/03/2018

Brian Hoye, PG, Senior Geologist,
Environmental Services Division

Date

04/06/2018

John Hesemann, PE,
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Date

Biennial Review:

Revision/Review	Date	Responsible Party	Description of Change
Revision 01	04/03/2018	Hildebrandt, Martha	Minor grammar and reference updates.

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1.0 PURPOSE AND APPLICABILITY

The purpose of *SOP 410 Sampling Protocols for Perfluoroalkyl and Polyfluoroalkyl Substances* is to establish uniform procedures and site management protocols for the collection of samples to be analyzed for perfluoroalkyl and polyfluoroalkyl substances (PFAS) at environmental sites. This standard operating procedure (SOP) covers the ***additional precautions and procedures*** that should be followed when sampling for PFAS and ***supplements*** the SOPs used for specific sampling methods, documentation, and field procedures. Sample rationale and scope including locations, depths, required sample amounts, etc. are detailed in the Project-Specific Work Plan(s). *SOP 410 Sampling Protocols for Perfluoroalkyl and Polyfluoroalkyl Substances* has been prepared in accordance with the *Guidance for the Preparing of Standard Operating Procedures* (United States Environmental Protection Agency [USEPA], 2007) and the Burns & McDonnell Engineering Co., Inc (Burns & McDonnell) *Policy Manual* (Burns & McDonnell, 2018).

2.0 SUMMARY OF PFAS PROTOCOLS

PFAS are a family of chemicals that do not occur naturally in the environment. PFAS are persistent, bioaccumulative, and toxic and, due to their persistence in the environment and moderate solubility, can be transported long distances in air and water (Government of Western Australia, Department of Environmental Regulation [WA DER], 2016). Common uses of PFAS have included fire-fighting foam; impartation of water-, oil-, and fire-resistant properties to textiles and other materials; nonstick coatings; insecticides; and a wide variety of other industrial purposes. Because of this, PFAS are found in commonplace man-made objects. Field personnel sampling for PFAS should take this into consideration and take actions to prevent PFAS-containing materials and goods from entering the work site so to minimize the potential of cross contamination by sampling equipment, sampling supplies, clothing worn by the samplers, and other materials used to support the field investigation. PFAS may also be present in site media including air, soil, and water. Field personnel should take precautions to limit the potential for contamination of project samples by non-target environmental media and collect field and rinsate blanks to assess the potential for cross-contamination. This SOP presents the ***additional precautions and procedures*** that should be followed when sampling for PFAS and as such ***supplements*** the SOPs used for specific sampling methods, documentation, and field procedures. Procedures as presented in this SOP are based upon the *Interim Guidance on the Assessment and Management of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS)* (WA DER, 2016).

3.0 DEFINITIONS

- **Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) -** A large group of manufactured compounds consisting of a fully fluorinated hydrophobic alkyl chain and a hydrophilic end group. PFAS are used in a wide range of applications for their dirt, water, and grease resistance; heat, chemical, and abrasion resistance; surfactant and dielectric properties; and thermal stability, versatility, strength, resilience, and durability.

- **Project-Specific Work Plan** – The plan(s) that details the rationale, scope, and techniques to be used at the Site to achieve the project objectives. Project-Specific Work Plans can include work plans, field sampling plans, quality assurance project plans, technical memorandums, and other documentation of proposed work.

- **Project-Specific Health and Safety Plan –** The plan(s) that addresses applicable safety and health procedures and requirements to be used at the Site. Project-Specific Health and Safety Plans can include Accident Prevention Plans, Site Health and Safety Plans, client accident and safety plans and protocols, technical memorandums, and other documentation of safety and health.

4.0 SAFETY AND HEALTH

Field activities as detailed in this SOP will be performed in accordance with applicable safety related documents/requirements which may include but are not limited to: Project-Specific Safety and Health Plans, the Burns & McDonnell *Safety and Health Program* (Burns & McDonnell, 2017), and site / client-specific requirements. Personal protective equipment (PPE) should be worn as appropriate and as detailed in the Project-Specific APP/SSHP. PPE requirements should be assessed daily and on a per task basis.

5.0 CAUTIONS

Cross-contamination of samples through improper decontamination or use of improper materials can result in false detections. Due to the low reporting and regulatory limits of PFAS, it is very important to

Resin	Resin Identification Code Option A	Resin Identification Code Option B
Polyethylene terephthalate	1 PETE	01 PET
High density polyethylene	2 HDPE	02 PE-HE
Polyvinyl chloride	3 V	03 PVC
Low density polyethylene	4 LDPE	04 PE-LD
Polypropylene	5 PP	05 PP
Polystyrene	6 PS	06 PS
Other resins	7 OTHER	07 O

*Resin codes from ASTM D7611, *Standard Practice for Coding Plastic Manufactured Articles for Resin Identification.*

minimize all potential cross-contamination and eliminate PFAS-containing materials from the immediate vicinity of the area where samples are being collected. In the United States, PFAS, particularly perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS), have been phased out of production and use in many applications; however, it is still used in the production of goods in certain foreign countries such as China. As a result, field personnel should avoid using materials manufactured in these countries when reliable US-made products are available (e.g. – plastic bags, paper towels, etc.).

Preferences for plastic materials to be used include high density polyethylene (HDPE) and polypropylene. Well casing and screen materials should consist of nonplasticized polyvinyl chloride (PVC). Teflon™ should not be used in any application when sampling for PFAS. A table with resin codes is included to aid in the identification of marked plastic materials and supplies.

Specific instructions in reference to protocols to follow and materials to be used are detailed below. If, for any reason, there is a question about a material used, the sampler should, *with approval of the project manager*, obtain a rinsate sample from the material for analysis of target PFAS analytes.

6.0 PERSONNEL QUALIFICATIONS

Burns & McDonnell personnel conducting on-site environmental activities will have completed the 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) course and annual 8-hour HAZWOPER refresher courses. At a minimum, one person on site will be certified in first aid and cardiopulmonary resuscitation (CPR), and, if multiple people are on site, at least one person will have completed the 8-hour HAZWOPER Supervisor Training course. If Burns & McDonnell subcontractors are on site then, at a minimum, one Burns & McDonnell person will have completed the OSHA 30-hour Construction Industry Outreach Training course.

7.0 EQUIPMENT AND SUPPLIES

Equipment and supplies to be used during PFAS sampling should be chosen so to be free of PFAS. Details on specific equipment for procedures is found in Section 8.0 below. While the Field Site Manager holds final responsibility for identifying materials that are free of PFAS, the Project Manager or their designee will be responsible for making subcontractors (e.g. drillers) aware of this requirement.

8.0 PROCEDURES

The following presents the ***additional precautions and procedures*** that should be followed when sampling for PFAS and as such ***supplements*** the SOPs used for specific sampling methods, documentation, and field procedures. Specific SOPs to be used at a site will be included in the *Site-Specific Project Plans*.

8.1 Drilling, Development, and Sampling of Monitoring Wells

All equipment used in the construction, development, and sampling of monitoring wells should be free of Teflon and other potential sources of PFAS and decontaminated as detailed in Section 8.5 below. Prior to the start of any activity, field personnel should meet the requirements of personal wear and protection as detailed in Section 8.6 below. Monitoring wells should be constructed of new, nonplasticized (rigid) PVC or stainless steel, and care should be taken to ensure that well materials and drilling fluids used are PFAS-free. When identifying a water source to be used in drilling and well construction, care should be taken to assess whether or not the water supply has been affected by PFAS as many water treatment systems are not constructed to remove PFAS. If water is used in the drilling process, a sample should be submitted for PFAS analysis. HDPE and polypropylene development and sampling equipment is recommended. Tubing should be HDPE or silicone. Teflon or Teflon-containing field equipment such as tubing, bailers, bladders, tape, etc. should not be on or used at the site. Aluminum foil should not be used on the site.

Groundwater samples should be collected using peristaltic pumps with silicone or HDPE tubing, HDPE HydraSleeves™, or bladder pumps obtained from a reputable vendor of environmental supplies. If bladder pumps are used, none of the portions of the pump may be composed of Teflon, and bladders and O-rings should be changed between locations. Groundwater samples should not be filtered in the field. Efforts should be made to minimize the turbidity of groundwater samples. During sample processing and storage, efforts should be made to minimize the exposure of the groundwater sample to light.

8.2 Soil Sampling

Any part of the equipment that may contact the sample should be decontaminated as described in Section 8.5. Prior to the start of any activity, field personnel should meet the requirements of personal wear and protection as detailed in Section 8.6 below. Soil cores should be collected using single-use PVC liners.

8.3 Surface Water and Sediment Sampling

Any part of the equipment that may contact the sample should be decontaminated as described in Section 8.5. Prior to the start of any activity, field personnel should meet the requirements of personal wear and protection as detailed in Section 8.6 below. Waders should be constructed from fabric that has not been

treated with water proofing coatings. Sediment cores should be collected using single-use PVC liners. Unless specified otherwise, surface water samples should be collected at least 4 inches below the top of water and 4 inches above the top of sediment and as near to the center of the channels as possible. Surface water should be collected by submerging the container entirely within the water prior to removing the lid to prevent the collection of any surface films. During sample processing and storage, efforts should be made to minimize the exposure of the surface water sample to light.

8.4 Potable Water Sampling

Any part of the equipment that may contact the sample should be decontaminated as described in Section 8.5. Prior to the start of any activity, field personnel should meet the requirements of personal wear and protection as detailed in Section 8.6 below. Chlorinated water may require a buffering agent to remove free chlorine, if so this should be specified in the Project-Specific Work Plan. During sample processing and storage, efforts should be made to minimize the exposure of the water sample to light.

8.5 Equipment Decontamination

Decontamination of drilling and sampling equipment should avoid the use of detergents that have not been verified by the manufacturer as being PFAS-free. Equipment should be scrubbed with a plastic brush using a solution prepared with PFAS-free water and Alconox, rinsed thoroughly in tap water, then triple rinsed in distilled water. Laboratory grade solvents such as acetone, hexane, methanol, and isopropanol can be used as required by the Site-Specific Work Plan.

8.6 Personal Wear and Protection

8.6.1 Gloves

Gloves wore for PFAS sampling will be composed of nitrile. Prior to the start of sampling, field personnel should wash their hands using soap and water, then rinse thoroughly in water prior to donning clean nitrile gloves. Most detergents and soaps are PFAS-free; however, the sampler should check the manufacturer’s ingredient list prior to use. A new pair of nitrile gloves should be donned prior to collecting each sample and at the start of each new field activity. If the old pair of gloves was compromised or if the field personnel’s ungloved hand(s) touched any item that may represent potential PFAS contamination, then the field personnel will wash their hands again prior to donning the new nitrile gloves.

8.6.2 Boots

Treated boots (waterproof, water-resistant, or stain-resistant) should not be brought or worn on site. Steel-toed boots made with polyurethane and PVC are acceptable.

8.6.3 Clothing

Clothing worn by field personnel should be washed a minimum of six times after purchase prior to being worn at the site. Most detergents and fabric softener are PFAS-free; however, the sampler should check the manufacturer's ingredient list prior to use. Clothing with stain-resistant, rain-resistant, or waterproof coatings (e.g. GORE-TEX®) should not be worn and should not be within 2 to 3 meters of the sampling area. Polyethylene rain gear, vinyl, or PVC clothing is acceptable. Tyvek clothing should not be used on site.

8.6.4 Sunscreens and Insect Repellants

Sunscreen, insect repellant, cosmetics, lotions, and moisturizers should not be used or brought on site unless known to be PFAS-free.

8.6.5 Food

Pre-wrapped foods and snacks or fast food papers or containers should not be brought on site. Breaks for meals should be off site and field personnel should wash their hands as detailed in 8.3.1 prior to starting work after breaks. Drinks brought on site should be in rigid plastic (i.e. HDPE) or stainless-steel containers.

8.7 Sample Containers and Shipping

Sample containers should consist of polypropylene or HDPE containers with polypropylene lids. Glass containers should not be used unless deemed by the laboratory as acceptable for PFAS analyses. Teflon-lined lids are prohibited. Blue ice should not be used either in the field or during transportation of samples or sample containers.

8.8 Field Documentation

Waterproof paper, notebooks, or labels should not be used on site unless known to be free of PFAS. Self-sticking notes and similar office products should not be used. Field documentation should be completed with a ball point pen on standard paper. Felt tip markers should not be used.

9.0 DATA AND RECORDS MANAGEMENT

Environmental field activities will be documented as detailed in *SOP 701 Field Documentation*. Field documentation will be completed as activities are conducted and will be relayed to the Field Site Manager or Project Manager at a minimum weekly or on a more frequent basis if so stated in the Project-Specific Plans.

10.0 QUALITY ASSURANCE/QUALITY CONTROL

Prior to the start of any field activity, Burns & McDonnell personnel will have read and understood the Project-Specific Plans as well as this and accompanying SOPs. If field personnel have not sampled prior for PFAS, they will be trained prior to commencement of field activities.

Quality control (QC) samples will be collected in the field to aid in the determination of the validity of the analytical results. The type, number, and location of QC samples to be collected will be detailed in the Project-Specific Work Plan(s). Typical field QC samples for PFAS samples include:

- Field duplicates
- Matrix spike/matrix spike duplicates (MS/MSDs)
- Field blanks
- Equipment rinsate blanks (ERBs)
- Trip blanks
- Temperature blanks

10.1 Field Duplicate Samples

Field duplicate samples will be obtained at the same time and analyzed for the same set of parameters as the investigative sample they are intended to replicate. Field duplicate samples are used to assess precision, including variability associated with both the laboratory analysis and the sample collection process. Field duplicate samples will be collected as detailed in the sample-specific SOP. Both the original and the duplicate will be sent to the primary laboratory or on-site laboratory, as applicable, and analyzed for the same analytical parameters. Field samples will be identified with unique sample identification numbers. Field duplicates will be numbered so to be blind to the laboratory. Sample locations where field duplicate samples are collected will be documented in the field logbook. Field duplicates are typically taken on 10 percent of the original samples collected.

10.2 MS/MSDs

MS/MSDs will be analyzed for the same constituents as the original sample. MS/MSD samples provide information on matrix interference encountered during extraction, digestion, and analysis (i.e., suppression or enhancement of instrument signals). MS samples are principally used to evaluate accuracy by measuring recovery of the spiked compounds. When the MS sample is used together with an associated MSD sample, information is obtained on analytical precision. MS/MSD samples will be collected as detailed in the sample-specific SOP. The samples will be identified as the original, MS, and MSD. The COC will be completed to notify the laboratory that a MS/MSD should be completed in addition to the original sample.

MS/MSDs are typically taken on 5 percent of the original samples collected; however, some projects may require a site-specific MS/MSD for each batch analyzed at the laboratory. For analytical methods with short holding times (i.e., less than 7 days), it may be necessary to collect MS/MSDs at a frequency greater than 5 percent. The analytical laboratory should be consulted regarding their MS/MSD batching needs when requesting sample analysis for short holding time methods.

10.3 Trip Blanks

Trip blanks are analyte-free water, shipped from and returned unopened to the laboratory in the same shipping containers. The blanks are prepared at the laboratory using ASTM Type II DI Water, sent to the project location, carried with the sampling team(s) during sampling, and shipped to the laboratory for analysis with the environmental samples. Trip blank samples will be collected and analyzed at a rate of one per sample cooler containing samples when the analyses include volatile PFAS. The number or rate of trip blanks to be collected will be provided in the Project-Specific Work Plan.

10.4 Field Blanks

Field blanks are analyte-free water that is decanted into sample containers in the same manner as samples collected at the site. Field blanks are used to determine if sample results have been impacted by air borne contaminants at the site. The blanks are prepared using laboratory provided PFAS-free water or ASTM Type II DI Water and sample containers as used for original samples. Field blanks are shipped to the laboratory for analysis with the environmental samples. Field blank samples are commonly collected and analyzed at a rate of one per sample event unless specified otherwise in the Project-Specific Work Plan.

10.5 Equipment Rinsate Blanks

ERBs will be prepared for non-dedicated sampling equipment used to collect soil or water samples for chemical analyses. ERBs are used to evaluate potential cross-contamination between samples caused by residual contamination on the sampling equipment. To prepare an ERB, the portion of the equipment that could potentially touch a sample will be decontaminated per protocol then will be rinsed with deionized water. The rinsate (ERB) will be placed directly into the specified containers and will be analyzed for the same parameters as the primary sample. The batch number of the water used to prepare the ERB will be noted in the field logbook. ERBs are typically not required for disposable equipment that is not reused; however, collection of an ERB from disposable equipment may be warranted if there are questions about whether or not PFAS were used in the manufacturing of equipment. ERBs are typically taken a minimum of once per sample type per sample event.

10.6 Temperature Blanks

Temperature blanks will consist of small containers filled with water. A temperature blank will be included in each cooler. The temperature of each blank will be measured by laboratory personnel upon arrival at the laboratory to determine if method-specific preservative requirements (i.e., +4°C) were met. In the event a temperature blank is not provided, the laboratory may register the cooler temperature using a project sample bottle.

11.0 REFERENCES

ASTM, 2013. *D7611 / D7611M-13e1 Standard Practice for Coding Plastic Manufactured Articles for Resin Identification.* ASTM International, West Conshohocken, PA.

Burns & McDonnell Engineering, Co, Inc. (Burns & McDonnell), 2018. *Policy Manual*,

- Chapter 8, Employee Safety & Health, April 2017.
- Chapter 10, Quality Control Manual, January 2017.

Government of Western Australia, Department of Environmental Regulation, 2016. *Interim Guidance on the Assessment and Management of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS).* February 2016.

United States Environmental Protection Agency (USEPA), 2007. *Guidance for Preparing Standard Operating Procedures*. EPA/600/B-07/001. April

12.0 ATTACHMENTS

Attachment A - Table A1 from *Interim Guidance on the Assessment and Management of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS)* (WA DER, 2016).

Attachment A

Table A1. Known or commonly-suspected sources of environmental sample contamination during PFAS investigations, and recommended mitigation practices and alternatives

Product	Mitigation Practice	Alternative Product or Practice When PFAS Sampling is to be Undertaken
Clothing and food		
New clothing	Prohibited for sampling personnel[1]	All field clothing to be washed a minimum of six times after purchase before using at the site
Clothing with stain-resistant, rain-resistant, or waterproof coatings/ treated fabric (e.g. GORE-TEX®)		Avoid sampling during rain if possible; polyethylene rain gear (e.g. disposable LDPE), vinyl, or polyvinyl chloride (PVC) clothing are acceptable
Tyvek® clothing		None
Fast food wrappers and containers		Use rigid plastic containers or bags or stainless steel containers for all food brought to site
Pre-wrapped foods and snacks (e.g. chocolate bars, energy bars, granola bars, potato chips etc.)		Food brought to the site must be contained in plastic (rigid containers or bags) or stainless steel containers
Sampling equipment and containers		
Teflon®-containing or -coated field equipment (tubing, bailers, tape, plumbing paste, etc.)	Prohibited at site[2]	High Density Polyethylene (HDPE) or silicone tubing, and HDPE or polypropylene field equipment recommended
Teflon®-lined lids on containers (e.g. sample containers, rinsate water storage containers)	Prohibited at site[2]	Polypropylene lids[3] for sample containers and polypropylene or HDPE containers for rinsate
Glass sample containers with lined lids	Contact with samples prohibited	Use polypropylene or HDPE for sample containers[3]; glass jars are acceptable provided lids are unlined or are lined with HDPE
Other products		
Aluminium foil	Prohibited at site[1]	Thin HDPE sheeting (commonly used as drop cloths for painting or home improvement) can be used
Self-sticking notes and similar office products (e.g. 3M Post-it notes)	Prohibited at site[2]	Avoid the use of these products at the site
Waterproof paper, notebooks, and labels	Prohibited at site[2]	Standard paper and paper labels
Drilling fluid containing PFAS	Prohibited for use at site[2]	PFAS-free drilling fluids
Detergents and decontamination solutions (e.g. Decon 90® Decontamination Solution)	Prohibited for all equipment	Follow water-only decontamination approach
Reusable chemical or gel ice packs (e.g. BlueIce®)	Prohibited for sample storage and transport	Ice contained in plastic (polyethylene) bags (double bagged)

Notes

[1] Sampling personnel includes all personnel who:

- are directly involved in the collection, handling, and/or processing of samples prior to the samples leaving the site;
- handle any part of well development equipment that directly contacts bore water being sampled;
- handle any part of equipment that directly contacts surface water or aquatic sediment;
- are within 2–3m of the borehole during soil sampling; or
- are within 2–3m of the collection and processing area on aquatic vessels during sediment or surface water sampling.

Personnel are not included as sampling personnel if they remain at least 2–3m away from sample collection areas prior to and during sampling.

[2] Entire sample collection and processing area, including vehicles used by sampling personnel.

[3] USEPA and ASTM method for the analysis of PFAS in solid and liquids specify polypropylene or HDPE with polypropylene lids. Check with the laboratory in regards to preference for polypropylene or HPDE.

Table A1 from *Interim Guidance on the Assessment and Management of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS)* (WA DER, 2016).

APPENDIX D – QA/QC REVIEW OF ANALYTICAL DATA MEMORANDUMS

Date: July 6, 2021

To: Carrie Freeman

From: Shauna Lawrence

Re: Quality Assurance/Quality Control (QA/QC) Review of Analytical Data
Project No. 123590 (MNDMA Camp Ripley, Little Falls, Minnesota)

Groundwater samples were collected on May 12, 2020 at the Minnesota National Guard, Camp Ripley facility in Little Falls, Minnesota (Site). Additionally, field quality control (QC) samples, including field blanks and field duplicates were collected during the sampling activities. All samples were analyzed by Eurofins TestAmerica of West Sacramento, California (Eurofins) for the following analysis:

Parameter	Analytical Method(s)
Per and Polyfluoroalkyl Substances (PFAS)	EPA 537.1

The quality assurance (QA)/QC results in association with the samples collected were evaluated for any method-specific QA/QC criteria. Data qualifiers, when appropriate, were assigned according to the guidelines presented in *Data Review and Validation Guidelines for Perfluoroalkyl Substances (PFASs) Analyzed Using EPA Method 537* (USEPA, 2018). The QA/QC review results are discussed below. Data qualifiers added to the data as a result of the QA/QC review are presented on Table 1.

1. Chain-of-Custody (COC) – The relinquished and received signatures, times, and dates on all COC forms were present and properly signed. The laboratory noted that some sample container labels were smeared with partial sample identifications. These were identified based on the COC, and impact was negligible.

2. Requested Analyses Completed – All analyses were performed as requested. Several notes were made by the laboratory in the case narrative regarding observations of the field samples. These are summarized as follows:

    - Four samples were observed to contain a thin layer of sediment in the sample bottle prior to extraction. No sample-specific QC problems were noted for these samples, and no qualifiers were added based on this observation note.

    - Several samples were observed to exhibit a yellow color prior to extraction or after final volumizing of the extract. The lab was contacted to inquire if these notes indicated matrix interferences and/or any potential interferences encountered during analysis. The laboratory confirmed that these were observations made by the analyst since the extracts were not clear in color. The laboratory confirmed that since all associated QC were within control limits, the colors likely did not have an impact on the analyses or reported results. No qualifiers were added based on these observation notes.

    - One sample was observed to exhibit an orange color and sediment at the bottom of the bottle prior to extraction. Based on the same rationales noted above, no qualifiers were added based on these observation notes.

3. Holding Times – All samples were extracted and/or analyzed within holding time, and no data qualifiers were necessary.

4. Sample Preservation – Samples were received by Eurofins at or below 4 degrees Celsius (°C). Because no samples were frozen, the samples were viable, and no qualification was required.

   The laboratory noted the pH for W-MN-RIPL-007-12MAY20 (320-60873-13) was 6.3 standard units (su), which was slightly below the recommended preservation range of 6-5-7.5 su. Because the pH was only slightly below the noted criteria, the results, for this sample (which were nondetect) were qualified as estimated at the reporting limit (UJ), rather than rejected.

5. Blanks – Blank samples were evaluated in this review to assess potential cross-contamination in the field, preparation, and/or analysis procedures. In accordance with the USEPA PFAS validation guidance, when a blank detection was noted, any detection of said analyte in the associated sample less than ten times (10x) the blank detection was disregarded as false positive, and qualified as nondetect (U). The following blanks were reviewed for this sampling event:

   - Method Blanks: These blanks were prepared in the laboratory with each QC batch to assess potential cross-contamination. No detections were noted in the method blanks.

   - Field Blanks: These blanks were collected in the field to assess potential cross-contamination due to site conditions. No detections were noted in the field blanks.

6. Surrogate Spikes – Four surrogate standards were used for this sampling event, and spiked in the field and laboratory PFAS samples. Surrogates are compounds not normally found in the environment that are added (spiked) into samples and analyzed for percent recovery (REC), with maximum and minimum limits on the RECs set forth in the aforementioned USEPA PFAS guidance. For any surrogate REC exceeding its 130 percent control limit, associated detections were qualified as estimated (J) and nondetects did not require qualification. Any surrogate REC below the 70 percent control limit resulted in detections qualified as estimated (J), and nondetects qualified as estimated at the reporting limit (UJ). For extremely low or lack of surrogate RECs, additional considerations would be reviewed, and the nondetect results may be rejected (R).

   Although all surrogate RECs were within the 70-130 percent QC limits, the laboratory flagged several surrogate RECs for two of the four standards with a "M" to indicate that manual integration was necessary. As noted in the comprehensive analytical data report, manual integration was necessary to address either incomplete integration of a constituent or to return peaks to baseline. Qualification was not required based on the manual integration.

7. Laboratory Control Sample/Lab Control Sample Duplicate (LCS/LCSD) – The LCS contains a matrix similar to that of the sample that has been spiked with known concentrations of target analytes. The LCS is prepared and analyzed by the same method as the samples. As a measure of analytical accuracy, the results of the LCS are compared against the known analyte concentrations in the spike to determine REC. The purpose of the LCS is to determine the performance of the laboratory with respect to analyte recovery, independent of field sample matrix interference. A LCSD is a duplicate sample of the LCS. The difference between the LCS/LCSD RECs is calculated for precision and reported as the relative percent difference (RPD).

All LCS/LCSD results were within their respective QC limits. However, the laboratory flagged several LCS/LCSD RECs with one or more of the following qualifiers:

- Laboratory qualifier "M": This qualifier was applied to indicate that manual integration was necessary. As noted in the comprehensive analytical data report, manual integration was necessary to address either incomplete integration of a constituent or to return peaks to baseline. Qualification was not required based solely on the manual integration. This qualifier was applied to one or more analytes in all three QC batches.

- Laboratory qualifier "E": This qualifier was applied to indicate that the qualified result exceeded the calibration range of the instrument. For this particular LCS QC batch, higher LCS spike concentrations were used for spiking, while the higher calibration standards were not used for the instrument calibration. In other words, the LCS samples were spiked with higher concentrations than the instrument was calibrated for at the time of analysis. As such, the LCS results exceeded this range, and were flagged as "E" by the laboratory. Since the LCS RECs were within their QC limits, no data qualifiers were added to the associated samples based on these laboratory qualifiers. This qualifier was applied to one or more analytes in QC batch 380280.

8. Matrix Spike/Matrix Spike Duplicates (MS/MSD) – MS/MSDs are typically run for organic and inorganic analyses. A sample is split into three portions (original, MS and MSD), and a known amount of a target analyte is added (spiked) to two portions (MS and MSD) of the sample. The results of these two portions are compared with each other for reproducibility using the RPD. They are also compared against the unspiked portion of the sample for REC of the spike. Note, only site-specific MS/MSDs are typically reviewed for QA/QC review.

    - W-MN-RIPL-006-12MAY20 (320-60873-12): All MS/MSD results for this spiked sample were within QC limits. See notes below regarding laboratory "E" and "M" flags.

    - W-MN-RIPL-008-12MAY20 (320-60873-14): All MS/MSD results for this spiked sample were within QC limits. See note below regarding laboratory "M" flags.

    - Laboratory qualifier "M": Same as above note for LCS/LCSD, except for MS/MSD. No qualifiers were necessary.

    - Laboratory qualifier "E": Same as above note for LCS/LCSD (batch 380280), except for MS/MSD. No qualifiers were necessary.

9. Field Duplicates – Field duplicates provided information on the ability to reproduce field results and account for error introduced from handling, shipping, storage, preparation, and analysis of field samples. Field duplicate results were reviewed in accordance with criteria presented in analytical method EPA 537.1, and is summarized as follows:

    - For detections > 2x the reporting limit, a 30 percent RPD QC limit was be allowed for these analytes.

- For detections <2x the reporting limit, greater variability may be observed. A 50 percent RPD QC limit was allowed for these analytes.

- For analytes exceeding the above criteria, with all corresponding QC results within control limits, the interferences are likely matrix-based. Data qualifiers may be added based on professional judgment for elevated RPDs if other factors are determined to be a causing factor.

Three field duplicate pairs were collected and reviewed for this sampling event:

- W-MN-RIPL-002-12MAY20 and DUP-1/S1: No detections were noted in either sample. Thus, all results were adequately replicated.

- W-MN-RIPL-004-12MAY20 and DUP-2/S2: Two detections were noted in this field duplicate pair, and were adequately replicated.

- W-MN-RIPL-021-12MAY20 and DUP-3/S1: No detections were noted in either sample. Thus, all results were adequately replicated..

10. Detection and Quantitation Limits – All samples were analyzed at a 1:1 dilution factor.

    Note that the PFAS results for W-MN-RIPL-006-12MAY20 (320-60873-12) were reported as low-level trace detections (J-flagged) by the laboratory to indicate these analytes were detected at concentrations between their respective method detection limit (MDL) and reporting limit. The laboratory was contacted regarding these trace detections as they were reported for all analytes in this sample. The laboratory noted that these were likely due to inadvertent addition of the MS and/or MSD aliquots to this sample when going through the solid phase extraction column. Due to the time limitations on holding samples, the sample had already been disposed and a re-extraction was unable to be performed. The data for this sampling event for this location should be used at reported by the laboratory, unless otherwise noted herein.
11. Instrument Calibrations and Standards – The following QC components were reviewed to account for instrument stability and ongoing QC evaluations during the PFAS analyses:

    - The initial calibration blank was free of detections of target analytes.

    - All initial and continuing calibration results were within control limits.

    - All internal standards were within control limits.

    - As noted previously, the laboratory noted that one or more analytes also required manual integration (“M” qualifier). These integrations were made based on laboratory protocols with any adjustments to reported results made as needed. No data qualifiers were added based solely on the manual integrations, and the “M” qualifier should be dropped for final reporting of the data.

12. Conclusion – The data were reviewed for achievement of any method-specified QA/QC criteria. One sample was qualified for not meeting the recommended sample preservation criteria. All data are valid for use, as qualified, in reporting the results of this investigation.

Attachment
Table 1 – Qualifiers Added During QA/QC Review

Table 1
Data Qualifiers Added During QA/QC Review
May 2020 Sampling Event
Minnesota National Guard, Camp Ripley - Little Falls, Minnesota

Sample Identification	Laboratory Number	Analytical Method	Analyte(s)	Data Validation Qualifier	Reason for Qualification
W-MN-RIPL-007-12MAY20	320-60873-13	537.1	All PFAS Analytes	UJ	Sample pH was 6.3 su, which was slightly below the recommended sample preservation range of 6.5-7.5 su.

Notes:
PFAS = Per and Polyfluoroalkyl Substances
QC = quality assurance
QC = quality control
su = standard units
UJ = compound was estimated at the reporting limit

Date: November 16, 2020

To: Carrie Freeman

From: Kortney Blaufuss

Re: Quality Assurance/Quality Control (QA/QC) Review of Analytical Data
Project No. 123590 (MNDMA Camp Ripley, Little Falls, Minnesota)

Drinking water well samples were collected on September 29, 2020 at the Minnesota National Guard, Camp Ripley facility in Little Falls, Minnesota (Site). Additionally, field quality control (QC) samples, including field blanks and field duplicates were collected during the sampling activities. All samples were analyzed by Eurofins TestAmerica of West Sacramento, California (Eurofins) for the following analysis:

Parameter	Analytical Method(s)
Per and Polyfluoroalkyl Substances (PFAS)	EPA 537.1

The quality assurance (QA)/QC results in association with the samples collected were evaluated for any method-specific QA/QC criteria. Data qualifiers, when appropriate, were assigned according to the guidelines presented in *Data Review and Validation Guidelines for Perfluoroalkyl Substances (PFASs) Analyzed Using EPA Method 537* (USEPA, 2018). The QA/QC review results are discussed below. No data qualifiers were added as a result of the QA/QC review.

1. Chain-of-Custody (COC) – The relinquished and received signatures, times, and dates on all COC forms were present and properly signed.

2. Requested Analyses Completed – All analyses were performed as requested. Several notes were made by the laboratory in the case narrative regarding observations of the field samples. These are summarized as follows:

    - Five samples were observed to exhibit a yellow color and sediment at the bottom of the sample bottle prior to extraction. No sample-specific QC problems were noted for these samples, and no qualifiers were added based on this observation note.

    - Several samples were observed to exhibit a yellow color prior to extraction or after final volumizing of the extract. This was also evident in the previous sampling event, and the lab was contacted to inquire if these notes indicated matrix interferences and/or any potential interferences encountered during analysis. The laboratory confirmed that these were observations made by the analyst since the extracts were not clear in color. The laboratory confirmed that since all associated QC were within control limits, the colors likely did not have an impact on the analyses or reported results. Based on this same observance in the previous sampling event, and laboratory explanation, no qualifiers were added based on these observation notes.

    - One sample was observed to exhibit an orange color and sediment at the bottom of the bottle prior to extraction. Based on the same rationales noted above, no qualifiers were added based on these observation notes.

3. Holding Times – All samples were extracted and/or analyzed within holding time, and no data qualifiers were necessary.

4. Sample Preservation – Samples were received by Eurofins slightly below the recommended sample preservation temperature range of 4 degrees Celsius (°C) ± 2 °C. Because no samples were frozen, the samples were considered viable, and no qualification was required.

5. Blanks – Blank samples were evaluated in this review to assess potential cross-contamination in the field, preparation, and/or analysis procedures. In accordance with the USEPA PFAS validation guidance, when a blank detection was noted, any detection of said analyte in the associated sample less than ten times (10x) the blank detection was disregarded as false positive, and qualified as nondetect (U). The following blanks were reviewed for this sampling event:

    - Method Blanks: These blanks were prepared in the laboratory with each QC batch to assess potential cross-contamination. No detections were noted in the method blanks.

    - Field Blanks: These blanks were collected in the field to assess potential cross-contamination due to site conditions. No detections were noted in the field blanks.

6. Surrogate Spikes – Four surrogate standards were used for this sampling event, and spiked in the field and laboratory PFAS samples. Surrogates are compounds not normally found in the environment that are added (spiked) into samples and analyzed for percent recovery (REC), with maximum and minimum limits on the RECs set forth in the aforementioned USEPA PFAS guidance. For any surrogate REC exceeding its 130 percent control limit, associated detections were qualified as estimated (J) and nondetects did not require qualification. Any surrogate REC below the 70 percent control limit resulted in detections qualified as estimated (J), and nondetects qualified as estimated at the reporting limit (UJ). For extremely low or lack of surrogate RECs, additional considerations would be reviewed, and the nondetect results may be rejected (R). All surrogate RECs were within the 70-130 percent QC limits.

7. Laboratory Control Sample/Lab Control Sample Duplicate (LCS/LCSD) – The LCS contains a matrix similar to that of the sample that has been spiked with known concentrations of target analytes. The LCS is prepared and analyzed by the same method as the samples. As a measure of analytical accuracy, the results of the LCS are compared against the known analyte concentrations in the spike to determine REC. The purpose of the LCS is to determine the performance of the laboratory with respect to analyte recovery, independent of field sample matrix interference. A LCSD is a duplicate sample of the LCS. The difference between the LCS/LCSD RECs is calculated for precision and reported as the relative percent difference (RPD).

    All LCS/LCSD results were within their respective QC limits. However, the laboratory flagged several LCS/LCSD RECs with the following qualifier:

- Laboratory qualifier "M": This qualifier was applied to indicate that manual integration was necessary. As noted in the comprehensive analytical data report, manual integration was necessary to address either incomplete integration of a constituent or to return peaks to baseline. Qualification was not required based solely on the manual integration. This qualifier was applied to one or more analytes in all three QC batches.

8. Matrix Spike/Matrix Spike Duplicates (MS/MSD) – MS/MSDs are typically run for organic and inorganic analyses. A sample is split into three portions (original, MS and MSD), and a known amount of a target analyte is added (spiked) to two portions (MS and MSD) of the sample. The results of these two portions are compared with each other for reproducibility using the RPD. They are also compared against the unspiked portion of the sample for REC of the spike. Note, only site-specific MS/MSDs are typically reviewed for QA/QC review.

    - W-MN-RIPL-014-29SEP20 (320-65225-14): All MS/MSD results for this spiked sample were within QC limits. See notes below regarding laboratory "M" flags.

    - W-MN-RIPL-017-29SEP20 (320-65225-16): All MS/MSD results for this spiked sample were within QC limits. See note below regarding laboratory "M" flags.

    - Laboratory qualifier "M": Same as above note for LCS/LCSD, except for MS/MSD. No qualifiers were necessary.

9. Field Duplicates – Field duplicates provided information on the ability to reproduce field results and account for error introduced from handling, shipping, storage, preparation, and analysis of field samples. Field duplicate results were reviewed in accordance with criteria presented in analytical method EPA 537.1, and is summarized as follows:

    - For detections > 2x the reporting limit, a 30 percent RPD QC limit was be allowed for these analytes.

    - For detections <2x the reporting limit, greater variability may be observed. A 50 percent RPD QC limit was allowed for these analytes.

    - For analytes exceeding the above criteria, with all corresponding QC results within control limits, the interferences are likely matrix-based. Data qualifiers may be added based on professional judgment for elevated RPDs if other factors are determined to be a causing factor.

    Three field duplicate pairs were collected and reviewed for this sampling event. The following summarizes the field duplicate review:

    - W-MN-RIPL-001-29SEP20 and W-MN-RIPL-DUP1-29SEP20: Three detections were noted in the samples, and all results were adequately replicated.

    - W-MN-RIPL-006-29SEP20 and W-MN-RIPL-DUP2-29SEP20: No detections were noted in either sample. Thus, all results were adequately replicated.

- W-MN-RIPL-008-29SEP20 and W-MN-RIPL-DUP3-29SEP20: Two detections were noted in the samples, and all results were adequately replicated.

10. Detection and Quantitation Limits – All samples were analyzed at a 1:1 dilution factor.

11. Instrument Calibrations and Standards – The following QC components were reviewed to account for instrument stability and ongoing QC evaluations during the PFAS analyses:

    - The initial calibration blank was free of detections of target analytes.
    - All initial and continuing calibration results were within control limits.
    - All internal standards were within control limits.
    - As noted previously, the laboratory noted that one or more analytes also required manual integration ("M" qualifier). These integrations were made based on laboratory protocols with any adjustments to reported results made as needed. No data qualifiers were added based solely on the manual integrations, and the "M" qualifier should be dropped for final reporting of the data.

12. Conclusion – The data were reviewed for achievement of any method-specified QA/QC criteria. No data qualifiers were added during this QC review, and all data are valid for use in reporting the results of this investigation.

Date: January 22, 2021

To: Carrie Freeman

From: Kortney Blaufuss

Re: Quality Assurance/Quality Control (QA/QC) Review of Analytical Data
Project No. 123590 (MNDMA Camp Ripley, Little Falls, Minnesota)

Drinking water well samples were collected on November 23, 2020 at the Minnesota National Guard, Camp Ripley facility in Little Falls, Minnesota (Site). Additionally, field quality control (QC) samples, including field blanks and field duplicates were collected during the sampling activities. All samples were analyzed by Eurofins TestAmerica of West Sacramento, California (Eurofins) for the following analysis:

Parameter	Analytical Method(s)
Per and Polyfluoroalkyl Substances (PFAS)	EPA 537.1

The quality assurance (QA)/QC results in association with the samples collected were evaluated for any method-specific QA/QC criteria. Data qualifiers, when appropriate, were assigned according to the guidelines presented in *Data Review and Validation Guidelines for Perfluoroalkyl Substances (PFASs) Analyzed Using EPA Method 537* (USEPA, 2018). The QA/QC review results are discussed below. No data qualifiers were added as a result of the QA/QC review.

1. Chain-of-Custody (COC) – The relinquished and received signatures, times, and dates on all COC forms were present and properly signed.

2. Requested Analyses Completed – All analyses were performed as requested. Several notes were made by the laboratory in the case narrative regarding observations of the field samples. These are summarized as follows:

    - Twelve samples were observed to have sediment at the bottom of the sample bottle prior to extraction. No sample-specific QC problems were noted for these samples, and no qualifiers were added based on this observation note.

    - Several samples were observed to exhibit a yellow color prior to extraction or after final volumizing of the extract. This was also evident in the previous sampling event, and the lab was contacted to inquire if these notes indicated matrix interferences and/or any potential interferences encountered during analysis. The laboratory confirmed that these were observations made by the analyst since the extracts were not clear in color. The laboratory confirmed that since all associated QC were within control limits, the colors likely did not have an impact on the analyses or reported results. Based on this same observance in the previous sampling event, and laboratory explanation, no qualifiers were added based on these observation notes.

3. Holding Times – All samples were extracted and/or analyzed within holding time, and no data qualifiers were necessary.

4. Sample Preservation – Samples were received by Eurofins at or slightly below the recommended sample preservation temperature range of 4 degrees Celsius (°C) ± 2 °C. Because no samples were frozen, the samples were considered viable, and no qualification was required.

5. Blanks – Blank samples were evaluated in this review to assess potential cross-contamination in the field, preparation, and/or analysis procedures. In accordance with the USEPA PFAS validation guidance, when a blank detection was noted, any detection of said analyte in the associated sample less than ten times (10x) the blank detection was disregarded as false positive, and qualified as nondetect (U). The following blanks were reviewed for this sampling event:

    - Method Blanks: These blanks were prepared in the laboratory with each QC batch to assess potential cross-contamination. No detections were noted in the method blanks.

    - Field Blanks: These blanks were collected in the field to assess potential cross-contamination due to site conditions. No detections were noted in the field blanks.

6. Surrogate Spikes – Four surrogate standards were used for this sampling event, and spiked in the field and laboratory PFAS samples. Surrogates are compounds not normally found in the environment that are added (spiked) into samples and analyzed for percent recovery (REC), with maximum and minimum limits on the RECs set forth in the aforementioned USEPA PFAS guidance. For any surrogate REC exceeding its 130 percent control limit, associated detections were qualified as estimated (J) and nondetects did not require qualification. Any surrogate REC below the 70 percent control limit resulted in detections qualified as estimated (J), and nondetects qualified as estimated at the reporting limit (UJ). For extremely low or lack of surrogate RECs, additional considerations would be reviewed, and the nondetect results may be rejected (R). All surrogate RECs were within the 70-130 percent QC limits.

7. Laboratory Control Sample (LCS) – The LCS contains a matrix similar to that of the sample that has been spiked with known concentrations of target analytes. The LCS is prepared and analyzed by the same method as the samples. As a measure of analytical accuracy, the results of the LCS are compared against the known analyte concentrations in the spike to determine REC. The purpose of the LCS is to determine the performance of the laboratory with respect to analyte recovery, independent of field sample matrix interference. All LCS results were within their respective QC limits.

8. Matrix Spike/Matrix Spike Duplicates (MS/MSD) – MS/MSDs are typically run for organic and inorganic analyses. A sample is split into three portions (original, MS and MSD), and a known amount of a target analyte is added (spiked) to two portions (MS and MSD) of the sample. The results of these two portions are compared with each other for reproducibility using the RPD. They are also compared against the unspiked portion of the sample for REC of the spike. Note, only site-specific MS/MSDs are typically reviewed for QA/QC review.

    - W-MN-RIPL-015-23NOV20 (320-67226-15): All MS/MSD results for this spiked sample were within QC limits.

    - W-MN-RIPL-006-23NOV20 (320-67226-6): All MS/MSD results for this spiked sample were within QC limits. Additionally, one or more analytes were flagged with laboratory

qualifier "M". This qualifier was applied to indicate that manual integration was necessary. As noted in the comprehensive analytical data report, manual integration was necessary to address either incomplete integration of a constituent or to return peaks to baseline. Qualification was not required based solely on the manual integration.

9. Field Duplicates – Field duplicates provided information on the ability to reproduce field results and account for error introduced from handling, shipping, storage, preparation, and analysis of field samples. Field duplicate results were reviewed in accordance with criteria presented in analytical method EPA 537.1, and is summarized as follows:

    - For detections > 2x the reporting limit, a 30 percent RPD QC limit was be allowed for these analytes.
    - For detections <2x the reporting limit, greater variability may be observed. A 50 percent RPD QC limit was allowed for these analytes.
    - For analytes exceeding the above criteria, with all corresponding QC results within control limits, the interferences are likely matrix-based. Data qualifiers may be added based on professional judgment for elevated RPDs if other factors are determined to be a causing factor.

    Three field duplicate pairs were collected and reviewed for this sampling event. The following summarizes the field duplicate review:

    - W-MN-RIPL-001-23NOV20 and W-MN-RIPL-DUP1-23NOV20: Three detections were noted in the samples, and were adequately replicated.
    - W-MN-RIPL-020-23NOV20 and W-MN-RIPL-DUP2-23NOV20: One detection was noted in the samples, and were adequately replicated
    - W-MN-RIPL-008-23NOV20 and W-MN-RIPL-DUP3-23NOV20: Two detections were noted in the parent sample, W-MN-RIPL-008-23NOV20, while W-MN-RIPL-DUP3-23NOV20 was nondetect for all analytes. All results were adequately replicated.

10. Detection and Quantitation Limits – All samples were analyzed at a 1:1 dilution factor.

11. Instrument Calibrations and Standards – The following QC components were reviewed to account for instrument stability and ongoing QC evaluations during the PFAS analyses:

    - The initial calibration blank was free of detections of target analytes.
    - All initial and continuing calibration results were within control limits.
    - All internal standards were within control limits.
    - As noted previously, the laboratory noted that one or more analytes also required manual integration ("M" qualifier). These integrations were made based on laboratory protocols

with any adjustments to reported results made as needed. No data qualifiers were added based solely on the manual integrations, and the "M" qualifier should be dropped for final reporting of the data.

12. Conclusion – The data were reviewed for achievement of any method-specified QA/QC criteria. No data qualifiers were added during this QC review, and all data are valid for use in reporting the results of this investigation.

Date: April 19, 2021

To: Carrie Freeman

From: Kortney Blaufuss

Re: Quality Assurance/Quality Control (QA/QC) Review of Analytical Data
Project No. 123590 (MNDMA Camp Ripley, Little Falls, Minnesota)

Drinking water well samples were collected on February 24, 2021 at the Minnesota National Guard, Camp Ripley facility in Little Falls, Minnesota (Site). Additionally, field quality control (QC) samples, including field blanks and field duplicates were collected during the sampling activities. All samples were analyzed by Eurofins TestAmerica of West Sacramento, California (Eurofins) for the following analysis:

Parameter	Analytical Method(s)
Per and Polyfluoroalkyl Substances (PFAS)	EPA 537.1

The quality assurance (QA)/QC results in association with the samples collected were evaluated for any method-specific QA/QC criteria. Data qualifiers, when appropriate, were assigned according to the guidelines presented in *Data Review and Validation Guidelines for Perfluoroalkyl Substances (PFASs) Analyzed Using EPA Method 537* (USEPA, 2018). The QA/QC review results are discussed below. No data qualifiers were added as a result of the QA/QC review.

1. Chain-of-Custody (COC) – The relinquished and received signatures, times, and dates on all COC forms were present and properly signed.

2. Requested Analyses Completed – All analyses were performed as requested. Several notes were made by the laboratory in the case narrative regarding observations of the field samples. These are summarized as follows:

    - Three samples were observed to exhibit a yellow color and had brown sediment at the bottom of the sample bottle prior to extraction. Following extraction, a yellowish color was still observed. No sample-specific QC problems were noted for these samples, and no qualifiers were added based on this observation note.

    - Several samples were observed to exhibit a yellow color prior to extraction or after final volumizing of the extract. This was also evident in the previous sampling event, and the lab was contacted to inquire if these notes indicated matrix interferences and/or any potential interferences encountered during analysis. The laboratory confirmed that these were observations made by the analyst since the extracts were not clear in color. The laboratory confirmed that since all associated QC were within control limits, the colors likely did not have an impact on the analyses or reported results. Based on this same observance in the previous sampling event, and laboratory explanation, no qualifiers were added based on these observation notes.

    - One sample was observed to exhibit a black powdery sediment at the bottom of the bottle prior to extraction. Based on the same rationales noted above, no qualifiers were added based on this observation note.

3. Holding Times – All samples were extracted and/or analyzed within holding time, and no data qualifiers were necessary.

4. Sample Preservation – Samples were received by Eurofins slightly below the recommended sample preservation temperature range of 4 degrees Celsius (°C) ± 2 °C. Because no samples were frozen, the samples were considered viable, and no qualification was required.

5. Blanks – Blank samples were evaluated in this review to assess potential cross-contamination in the field, preparation, and/or analysis procedures. In accordance with the USEPA PFAS validation guidance, when a blank detection was noted, any detection of said analyte in the associated sample less than ten times (10x) the blank detection was disregarded as false positive, and qualified as nondetect (U). The following blanks were reviewed for this sampling event:

    - Method Blanks: These blanks were prepared in the laboratory with each QC batch to assess potential cross-contamination. No detections were noted in the method blanks.

    - Field Blanks: These blanks were collected in the field to assess potential cross-contamination due to site conditions. No detections were noted in the field blanks.

6. Surrogate Spikes – Four surrogate standards were used for this sampling event, and spiked in the field and laboratory PFAS samples. Surrogates are compounds not normally found in the environment that are added (spiked) into samples and analyzed for percent recovery (REC), with maximum and minimum limits on the RECs set forth in the aforementioned USEPA PFAS guidance. For any surrogate REC exceeding its 130 percent control limit, associated detections were qualified as estimated (J) and nondetects did not require qualification. Any surrogate REC below the 70 percent control limit resulted in detections qualified as estimated (J), and nondetects qualified as estimated at the reporting limit (UJ). For extremely low or lack of surrogate RECs, additional considerations would be reviewed, and the nondetect results may be rejected (R). All surrogate RECs were within the 70-130 percent QC limits.

7. Laboratory Control Sample/Lab Control Sample Duplicate (LCS/LCSD) – The LCS contains a matrix similar to that of the sample that has been spiked with known concentrations of target analytes. The LCS is prepared and analyzed by the same method as the samples. As a measure of analytical accuracy, the results of the LCS are compared against the known analyte concentrations in the spike to determine REC. The purpose of the LCS is to determine the performance of the laboratory with respect to analyte recovery, independent of field sample matrix interference. A LCSD is a duplicate sample of the LCS. The difference between the LCS/LCSD RECs is calculated for precision and reported as the relative percent difference (RPD).

    All LCS/LCSD results were within their respective QC limits.

8. Matrix Spike/Matrix Spike Duplicates (MS/MSD) – MS/MSDs are typically run for organic and inorganic analyses. A sample is split into three portions (original, MS and MSD), and a known amount of a target analyte is added (spiked) to two portions (MS and MSD) of the sample. The results of these two portions are compared with each other for reproducibility using the RPD. They are also compared against the unspiked portion of the sample for REC of the spike. Note, only site-specific MS/MSDs are typically reviewed for QA/QC review.

    - W-MN-RIPL-012-24FEB21 (320-70574-12): All MS/MSD results for this spiked sample were within QC limits. See note below regarding laboratory "M" flags.

    - W-MN-RIPL-017-24FEB21 (320-70574-16): All MS/MSD results for this spiked sample were within QC limits. See note below regarding laboratory "M" flags.

    - Laboratory qualifier "M": This qualifier was applied to indicate that manual integration was necessary. As noted in the comprehensive analytical data report, manual integration was necessary to address either incomplete integration of a constituent or to return peaks to baseline. Qualification was not required based solely on the manual integration.

9. Field Duplicates – Field duplicates provided information on the ability to reproduce field results and account for error introduced from handling, shipping, storage, preparation, and analysis of field samples. Field duplicate results were reviewed in accordance with criteria presented in analytical method EPA 537.1, and is summarized as follows:

    - For detections > 2x the reporting limit, a 30 percent RPD QC limit was allowed for these analytes.

    - For detections <2x the reporting limit, greater variability may be observed. A 50 percent RPD QC limit was allowed for these analytes.

    - For analytes exceeding the above criteria, with all corresponding QC results within control limits, the interferences are likely matrix-based. Data qualifiers may be added based on professional judgment for elevated RPDs if other factors are determined to be a causing factor.

    Three field duplicate pairs were collected and reviewed for this sampling event. The following summarizes the field duplicate review:

    - W-MN-RIPL-003-24FEB21 and W-MN-RIPL-DUP1-24FEB21: Five detections were noted in the samples, and all results were adequately replicated.

    - W-MN-RIPL-005-24FEB21 and W-MN-RIPL-DUP2-24FEB21: Five detections were noted in the samples, and all results were adequately replicated.

    - W-MN-RIPL-020-24FEB21 and W-MN-RIPL-DUP3-24FEB21: No detections were noted in the samples.

10. Detection and Quantitation Limits – All samples were analyzed at a 1:1 dilution factor.

11. Instrument Calibrations and Standards – The following QC components were reviewed to account for instrument stability and ongoing QC evaluations during the PFAS analyses:

    - The initial calibration blank was free of detections of target analytes.
    - All initial and continuing calibration results were within control limits.
    - All internal standards were within control limits.
    - As noted previously, the laboratory noted that one or more analytes also required manual integration ("M" qualifier). These integrations were made based on laboratory protocols with any adjustments to reported results made as needed. No data qualifiers were added based solely on the manual integrations, and the "M" qualifier should be dropped for final reporting of the data.

12. Conclusion – The data were reviewed for achievement of any method-specified QA/QC criteria. No data qualifiers were added during this QC review, and all data are valid for use in reporting the results of this investigation.

BURNS McDONNELL

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